THE EFFECTS OF SEX AND SEX-ROLE TYPING BEHAVIOUR ON CHILDREN'S PROBLEM-SOLVING BEHAVIOUR AND OUTER-DIRECTEDNESS

A THESIS

SUBMITTED IN FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN PSYCHOLOGY

AT THE

UNIVERSITY OF WAIKATO

BY

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UNIVERSITY OF WAIKATO

1978

ABSTRACT

The effects of sex and sex-role typing behaviour on children's problem solving ability and glancing behaviour (outerdirectedness) were investigated. Two hundred and fifty five subjects were tested in a series of six experiments.

Experiment I was a pilot study involving adult student subjects whose glancing behaviour and problem solving skills were tested in three experimental tasks - the Rod and Frame Test, the object assembly tasks and the card game. In Experiments II and III, children were categorized into various sex roles by means of the Children's Androgyny Scale (C.A.S.), and the effects of sex and sex role typing behaviour on their problem solving ability and glancing behaviour were studied using the RFT and object assembly tasks. In Experiments IV and V, the effects of sex and sex role typing behaviour were investigated under the more 'social' condition of the concept identification task. In Experiment VI, the learning strategies utilized by different types of subjects were investigated by means of the discrimination task.

The findings from Experiment I revealed that adult student subjects, regardless of sex, engaged in very little glancing behaviour and its restricted range resulted in the non-significant difference in glancing behaviour between male and female subjects. As a result of this failure to demonstrate this important difference between the sexes, it was decided to abandon the use of adult subjects and to utilize children as subjects for the remainder of the research.

The findings from Experiment II failed to demonstrate any effects of sex role typing behaviour on subject's performance on the RFT. The introduction of external cues in the experimental

procedure in Experiment III yielded results that partially supported the hypotheses that children's problem solving ability and glancing behaviour can be differentially affected by their sex role typing behaviour. In Experiments IV and V, the subjects were tested with task problems that included 'social' cues, and the results supported the hypothesis that children's problem solving ability can be differentially affected by their sex role typing behaviour by demonstrating both the adaptability of the androgynous subjects and the behavioural restriction of the sex typed subjects in their performance on the experimental tasks. No effect of sex role typing behaviour on subject's glancing behaviour was demonstrated. The results also indicated that subjects of different sex and sex role orientation have different problem solving strategies. From the results, it appears that the female feminine subject's task approach orientation was characterized by a cue learning (reliance on external cues) strategy while the male masculine subject's task approach orientation was characterized by the problem learning (task oriented) strategy. The androgynous subject's task approach orientation appeared to be more flexible, varying between cue learning and problem learning depending on the nature of the situation. Experiment VI was designed to investigate these different learning strategies utilized by different types of subjects, and the findings corroborate the findings from Experiments IV and V that female feminine subjects do indeed use a cue learning strategy in their problem solving. The performance of the androgynous subjects of both sexes indicated that they were able to use either strategy effectively.

Overall, the results of the research supported the hypothesis that sex and sex role typing behaviour by children do

result in differential problem solving skills, with androgynous subjects being better problem solvers than sex typed subjects at tasks designed specifically to elicit masculine or feminine responses. The findings were attributed to the differential socialization process for males and females. Implications of the findings were discussed.

ACKNOWLEDGEMENTS

My sincere thanks to my supervisors Professor D.R. Thomas and Dr. P.N. Hamid for their guidance and encouragement. My thanks also to the students of Hamilton East Primary school who participated in the experiments, and to my wife Jacqui for her help in scoring and analysing the data. I would also like to thank Mrs. J. Wilson for typing the manuscript.

CONTENTS

LIST OF FIGURES AND TABLES

LIST OF FIGURES AND TABLES (CONT.)

CHAPTER I

CHAPTER I

INTRODUCTION

Sex differences in problem solving ability have been well documented (Garai & Scheinfeld, 1968; Maccoby & Jacklin, 1974; Ounsted & Taylor, 1972), and the consistency in the types of skills at which the sexes appear to be superior and inferior is impressive. From investigations carried out as early as 1920 (Brooks, 1921) to the very recent past, females have been found to be superior in skills that can be classed as 'communicative' or 'social' (Bahrick et al, 1975; Goodenough, 1957; Guilford, 1967; Maccoby & Jacklin, 1974; Oetzel, 1967; Witryol & Kaess, 1957), while males excel in skills that can be classed as 'analytical' or 'spatial mechanical' (Garai & Scheinfeld, 1968; Guilford, 1967; Hutt, 1972a; Tyler, 1965). There is ample evidence to suggest that it is this more analytic approach, assisted by a greater 'set-breaking' ability that have resulted in the consistent findings of male superiority in the solution of a variety of problems (Garai & Scheinfeld, 1968; Guetznow, 1951; Guilford, 1967; Sweeney, 1953; Tyler, 1965; Witkin et al, 1959, 1962).

The analytic or field independent approach is characterized by a problem solving style that is relatively free of passivity and dependency needs, with an active, manipulative orientation to the social environment. Alternatively, the social or field dependent approach is characterized by a passive, dependent orientation toward the

social environment. Thus, where females tend to perceive both stimulus and setting as inter-related (Witkin et al, 1962) when confronted with a task problem, males tend to concentrate on a particular stimulus, separating it from the background. This ability to separate the stimulus from its setting appears to surface early in life, with the observations that boys not only ask more 'why' or 'how' questions than girls (Garai & Scheinfeld, 1968; Smith, 1933) but also engage in more exploratory and manipulative behaviour (McGuinness, 1976). It is possible that early manipulative skills give rise to a high degree of spatial imagery, resulting in better performance for males, especially in tasks that require spatial mechanical skills, as in rotating or isolating visual images into new planes or combinations.

Effects of sex-role typing on problem solving ability (1.1)

Existing evidence has shown that not only do males and females differ in their problem-solving skills, but that these skills can be differentially affected by their sex-role typing behaviour. As have been noted by Constantinople (1974), it is unclear from currently available data whether the pattern of strong intercorrelations observed among the various sex-linked abilities is indicative of their relationship to a single higher-order factor which might be termed 'analytical ability' or whether it might simply be due to the fact that they are all affected by sex-typing as a moderator variable. For example, it has been shown that subjects regardless of sex, who identify more with the

masculine role have better spatial skills than those subjects who identify more with the feminine role. The consistent finding that the range of differences within each sex on measures of these abilities is almost always greater than the differences between the sexes, has added strength to the suggestion that the differences between men and women in problem-solving skills are merely a part of a more general difference between men and women in role identification. Support for this hypothesis can be found in a number of studies which have implicated some aspect of sex-role identification in accounting for both the within- and between-sex differences in this area. For example, masculine sex-role identification has been found to correlate highly with problem-solving ability (Kagan, 1964), and Milton (1957) has found that scores on inventories measuring masculinity-femininity (e.g. Terman-Miles Test of Masculinity-Femininity) also correlate highly with this ability, with both men and women who identify strongly with the masculine role being better problem solvers than those who fail to show such identification. Bieri (1960) observed father-identifiers among college students to be better problem-solvers on the Embedded-Figure-Test than mother identifiers. Similarly, in a study of over 300 female undergraduates, Elton and Rose (1967) found that in general, students scoring high on the Masculine Role dimension of the Omnibus Personality Inventory showed the 'masculine' pattern (Carlsmith, 1964) of relationship between SAT Verbal and Math scores; that is girls higher on Masculine Role tended to have Math scores higher than their Verbal scores.

The literature, then, shows that not only do males generally possess better problem-solving skills than females (especially in tasks that require spatial mechanical skills) but that there is also a positive relationship between masculine identification and problem-solving achievement. This finding of the effects of sex-role typing behaviour suggests that two assumptions are evident concerning problem-solving. The assumptions are; first, that masculine sex-role typing behaviour results in better problem-solving skills (as has been demonstrated in the studies reviewed), and, second, that feminine sex-role typing behaviour results in inferior problem-solving skills.

The concept of Androgyny (1.2)

The traditional view of sex-role typing behaviour is that masculinity and femininity are bi-polar ends along a single dimension, with different domains of positive traits and behaviours. Different theorists have designated different labels for these domains. According to Parsons (Parsons & Bales, 1955), masculinity has been associated with an 'instrumental' orientation, a cognitive focus on getting the job done or the problem solved, whereas femininity has been associated with an 'expressive' orientation, an affective concern for the welfare of others and the harmony of the group. Similarly, Bakan (1966) has suggested that masculinity is associated with an 'agentic' orientation, a concern for oneself as an individual, whereas femininity is associated with a 'communal' orientation, a concern for the relationship between oneself and others.

As bi-polar ends along a single dimension, the traditional view of masculinity and femininity therefore assumes that a person can either be masculine or feminine but not both. According to Bem (1974) and other researchers (e.g. Bakan, 1966; Bazin & Freeman, 1974; Bem, 1974, 1975; Bem & Lenney, 1976; Block, 1973; Gelpi, 1974; Harris, 1974; Hefner, Rebecca & Oleshansky, 1975; Heilbrun, 1973, 1976; Kaplan & Bean 1976; Pleck, 1975; Rossi, 1964; Secor, 1974; Spence, Helmreich & Stapp, 1975; Stimpson, 1974), this sex-role dichotomy has served to obscure a third type of individual - the Androgynous person, a person who incorporates both masculinity and femininity into his or her personality, and as such is free from the constraints of traditional 'sex-appropriate' norms. The concept of psychological androgyny implies that it is possible for an individual to be both masculine and feminine, both instrumental and expressive, both agentic and communal, depending on the situational appropriateness of these various modalities; and it further implies that an individual may blend these complementary modalities into a single act, for example, being able to remain independent in one's judgment when under pressure to conform, and yet doing so with the sensitivity as not to hurt other people's feelings. Where the sex-typed person is limited in his or her behaviours to those traditionally defined as 'sex appropriate', the androgynous person possesses the psychological freedom to engage in whatever behaviour seemed most effective at the moment, irrespective of its stereotype as masculine or feminine.

Based on this conception of the androgynous person,

one can suggest the hypothesis that the androgynous person would be more flexible in his or her behaviour and thus would perform better than sex-typed individuals in a number of task situations. Empirical research in to this hypothesis is beginning to appear in the psychological literature with the general findings supporting the concept of androgyny. For example, a more androgynous view of oneself has recently been found to be accompanied by greater maturity in one's moral judgments (Block, 1973) and by a higher level of self-esteem (Spence et al, 1975). Perhaps the most in-depth research into androgyny has been carried out by Sandra Bem and her colleagues. They found that androgynous individuals not only perform cross-sex behaviour with little reluctance or discomfort (Bem & Lenney, 1976) but display both 'masculine' independence when under pressure to conform as well as 'feminine' nurturance when given the opportunity to interact with either a baby kitten (Bem, 1975) or a lonely student (Bem, Martyna & Watson, 1976). Thus there is ample evidence to support the suggestion that the androgynous person is more well-adapted to task situations requiring both 'masculine' and 'feminine' responses, situations in which the sex-typed individual will be restricted in his or her choice of behaviours.

Based on this conception of the androgynous person, it becomes necessary to revise the two basic assumptions mentioned previously, that a person's problem-solving ability is differentially affected by his or her sex-role typing behaviour. Where it was originally assumed that masculinity and femininity will give rise to differential

problem-solving skills within the sexes, the inclusion of the androgyny sex role leads to the hypothesis that androgynous individuals of both sexes will perform as well as masculine and feminine individuals within both sexes in "masculine" or "feminine" responses.

Outerdirectedness (1.3)

Another factor that has been shown to relate to differential problem solving skills between the sexes is outerdirectedness or glancing behaviour (Achenbach & Weisz, 1975; Achenbach & Zigler, 1968; Ruble, 1975; Ruble & Nakamura, 1972, 1973). The literature on glancing behaviour points consistently to the difference in attention exhibited by males and females when confronted with a task (Garai & Scheinfeld, 1968; Goodenough, 1957), with females being more 'people' or 'socially oriented' and males being more 'object' or 'task' oriented. Differences in these two types of orientation are reflected in their cue-dependent behaviour when solving a difficult problem. Where males tend to concentrate their attention on the task problem and are more persistent in their problem solving motivation (Garai & Scheinfeld, 1968; Crandall & Rabson, 1960), females tend to be more susceptible to the peripheral field, engaging in more glancing and more imitating behaviour (Garai & Scheinfeld, 1968). This was supported in a study by McDavid (1959) who found that among children aged 3-9 years, who observed an adult perform a task, the girls were more likely to imitate the adult than the boys, who attacked the problem without looking for adult assistance.

Differences in glancing behaviour are not restricted to between-sex groups as have been noted by a number of investigators (e.g. Keogh, 1971; Ruble & Nakamura, 1972; Yando & Zigler, 1971). They found that children of either sex differ in their approach to an experimental task; some are very attentive to the task, essentially unaware of other stimuli, while others are less attentive to the task and appear to be very much aware of or even dependent on the tester or aspects of the external environment. The findings of sex differences in glancing behaviour may be relevant to the understanding of sex differences in problem solving ability. As males have been found to be more task-oriented (engaging in less glancing behaviour) and display more successful problem solving skills than females, it is possible that sex differences in problem solving skills are a function of the person's glancing behaviour. In other words, males may perform better because they are more task-oriented. Similarly, the finding of within sex differences in glancing behaviour may be relevant in explaining the observed differences between the sex roles in their problem solving skills. That is, masculine and feminine individuals of either sex may differ in their glancing behaviour when confronted with a task, resulting in the observed differences in their performance. This hypothesis forms the basis for the second major aim of this study, that is, to explore the possibility that sex-role typing behaviour by male and female subjects may have differential effects on their glancing behaviour, and this may contribute to the observed differences in problem solving skills, both between and

within the sexes.

An external or 'outerdirected' approach to a task has been defined as a style of problem solving characterized by overreliance on external cues (Sanders, Zigler & Butterfield, 1968; Turnure & Zigler, 1964; Yando & Zigler, 1971). Much of the literature on people's attention to incidental as opposed to focal cues assumes that performance on a task is facilitated by the ability to screen out irrelevant, non-task stimuli (Turnure, 1969; White, 1965), implying that an outerdirected approach may be inferior to a task-oriented approach when utilized in problem solving. For example, a study by Mondani and Lutko (1969) has shown that underachievers attend too much to incidental, irrelevant material and not enough to the central learning task. However, other lines of research have demonstrated that attention to external cues can have beneficial as well as detrimental effects, depending upon whether they are relevant or irrelevant to the task. Ward (1969) found that highly creative children gave more responses on an 'instances' test in a cue-rich testing environment than in a poor environment, while low creatives showed no such environmental effect. Turnure and Zigler (1964) demonstrated that glancing behaviour can facilitate performance on a task when the experimenter provides cues relevant to the task. Thus, it appears to be inappropriate to refer to one style of problem-solving as being inferior or superior to the other in all situations. As suggested by Ruble and Nakamura (1972) and Cole et al (1971) the style which is more effective may vary with situational factors. This

assumption is in line with the work of Cole and his colleagues (1971) and Labov (1970) who have shown that poor performance of certain groups of subjects on psychological tests may be explained more fruitfully in terms of varying environmental-social factors rather than the absence of particular cognitive processes due either to cultural deprivation (Baratz & Baratz, 1970; Deutsch, 1969; Hellmuth, 1967) or genetic factors (Jensen, 1969). Thus, as the quality of subject's performance in task problems may vary with situational factors, the present study also attempts to test the importance of 'cues' (direct, indirect, relevant, irrelevant) given during a problem. The utilization of cues given during a problem may depend on how the subjects view the cues, for example, whether they are seen as relevant or irrelevant to the problem.

A final purpose of this study is to see how subjects will respond to cues given impersonally via an apparatus versus cues given by a person. Some researchers have suggested that cues provided by human models may be more salient to an outerdirected child than are physical cues (Turnure & Zigler, 1964). However, others who have investigated this prediction have failed to verify it (Balla et al, 1971; Sanders et al, 1968; Yando & Zigler, 1971), leading to the suggestion that outerdirectedness embodies not only responsiveness to human cues but an excessive reliance on other types of cues as well.

Aims of the present research (1.4)

The purpose of the studies reported here was to investigate the possibility that a person's problem solving ability may be affected by 'non-intellectual' factors. Stated more explicitly, the purpose of the present studies were:

(1) To investigate the effects of sex and sex-role typing behaviour on problem-solving skills.

(2) To investigate the effects of sex and sex-role typing behaviour on outerdirectedness (glancing behaviour) and its effects on problem-solving skills.

(3) To test the effects of external cues (direct vs. indirect, relevant vs. irrelevant, social vs. physical) in the solution of problems.

CHAPTER II

CHAPTER II

EXPERIMENT I - PILOT STUDY

Past work on children's attention to incidental as opposed to focal cues assumes that performance on a task is facilitated by the ability to screen out irrelevant, non-task stimuli. In a recent study by Ruble and Nakamura (1972), it was found that field dependent children are more socially oriented and more responsive to social cues than field independent children, who are more task oriented and less responsive to social cues. It was decided to replicate this study, but instead of using children as subjects, adult university students were tested. The purpose of this was to see whether the findings obtained from the Ruble and Nakamura (1972) study can be extended to explain adult subjects' glancing behaviour and problem solving skills. As past findings have indicated that females are more 'people' oriented while males are more 'object' oriented, an important aim of this experiment was to see whether there is any difference between the sexes in attention to the experimenter and the utilization of the cues provided. The present study was conducted by a male experimenter.

Method

Subjects

40 undergraduate students (20 males, 20 females) from the University of Waikato served as subjects. Their ages ranged from 18 to 24 years. Each subject took part in the Rod and Frame Test, the Object-Assemby Task and the Card Game.

Apparatus

The Rod and Frame Test (RFT) used in the present experiment is similar to a portable Rod and Frame apparatus developed by Oltman (1968). The test consisted of a black box 74 cm (25½ inches) long, 39 cm (13½ inches) wide and 27 cm (10½ inches) high. A white frame was mounted inside one end of the box so that the experimenter could tilt it to the left or right by manipulating a dial outside of the box. The rod, painted red, was mounted at the center of the frame and could be rotated independently of the frame. The interior of the box was illuminated with two 0.9 watt battery-powered lamps. The experimenter could read the positions of the rod and frame on a protractor-like dial on the outside of the box. The subject looked at the rod and frame through an opening at the end of the box.

The object-assembly task consisted of 2 puzzles, each consisting of seven unevenly-shaped pieces, which when put together correctly formed a 20 cm square. One puzzle was painted red and the other black. The card game consisted of a deck of 12 ordinary playing cards of various suits, and ranging in value from 'Two' to 'King'. A video tape

camera and recorder were used to record each subject's glances on the object-assembly tasks and the card game.

Procedure

Rod and Frame Test - All subjects were tested individually. Upon entering the room, the subject was seated in front of the Rod and Frame appartus and was asked to look inside the 'box' for the red stick. Once the red stick was located, the subject was shown that he could turn the red stick either left or right of the upright by manipulating a dial located beneath the opening at his end of the box. The subject was then told that his task was to make the stick stand 'straight up and down like a telephone pole'. The test consisted of four different trial settings:
(1) frame and rod both 28° left of upright,
(2) frame 28° left of upright, rod 28° right of upright,
(3) frame 28° right of upright rod 28° left of upright, and
(4) frame and rod both 28° right of upright.
Between each trial, the light inside the box was turned off so that the subjects could not watch the positions being set. Each subject was tested with the four settings and the degree of deviation from the upright for each setting was recorded. The mean error of deviation from the vertical over the four settings for each subject was then calculated.

Object-Assembly Task - The procedure for administering the object-assembly tasks was similar to that described in Ruble's (1975) study. The subject was seated at the middle of a small table. The experimenter sat at one end and at a

right angle to the subject's left. The video camera was positioned directly across the subject and at a level that allowed unrestricted recording of the subject's eyes. The subject was then told that his task was to assemble some puzzles. The subject was shown one of the two puzzles and was asked to put it together as fast as he could. In addition, while the subject was assembling his puzzle, the experimenter was also assembling the second puzzle in full view of the subject. The experimenter would quickly assemble his puzzle, left it in view for 15 seconds, then disassembled the figure and left the pieces in view for a couple of seconds. This procedure was repeated until the subject had finished his puzzle or until three minutes have passed. After the subject had finished with the first puzzle, he was required to assemble the second puzzle. The score for each of the two puzzles ranged from 0 to 10, one point given for each piece correctly placed plus one bonus point for completing the task in less than 3 minutes, 2 bonus points for completing it in less than 2 minutes and 3 bonus points for completing it in less than 1 minute.

Card Game - The procedure was similar to those reported in studies of outerdirectedness (Ruble & Nakamura, 1972; Achenbach & Zigler, 1968; Ruble, 1975). The 12 cards were spread out 3 at a time in front of the subject and the subject's task was to figure out which card was correct for each of 3 blocks of trials. The subject began a new block of trials either upon reaching a criterion of 5 correct in

a row or after 15 trials. In the first block of trials, the subject could reach criterion by either attending to the social cue or a task stimulus dimension (largest number). In block 2, only the social cue was correct and in block 3, only the stimulus dimension (smallest card) was correct. For the social cue, the experimenter repeatedly looked at and leaned very slightly toward the correct card. During the first block the social cue was directed at the large number card. Thus, the subject could reach criterion by attending either to the social cue or stimulus dimension. For the second block of trials, the social cue was randomized over the size of the cards and the correct response was the stimulus the experimenter was looking at. For the third block of trials, no social cue was given and the subject had to attend to the stimulus dimension (smallest number card) to reach criterion.

For both the object-assembly tasks and the card game, the measure of glancing behaviour for each subject was the number of glances at the experimenter or at the experimenter's puzzle scored from the video tape by two observers. A reliability estimate was obtained by correlating the independent ratings obtained from the two observers. The result indicated that the inter-observer reliability of scoring glances was very high ($r = .98$).

Results (2.1)

Past studies have shown that field dependency decreases with age (Ruble & Nakamura, 1972; Turnure & Zigler, 1964) and the results from the present study are consistent with this finding. In the study by Ruble and Nakamura (1972), 56 children with a mean age of $7\frac{1}{2}$ years were tested with the RFT. The obtained range in deviation scores was from 5° to 78°. In the present study, the adult subjects yielded average deviation scores which ranged from only 2° to 30°.

The subjects were divided by sex and classed as either field dependent or field independent on the basis of their RFT scores, by means of median splits. The means and standard deviations of the RFT scores for the different sex groups are presented in Table 1. Witkin, Goodenough and Karp (1959) have demonstrated sex differences on the RFT from the 8 year level on, with males being better than females in adjusting a rod to the absolute vertical under conditions of various tilts of self and rod. This sex difference has been cross-culturally confirmed by studies of American, English, Dutch, French, Italian and Hong Kong samples of various ages (Witkin, 1960). The results from the RFT test in the present study lend further support to these findings, with the observations that male subjects performed better than female subjects ($t(38) = 1.82$, $p < .05$ one-tailed)

Object-Assembly Task - The means and standard deviations for glances and performance points on the two puzzles have been recorded in Table 2. The dependent variable of

Table 1. Means and standard deviations of RFT scores for each sex group (N = 10) in Experiment I.

	Male			Female		
	FD	FI	Total	FD	FI	Total
Mean	6.62	3.13	4.87	11.49	3.66	7.57
S.D.	1.69	0.91	2.22	6.90	0.92	6.25

Table 2. Means and standard deviations of glances and points on the object assembly task (N =10 per cell) in Experiment I.

	Glances			Points	
Male	Puzzle 1		Puzzle 2		
FD	At E's puzzle	At E. in gen.	At E. in gen.	P1	P2
Mean	9.80	1.20	0.8	4.5	7.2
S.D.	7.33	2.39	2.2	4.45	3.25
FI					
Mean	4.4	0.3	0.1	6.3	5.5
S.D.	5.03	0.48	0.31	3.71	4.11
Female					
FD					
Mean	4.9	0.7	0	4.1	6.2
S.D.	4.88	1.25	0	3.51	3.91
FI					
Mean	2.9	0.6	0	5.4	6.0
S.D.	5.44	1.07	0	4.99	4.42

glancing behaviour was subjected to a 2 x 2 ANOVA (sex x RFT cognitive style). As females and field dependent subjects have been claimed to be more 'socially' oriented and cue-dependent than male and field independent subjects, it would be expected that they would be more attentive to the experimenter and engage in more glancing behaviour than male and field independent subjects. As such, significant main effects of sex and cognitive style would be expected. The ANOVA however showed that only the main effect of cognitive style was marginally significant, with field dependent subjects engaging in more glancing behaviour than field independent subjects ($F(1,36) = 4.02$, $p < .06$). The frequent contention that females are more socially oriented than males (Garai & Scheinfeld, 1968) was not supported, ($F(1,36) = 2.48$, $p > .05$). A reason for this non-significant sex effect may be due to the fact that the subjects were tested only by a male experimenter. The literature on sex differences have shown that female subjects frequently react differently to male than to female experimenters, and male subjects to female than to male experimenters (Borstleman, 1961; Glixman, 1967; Hetherington & Ross 1963; Stevenson, 1961). Moreover, research dealing with eye-contact and looking behaviour has shown that during same-sex interactions there is more eye contact or looking behaviour between female interactants than between male interactants (Argyle & Dean, 1965; Exline, Gray & Schuette, 1965; Exline & Winters, 1965). As such, the non-significant sex effect in glancing behaviour demonstrated here may be due to the limitation of having only a male experimenter.

A three factor ANOVA (sex x cognitive style x points from puzzles 1 and 2, with repeated measures on points) was applied to the puzzle scores. None of the main effects or the various interaction effects were found to be significant. The subjects, regardless of sex and cognitive style, performed similarly on the two puzzles. It was found that field dependent subjects glanced at the experimenter more than field independent subjects, and since most of the glances were directed at the experimenter's puzzle, it would be expected that the field dependent subjects would utilize this information in their assembling of puzzle 2. In other words, the points scored by the field dependent subjects should be greater for puzzle 2 than for puzzle 1. Although the results showed this trend occurred, the difference was not statistically significant. It appears that the female and field dependent subjects did not utilize the cues provided by the experimenter to a significantly greater degree than field independent subjects. (SEE APPENDIX 2 FOR CLARIFICATION).

Card Game - For the Card Game, the number of glances over each of the 3 blocks of trials for each subject were scored. The mean number of glances and trials to criterion for each group across the 3 blocks of trials are shown in Table 3. Chi-square tests were calculated to see whether the different cues given in the 3 different blocks significantly affected the number of glances over the trials. The results indicated no significant differences in glancing behaviour among the 3 blocks of trials, regardless of the

Table 3. Mean number of glances and trials to criterion in each group for card game (N = 10) in Experiment I.

Male	Trial 1		Trial 2		Trial 3	
FD	T. to crit.	Gl.	T. to crit.	Gl.	T. to crit.	Gl.
Mean	9.7	1.1	18.9	1.0	10.7	1.5
S.D.	4.66	2.46	3.47	2.21	6.51	2.91
FI						
Mean	9.8	2.0	17.0	1.8	13.5	2.3
S.D.	5.45	3.55	4.98	2.29	6.93	5.39
Female						
FD						
Mean	10.4	0.4	17.5	2.4	12.8	0.8
S.D.	4.40	0.69	4.08	3.89	7.23	1.93
FI						
Mean	10.9	1.9	15.1	1.8	9.2	1.4
S.D.	5.76	3.57	6.62	2.93	5.59	2.71

subject's sex or cognitive style. In order to examine the differences in the number of glances between the sex and cognitive style groups, the number of glances over all 3 blocks were combined and compared across groups. Chi-square tests* were calculated for the following groups: Male vs. female, field dependents vs. field independents, female (FD vs. FI), male (FD vs. FI), male field independents vs. female field dependents. Again, none of the analyses yielded significant differences. From past research, it could be predicted that the largest difference in the amount of looking would occur between male field independents and female field dependents; the present results however do not support this. It appears that the frequent contention that female and field dependent subjects are more socially oriented and outerdirected than male and field independent subjects is not supported by the results from these subjects.

The mean trials to criterion scores for the field independent and field dependent male and female subjects over the 3 blocks of trials were subjected to a three factor ANOVA (sex x cognitive style x blocks of trials, with repeated measures on blocks). Only the blocks main effect was clearly significant ($F(2,72) = 15.07$, $p < .01$) and this effect was almost wholly accounted for by the scores in block 2 differing from the other two. The subjects, regardless of sex and cognitive style, took significantly longer to reach criterion when only the social cue was relevant. From past findings, it could be expected that female and field dependent subjects would be most responsive

* IN EACH CASE THE GROUPS WERE SPLIT AT THE MEDIAN INTO "HIGH" AND "LOW" GLANCING SUBJECTS.

and male and field independent subjects would be least responsive to the cues provided in this task, resulting in differential performance across the blocks of trials. The results do not support this and indicated that female and field dependent subjects did not make better use of the social cues provided than male and field independent subjects.

Discussion (2.2)

The results from the RFT are consistent with past findings of male superiority in adjusting the rod to the vertical, and lend further support to the contention that the sexes differ in their analytic ability to differentiate objects from embedding backgrounds. The finding of large variation within each sex in RFT scores suggests that individual variation in analytic ability exists not only between sex but also within sex.

The present experiment is basically a replication of Ruble and Nakamura's (1972) study, but the results obtained from the object-assembly tasks and card game in this experiment are quite different from those obtained in their study. Although the finding of differential glancing behaviour by field dependent and field independent subjects is consistent with the findings of Ruble and Nakamura's (1972) study, no similar differences in performance ability between different types of subjects were demonstrated in the present experiment. Moreover, the results from the card game failed to demonstrate any significant differences in glancing behaviour and trials to criterion for both

between and within sex comparisons. Although Ruble and Nakamura (1972) showed that girls and field dependents were able to utilize the social cue given in block 2 of the trials more readily than boys and field independents, the results from the present experiment failed to show any similar differences between the sexes or between different types of subjects. The contention that female and field dependent subjects are more socially oriented and cue-dependent than male and field independent subjects was not supported in this experiment.

The differences in findings between this experiment and the study by Ruble and Nakamura (1972) may lie in the differences in age of the subjects used and the different sorts of strategies that the subjects used in solving the experimental tasks. According to Saarni (1973), the sorts of strategies an individual uses in a problem-solving situation can be understood in terms of the developmental capacities the subject brings into the situation. These strategies dictate the approach to the problem and to a considerable extent, the performance of the individual. This suggestion is in line with the findings from studies dealing with the developmental trends for field dependency. Children have been found to be relatively field dependent early in life and becoming more field independent as they grow older (Ruble & Nakamura, 1973). As there is evidence of a relationship between individual variation in attending to the environment and field dependence (Crutchfield, Woodworth & Albrecht, 1957; Beller, 1958; De Varis, 1955), there is reason to suggest that developmental trends in

field dependency apply not only to the perceptual field (Witkin et al, 1959) but also to the attentiveness to the human environment. Thus, it appears valid to assume that, the younger children are, the more field dependent their approach to a problem would be, as characterized by their tendency to glance away from the task. Theoretically, this developmental trend should occur because for the very young child, outerdirectedness should more likely result in success than should reliance on poorly developed cognitive skills (Turnure & Zigler, 1964). As the child grows older, he or she becomes more field independent as a result of better cognitive skills, and their preference to rely on their own skills is characterized by problem-solving behaviour which is more internally oriented, an attempt to solve the task by means of inductive rules and glancing away less from the immediate task. These differences in strategies have been supported in numerous studies (Balla, Styfco & Zigler, 1971; Ruble and Nakamura, 1973; Zigler & Yando, 1972), and the results from the Ruble and Nakamura (1972) study and those from the present study are consistent with these developmental changes in problem-solving strategy.

Overall the results from this pilot study indicate that university student subjects may not show as large differences as children in research dealing with glancing behaviour. However it must be noted that this finding may be relevant only to the student subjects tested in this study and may not apply to the adult population in general. It has been pointed out by past researchers (Schultz, 1969;

Smart, 1966) that university students may represent a non-random or select group from the adult population and as such may limit any interpretations of the findings from this study to this particular group of subjects. As the present project involved glancing behaviour as a major factor, it was decided to use children as subjects in the further experiments in order to maximize sex differences on this variable.

CHAPTER III

CHAPTER III

EXPERIMENTS II & III

Experiment II was designed specifically to test the aim mentioned earlier, that children's problem solving ability is differentially affected by their sex and sex role typing behaviour. Between and within-sex differences in problem-solving skills have been noted, with the observation that male and masculine subjects generally possess superior problem-solving skills (spatial mechanical) than female and feminine subjects. With the inclusion of a measure of androgyny a new category has been added to the superior-inferior dichotomy of sex and sex-role related problem solving skills. As the androgynous person incorporates both masculinity and femininity into his or her personality, and as such is said to be free from the constraints of traditional 'sex-appropriate' norms, it would be expected that the androgynous person would be more flexible in his or her behaviour and thus would perform better on a number of tasks than sex-typed individuals (Bem, 1975, 1976; Bem, Martyna & Watson, 1976). The present experiment investigates the relationship between sex-typing and one area of analytic ability that has been shown to relate consistently with sex differences, that of the Rod and Frame Test. Based on the conception of the androgynous individual, one would hypothesize that within the male and female samples, masculine and androgynous subjects would

not differ in their performance, but that they would perform better than feminine and undifferentiated (those who are low in both masculinity and femininity) subjects on the RFT.

Method

Subjects

The subjects used in this experiment were children, whose ages ranged from 8 to 10 years. There were 47 boys and 48 girls (N = 95), from Standards 2 and 3 of a primary school in Hamilton. No child in the sample showed evidence of gross motor, sensory or psychological disturbances.

Measure of sex-role typing behaviour

As the subjects used in the present study were between the ages of 8 and 10½ years, the test used to elicit sex-role typing response must be relevant to the children's cognitive level. Such a scale, the 'Children's Androgyny Scale' (C.A.S.) has been constructed at the University of Waikato and has been successfully administered to a sample of 148 New Zealand primary school children (Ritchie, VILLIGER & QUIGNAN, 1977). Basically, the C.A.S. is similar to the Bem Sex Role Inventory (BSRI), and consists of 24 items, of which 12 are 'masculine' and 12 are 'feminine'. The items were designated as either masculine or feminine if they were rated as being significantly more appropriate ($P < .001$) for one sex than the other. A first person verbal clause was added to the front

of each item to make it more comprehensible to the children. For example, Masculine items - I like sport, I am noisy, I am strong; Feminine items - I am kind, I am helpful, I am shy, (For complete Children's Androgyny Scale, see Appendix 1.). To lessen the effect of response bias, the items were arranged so that 'masculine' and 'feminine' items were alternated throughout. The C.A.S. asks the child to indicate on a 5-point scale how well each of the 24 masculine and feminine items describes themself. The scale ranges from 1 (never) to 5 (very often) and is labelled at each point. The scoring of the C.A.S. is by means of median splits, whereby subjects are divided at the median score of each group on both the masculinity and femininity scales of the C.A.S. This method, proposed by Spence, Helmreich and Stapp (1975) and which is now adopted by Ben (Bem, 1975) yields four categories for each sex: Androgynous (high masculine-high feminine), Masculine (high masculine-low feminine), Feminine (high feminine-low masculine), and Undifferentiated (low masculine-low feminine). (SEE APPENDIX 3 FOR DETAILS OF THE C.A.S.).

Apparatus

The RFT used in the present experiment was the same as the one used in Experiment I.

Procedure

The procedure for administering the RFT was the same as that described in Experiment I. After completion of the RFT, each subject was administered with the C.A.S. individually in the testing room. The instructions were read to the

subjects and after ensuring that the subjects knew exactly what to do, the experimenter read out the 24 sex-typed items one by one. As each item was read out, the subjects indicated on the 5-point scale how well that item described themselves. Finally, before each subject was returned to the classroom they were told that they had done very well or better than most children their age on the tasks.

Results (3.1)

Classifying the subjects into the appropriate sex-role categories revealed an unexpected finding. The C.A.S. in the present study yielded only 3 categories for each sex: Masculine (for male subjects)/Feminine (for female subjects), Androgynous and Undifferentiated, as opposed to the expected four categories yielded from this type of measure (Bem, Martyna & Watson, 1976: Ritchie, Duignan & Villager, 1977; Spence et al, 1975). Thus there were no sex-reversed subjects in this study. The absence of a fourth sex-reversed category (male subjects who score high on the feminine scale and low on the masculine scale, and female subjects who score high on the masculine scale and low on the feminine scale) within both sexes is an interesting feature, especially when girls at this age usually show marked cross-sex preference (Brown, 1957; Hartup & Zook, 1960; Reed & Asbjornsen, 1968).

Table 4 contains the means and standard deviations of the error scores for the male and female sex-role categories on the RFT. In order to test the hypothesis that masculine and androgynous subjects would perform better than feminine

Table 4. Means and standard deviations for male and female sex role categories on RFT scores in Experiment II.

	Male subjects			Female subjects		
Sex-role categories	n	Mean	S.D.	n	Mean	S.D.
Masculine	23	13.92	10.49	-	-	-
Feminine	-	-	-	23	23.32	13.57
Androgynous	11	14.14	9.77	16	22.48	6.56
Undifferentiated	13	16.58	8.52	9	15.22	5.51

and undifferentiated subjects, a 2 factor ANOVA (subject's sex x sex-roles) for unequal cell frequencies was applied to the RFT scores. The results of the ANOVA are shown in Table 5. Only the main effect of 'sex' was significant, $F(1,89) = 10.69$, $p < .01$, with male subjects making fewer errors in adjusting the rod to the vertical. This finding lends further support to the contention that males are superior to females in analytic ability as measured by the RFT. The major effect that was relevant to the specific hypothesis of the present study was the sex x sex-roles interaction effect, which was found to be non-significant, $F(2,89) = 1.82$, $p > .05$. Thus, contrary to expectations, differential sex-role typing by the subjects within the sexes did not result in differential performance. Masculine and androgynous subjects did not perform better than feminine and undifferentiated subjects on the RFT.

Discussion (3.2)

The major finding from the present study does not support the hypothesis that analytic ability is differentially affected by sex-role typing behaviour. This failure to demonstrate the effects of sex-role typing behaviour could be due to a number of factors related to the present study.

First, based on its functional definition, androgyny appears to have meaning only when related to social personality traits. This view is supported by the numerous studies which have successfully related only social variables (for example nurturance, attitudes, warmth, and

Table 5. Summary of 2 X 3 ANOVA (sex X sex-roles) on RFT scores in Experiment II.

Source	SS	df	MS	F	P
Total	10804.41	94			
Sex	1104.09	1	1104.09	10.69	<.01
Sex-roles	133.45	2	66.72	<1	
Sex x Sex roles	376.54	2	188.27	1.82	
Error	9190.31	89	103.26		

choice of appropriate behaviours) to androgyny (Bem, 1975; Bem & Lenney, 1976; Bem, Martyna & Watson, 1976; Zeldow, 1976). The present study involved the RFT, which required non-social, spatial mechanical skills on the part of the subjects.

Second, past works have attributed differential RFT performance within the sexes to the so-called 'cultural reward hypothesis' (Barrett & Thornton, 1967; Evans, 1969; Vaught, 1965). Vaught (1965) argued that the attributes accompanying each cultural role for males and females accounted for the differential RFT performance. He suggested that, for example, masculinity has long been associated with mechanical and scientific interests, and when a female becomes interested in mechanical tasks, she would not only be identified as relatively masculine, but she would also tend to make fewer errors in the RFT. However the results of the present study are not completely consistent with Vaught's hypothesis. One possible reason for this may lie with what Horner(1969) calls the 'fear of success', exhibited by women (demonstrated earlier by Maccoby (1966) and Saradon (1960)). Working with college students, Horner (1969) found that female achievement incurs anxiety as a result of equating achievement with loss of femininity. She reasoned that in achievement-orientation situations, women would worry not only about failure but also about success. According to Horner, 'if she fails, she is not living up to her own standards of performance; if she succeeds, she is not living up to societal expectations about the female role'. Horner's major hypothesis was that, for women, the

desire to achieve is often very much in conflict with what she labelled as the 'motive to avoid success'. The results from the present study appear to support her hypothesis in that the failure of the androgynous females to perform significantly better than the feminine females could be due to this 'fear of success'. Although Horner (1969) arrived at her conclusions in studies using college students as subjects, it appears from the results of the present study that this 'fear of success' may not be limited only to adult females.

Another reason why the results of the present study are not consistent with Vaught's (1965) 'cultural reward hypothesis' may lie with Ullian's (1976) findings of differential utilization of cultural sex-roles by adults and children. In comparing adult's and children's acceptance of cultural sex-roles, she suggested that adult subjects can view their own experience as only one of many alternatives, and as a result their behaviours are not constricted to one particular sex-role. In contrast to adult subjects, the 9 to 10 year old children in the present study are at a level where sex appropriate behaviours are determined and limited by social norms and conventions. Although adults can choose between different cultural roles and their analytical ability affected by the attributes of whatever role they choose, the children's performance is consistent with the cultural roles with which they have been socialized and taught as being appropriate to their sex.

The use of the C.A.S. inventory in the present study

has been successful in differentiating between sex-typed and androgynous subjects. As the C.A.S. allows the subject to simultaneously endorse and reject sex-typed attributes, the scale thus measures the amount of masculinity and femininity that the subject includes in his or her self-description. As Bem and her colleagues, using a similar inventory (the BSRI), have successfully shown that such a scale is a valid and reliable measurement of sex-role typing behaviour and more important, that subject's behaviour can be differentially affected by their sex-role typing behaviour, it is highly probable that the failure of the present study to demonstrate any effects of sex-role typing behaviour on analytic ability may be due to the dependent variable rather than to the failure of the C.A.S. inventory.

EXPERIMENT III

The findings from Experiment II support the frequent contention that analytic ability is a masculine characteristic (Constantinople, 1974; Maccoby, 1963; Witkin et al, 1962) with males performing consistently better than females on the RFT (McGuinness, 1976). It is possible that this male superiority is such a dominant factor as to have resulted in the test favouring the spatial skills of males over females, regardless of sex-role typing by the subjects. Where boys are superior to girls in spatial skills, girls excel in what can be called 'social' skills (Goodenough,

1957; Oetzel, 1967). However, while the RFT allowed for the use of the boy's spatial skills in their performance, the task did not allow for the use of the special 'social' skills of the females. Experiment III was designed specifically to allow for the use of both types of skills.

Girls have been shown to be more interested and sensitive to the social environment than boys (Goodenough, 1957; McGrew, 1972; Oetzel, 1967; Witryol & Kaess, 1957) and it is possible that children particularly sensitive to the social environment would be attentive to the cues given by the experimenter during a task situation. As such, the inclusion of social cues relevant to the task problem should improve female subject's performance. The present experiment was designed with this in mind, and involved object-assembly tasks taken from the Wechsler object-assembly tests (A.C.E.R. 1968). These tasks involved the assembling of 3 puzzles and the subject's performance could be facilitated by attending to 2 types of cues - direct and indirect - provided by the experimenter. Thus, as performance in this experiment could be aided by both spatial and social skills (as indicated by subject's glancing behaviour), the experimental task was designed to allow for the use of different problem-solving strategies which have been shown by male and female subjects. With the inclusion of the social cue, it was expected that the subjects' glancing behaviour and task performance would be differentially affected by their sex-role typing behaviour.

Method

Subjects

The subjects used were the same as those employed in Experiment II. The subjects were grouped into the appropriate sex-roles by means of the C.A.S. scale.

Apparatus

Modified forms of the Object-Assembly task used in the Ruble and Nakamura (1972) study were employed. The object-assembly tasks were taken from the Wechsler object-assembly tests (A.C.E.R., 1968). No alterations were made to the figures and they were exactly the same size as those in the Wechsler tests.

A video tape was used to record subject's frequency and direction of glances. Live ratings were not possible as the experiment was carried out at the children's school which has no one-way mirror rooms. It was decided against having an observer in the room to record glancing behaviour, as the presence of an observer may have been a source of distraction.

Procedure

The subjects were tested individually with the object-assembly tasks. The procedure for administering the tasks was similar to that described in Ruble's (1975) study. The seating arrangements and the positioning of the video camera were the same as Experiment I. Each subject was told that their task was to assemble some puzzles. The subject was shown one of the 3 puzzles and was asked to put it together

as fast as they could. In addition, for the first puzzle, the experimenter said that he would be working on the same puzzle along with the subject. For the second puzzle, the experimenter said that he would be working on a different puzzle (puzzle 3) while the subject was working on the second, and for the third puzzle the subject had to work on the puzzle by himself. The presentation of the puzzles was in a predetermined random order. The differences in the procedures for the puzzles was to see if the cues given during puzzle 1 (direct) and puzzle 2 (indirect) would be utilized by the subjects in puzzles 1 and 3.

For each puzzle, the subject was allowed 3 minutes working time, during which his glancing behaviour was recorded on video tape. Also for puzzles 1 and 2, the experimenter assembled his puzzle, left it in view for 15 seconds, then disassembled the figure and left the pieces in view for a couple of seconds. This procedure was repeated until the subject had finished his puzzle or until the 3 minutes had passed. The time taken for each puzzle was recorded by stopwatch.

The scoring system for the 3 puzzle games was similar to the standard scoring system used in the Wechsler object-assembly test. The scoring for pieces correctly put together was the same as that described in the Wechsler test, with a maximum of 6 points given for a puzzle correctly assembled within the 3 minute time limit. However, due to the difference in the complexity of the 3 puzzles, the giving of bonus points (for puzzles correctly assembled before the 3 minute time limit) was differentiated as

follows:

a) Face puzzle - Less than 2 min. 30 sec. = 3;
2 min. 31 sec. - 2 min. 45 sec. = 2;
2 min. 46 sec. - 3 min. = 1.

b) Car puzzle - Less than 2 min. = 3;
2 min. 1 sec. - 2 min. 15sec. = 2;
2 min. 16 sec. - 2 min. 30 sec. = 1.

c) Horse puzzle - Less than 1 min. 30 sec. = 3;
1 min. 31 sec. - 1 min. 45 sec. = 2;
1 min. 46 sec. - 2 min. = 1.

Thus a subject could score a maximum of 9 points for each of the 3 puzzles if they could assemble each one correctly within the 3 minute time limit and within the specified time of each puzzle.

When the subjects had finished with the object-assembly task, they were asked not to discuss the task with their friends. Finally, before the subjects returned to their room, they were told they had done very well or better than most children of their age.

The measure of glancing behaviour for each subject was again scored from the video tape by 2 observers. A reliability estimate was calculated and result again indicated that the inter-observer reliability of scoring glancing was very high ($r = .96$).

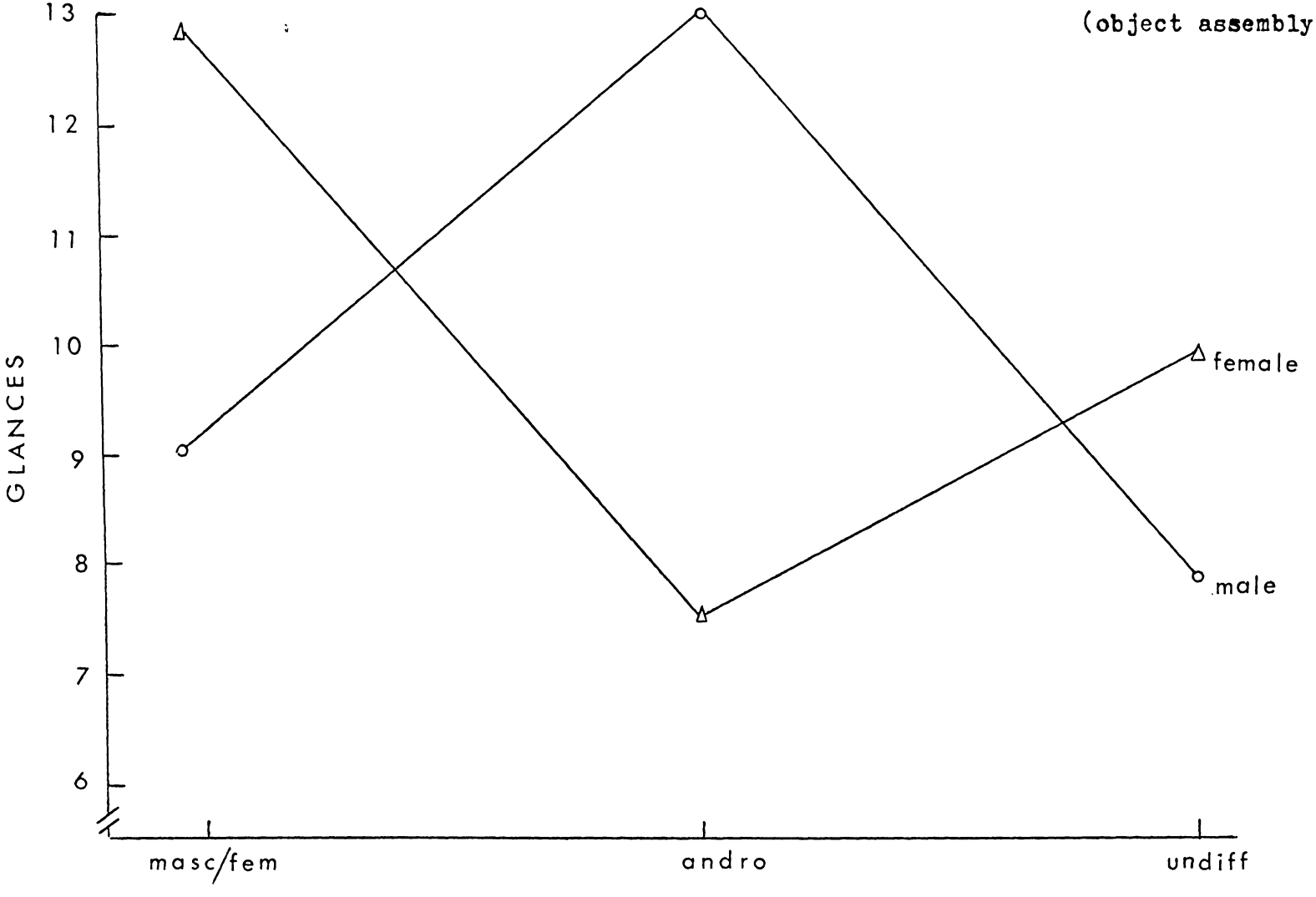
Results (3.3)

The means and standard deviations for glances and performance points for each group of subjects have been recorded in Table 6. The data have been graphed in Figure 1

Table 6. Means and standard deviations of glances and points on object assembly task in Experiment III.

Sex groups	Glances			Points		
Male						
Masculine (N = 23)	P1	P2	P3	P1	P2	P3
Mean	5.43	2.78	0.82	6.43	4.60	5.43
S.D.	6.99	3.37	1.46	3.11	3.25	3.31
Androgynous (N = 11)						
Mean	9.36	2.55	1.09	5.18	4.81	5.54
S.D.	7.92	3.29	2.66	3.60	3.34	3.29
Undifferentiated (N = 13)						
Mean	4.77	2.92	0.15	4.15	4.53	3.92
S.D.	5.44	3.86	0.37	3.48	2.84	3.17
Female						
Feminine (N = 23)						
Mean	8.04	4.00	0.86	5.0	3.60	3.13
S.D.	6.51	4.3	1.51	3.05	2.97	2.86
Androgynous (N = 16)						
Mean	3.75	3.38	0.25	4.81	4.18	3.87
S.D.	3.17	3.28	0.43	3.58	3.31	3.02
Undifferentiated (N = 9)						
Mean	6.00	3.56	0.44	6.33	4.22	3.22
S.D.	3.27	4.63	0.87	3.31	2.43	3.07

Figure 1. Mean number of glances for different sex groups in Experiment III (object assembly tasks).



(glancing scores) and Figure 2 (performance points). One of the major hypotheses of the present experiment was that the children's sex-role typing behaviour would differentially affect their glancing behaviour, resulting in a significant sex x sex-roles interaction effect. To test this, the glancing scores for each subject over the 3 puzzles were subjected to a 2 factor ANOVA (sex x sex-roles) for unequal cells. The results of the ANOVA are shown in Table 7. The results indicated that the expected interaction effect was only marginally significant, $F(2,89) = 2.50$. $p < .10$. Simple t-tests were used to evaluate the specific expectations of the present experiment. It was expected that male androgynous subjects would glance more than either male masculine or male undifferentiated subjects (due to their being more likely to show feminine behaviours). Although the trends are in the expected direction, they failed to achieve statistical significance - (Male androgynous vs. Male masculine $t(32) = 1.07$, $p > .05$; Male androgynous vs. Male undifferentiated $t(22) = 1.31$, $p > .05$). It might be expected that female androgynous subjects would glance less than either female feminine or female undifferentiated subjects (due to their being more likely to show masculine behaviours). The results showed that the former expectation was supported, but not the latter - (female androgynous vs. female feminine $t(37) = 2.04$, $p < .05$; female androgynous vs. female undifferentiated $t(23) = 1.06$, $p > .05$). The results of the ANOVA also indicated that there was no significant differences in glancing behaviour between male and female subjects, ($F(1,89)$

Figure 2. Mean scores for object assembly tasks in Experiment III as a function of sex and sex-roles.

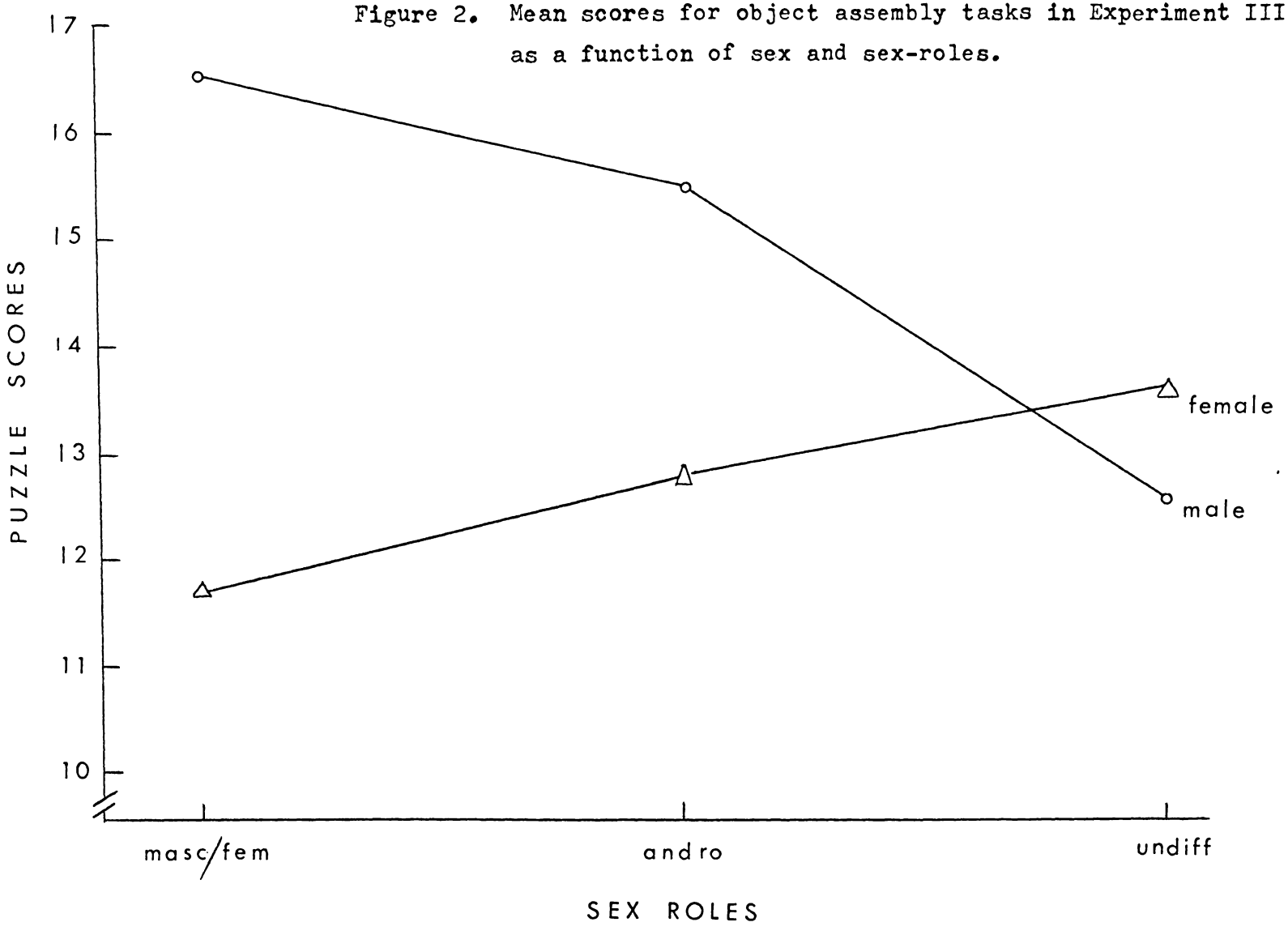


Table 7. Summary of 2 X 3 ANOVA (sex X sex-roles) on glancing scores obtained in Experiment III.

Source	SS	df	MS	F	P
Total	7307.32	94			
Sex	18.49	1	18.49	<1	
Sex-roles	81.98	2	40.99	<1	
Sex X sex-roles	384.62	2	192.31	2.50	$<.10$
Error	6822.22	89	76.65		

= 1, $p > .05$), and lends further support to the contention that the literature on sex difference for glancing behaviour is equivocal (Ruble, 1975). There were also more glancing scores recorded for puzzle 1 than for puzzles 2 and 3. A reason for this may lie with the fact that the subjects had prior knowledge that the cues given in puzzle 1 were directly relevant to their assembling of puzzle 1. Although the cues given during the assembling of puzzle 2 were also relevant (though indirect), subjects were not informed of this. There were no cues given during the assembling of puzzle 3.

The second major hypothesis of the present experiment was that subject's sex-role typing behaviour would also differentially affect their performance on the experimental task. To test this, a 3 factor ANOVA (sex x sex-roles x puzzle scores, with repeated measures on Scores) for unequal cells was applied to the puzzle scores. The results of the ANOVA are shown in Table 8. The ANOVA yielded significant results for only the effects of 'sex' and 'trials'. The results indicated that overall, male subjects performed better than female subjects across the 3 tasks as expected ($F(1,89) = 4.29$, $p < .05$) and that subjects regardless of sex and sex-role typing behaviour performed better on puzzle 1 than on puzzles 2 and 3 ($F(2,178) = 4.29$, $p < .01$). This differential performance across puzzles can be attributed to the difference in cues given during puzzle 1 (direct) and those given during puzzle 2 (indirect). As the subjects knew that the cues given during puzzle 1 were directly relevant to their task, they looked more during this trial

Table 8. Summary of 2 X 3 X 3 ANOVA (with repeated measures on the third factor) on puzzle scores in Experiment III.

Source	SS	df	MS	F	P
Total	2939.76	284			
Between subjects	1361.10	94			
Sex	57.34	1	57.34	4.29	$<.05$
Sex-roles	5.35	2	2.67	<1	$>.05$
Sex X sex-roles	46.64	2	23.32	1.74	$>.05$
Error b	1189.06	89	13.36		
Within subjects	1578.66	190			
Trials	77.55	2	38.77	4.79	$<.01$
Trials X sex	21.89	2	10.94	1.35	$>.05$
Trials X sex-roles	20.08	4	5.02	<1	$>.05$
Trials X sex X sex-roles	20.43	4	5.10	<1	$>.05$
Error w	1438.69	178	8.08		

and as a result, performed significantly better than on puzzles 2 and 3. The main effect that was relevant to the expectations of the hypothesis of the experiment was the sex x sex-roles x trials interaction effect, which was found to be non-significant ($F(4,178) = <1$). Thus, it seems that sex-role typing behaviour within the sexes did not result in differential performance. However, according to the hypothesis, it would still be expected that as a result of sex-role typing, the biggest difference in performance scores would be between male masculine and female feminine subjects, with male masculine subjects doing better. A direct comparison supported this, $t(44) = 2.52$, $p < .01$. Thus it appears that the effects of sex-role typing behaviour on problem-solving skills within the sexes can not be completely discarded on the basis of the non-significant interaction effect.

Discussion (3.4)

The results lend partial support to the hypothesis that sex-role typing behaviour results in differential problem-solving skills and glancing behaviour. For female androgynous subjects, a shift towards masculinity resulted in a significant decrease in the feminine-related trait of glancing behaviour, while the biggest difference in performance scores was between male masculine and female feminine subjects, with male masculine subjects doing better. The finding that male subjects still performed better than female subjects regardless of the cues provided, suggests that the cues were not used by the female subjects to their

advantage. One reason for this could be attributed to the type of cues provided. The cues provided in this experiment were through the experimenter's puzzles and hands, and as such may not have been considered 'social' enough by the female subjects. This is in line with findings from past works that have shown that, under similar experimental tasks, socially oriented field dependent children were more likely to watch the experimenter's face for cues, rather than the assembling of his puzzle (Ruble & Nakamura, 1972; Achenbach & Weisz, 1975). The finding of no sex difference in glancing behaviour supports the assumption that female subjects did not appear to consider the cues provided as being 'social' enough to warrant special attention. As such, the task problems could still have favoured the superior spatial ability of males resulting in their better performance. Thus the experimental procedures may still not have allowed both males and females to do equally well on the tasks.

CHAPTER IV

CHAPTER IV

EXPERIMENT IV, V AND VI

The results from Experiment III lend only partial support to the hypothesis that sex-role typing behaviour could result in differential problem-solving ability and glancing behaviour. The inclusion of external cues did not result in better performance by the female subjects and a reason for this could be due to the cues provided. The results however do suggest that it is possible to demonstrate the effect of sex-role typing behaviour on problem-solving skills and glancing behaviour if more social cues were incorporated in to the procedure. The cues provided in the last experiment could have been viewed as mere distractions rather than relevant social cues by the female and androgynous male subjects. Experiment IV was designed with this in mind and included social cues provided by the experimenter's face. This procedure is in line with the assumption that, when seeking help through glancing behaviour, the more socially oriented subjects would more likely attend to the experimenter's face (and especially the experimenter's eyes) for information rather than the experimenter's puzzle.

Experiment IV was designed to again test the effects of sex-role typing behaviour on children's problem-solving ability and glancing behaviour. The experimental task used in this study was the concept-identification task, similar

to the one used in Ruble's (1975) study. This task differs from the object-assembly tasks used in Experiment III primarily in the type of cues provided during the procedure. Where in the object-assembly tasks, the subject's performance could be facilitated by attending to the cues provided by the experimenter's puzzle, in the present concept-identification task, subject's performance could be facilitated by attending to the cues provided by the experimenter's face and eyes. Thus, the concept-identification task can be said to be more 'social' than the object-assembly tasks.

Method

Subjects

The subjects used were the same as those employed Experiments II and III. They were grouped into the appropriate sex-roles by means of the C.A.S. scale.

Apparatus

The concept-identification task consisted of 90 10 x 15 cm cards on which were pasted one of three sizes of geometric figures (large, medium, small) that varied along the dimensions of shape and colour. A video tape was used to record subject's frequency and direction of glances.

Procedure

The procedure was similar to those reported in studies of glancing behaviour (Ruble & Nakamura, 1972; Ruble 1975; Achenbach & Zigler, 1968). The subject was seated at the

middle of a small table with the experimenter sitting directly infront of the subject. The video camera was positioned at about 45 degrees from the subjects right and at a level that allowed unrestricted recording of the subject's eyes. The 90 cards were arranged in 3 stacks of 30 and were turned over one at a time across the 3 stacks. The subject's task was to figure out which card was correct for each of 3 blocks of trials. The subject began a new block of trials either upon reaching a criterion of 5 correct in a row or after 15 trials. The instructions given were the same for all subjects:

> "I am going to put down three cards on the table. Out of these three cards, one is right and the other two are wrong. What I want you to do is to pick out the right card. There is a way to figure out the right card so that you can be correct every time. After you have chosen, I will tell you which one was right. If you get several cards correct in a row, I may change the method for working out the right card; then your job will be to figure out what the new correct card is".

In the first block of trials, the subject could reach criterion by either attending to the social cue or a task stimulus dimension (largest figure); in block two, for the external cue-relevant condition, only the social cue was correct, and in block three for the cue-irrelevant condition, only the stimulus dimension (smallest figure) was correct. For the social cue, the experimenter repeatedly looked at and leaned very slightly toward the correct card.

During the first block, the social cue was directed at the large card. Thus the subject could reach criterion by attending either to the social cue or stimulus dimension. For the cue-relevant second block of trials, the social cue was randomized over the size of the cards and the correct response was the card the experimenter was looking at. For the cue-irrelevant third block of trials, the position of the social cue was varied such that one third of the time the experimenter was looking at the correct stimulus, while for the remaining time the experimenter looked at one of the two incorrect stimuli in a pre-determined random order. This schedule was decided upon so that it would not be immediately obvious to the subjects that the cue was irrelevant.

All subjects in the present study participated in the concept-identification task and were tested with all three blocks of trials. The experimenter always started by presenting the first block of trials, during which the experimenter noted whether the subjects reached criterion by attending to the social cue or to the stimulus dimension for that block of trials. As the experimenter was seated only a few feet away and directly infront of the subject, it was possible for the experimenter to note (by the subject's eyes and head movements) whether the subject was attending to the experimenter's face or to the stimulus dimension in figuring out the correct card, even though the experimenter's glances were directed at the stimulus on the table. This was checked and confirmedlater by means of the video tape for each subject. The presentation of the second and third

blocks of trials was determined by the type of cues the subjects had attended to previously. If the subject reached criterion by attending to the social cue, then the next block of trials presented would have been the cue-irrelevant, third block of trials, followed by the cue-relevant second block of trials. If the subject reached criterion by attending to the stimulus dimension, then the following block of trials presented would have been the cue-relevant second block of trials, followed by the cue-irrelevant third block of trials. If the subject did not reach criterion in the first block of trials, then the following presentations of block 2 and block 3 of the trials were randomized. This order of presentation was decided upon so that subject's attendance to either the social cue or stimulus dimension of the first block of trials could not be used in the block of trials following the first block. This procedure was used in order to break up any learning effect that could have resulted by subjects attending either to the social or physical cue in block 1 of the trials. As the first block of trials contain cues that were relevant for both male masculine and female feminine subjects, the following presentation would be that block of trials containing cues non-preferred to the sex-typed subjects. For example, it was expected that female feminine subjects would attend to the social cue to reach criterion in the first block of trials and if this was found to be the case, then the following presentation would be that block of trials requiring attending to the physical cue and avoidance of the irrelevant social cue. This order was expected to counteract

any learning effect. Similarly, it was expected that male masculine subjects would attend to the physical cue to reach criterion in the first block of trials, and if this was found to be the case, then the following presentation would be that block of trials containing the relevant social cue only to counteract any learning effect. The rationale for this procedure was to estimate the extent to which the subjects were able to switch their problem-solving strategy and to avoid establishing a problem-solving 'set'.

Results (4.1)

The means and standard deviations for glances and trials to criterion for the various sex groups are shown in Table 9. To test the effects of sex and sex-role typing behaviour on the outerdirectedness variable, a 3 factor ANOVA (sex x sex-roles x trials, with repeated measures on trials) for unequal cell frequencies was applied to the glancing scores. The results of the ANOVA are shown in Table 10. The analysis yielded significant effects for 'sex' ($F(1,89) = 6.26$, $p < .05$), 'trials' ($F(2,178) = 35.16$, $p < .001$) and 'trials x sex' ($F(2,178) = 4.46$, $p < .05$). Thus it appears that female subjects engaged in more glancing behaviour than male subjects for the concept-identification task. Post Hoc t-tests showed that for both sexes, there were significantly more glances in Block 3 of the trials (irrelevant social cue) than in Block 1 (social cue and stimulus) and Block 2 (relevant social cue only) - Male subjects - Block 3 vs. Block 1 - $t(92) = 2.58$, $p < .05$;

Table 9. Means and standard deviations of glances and trials to criterion on the concept-identification task in Experiment IV.

Sex groups	Glances			Trials to crit.		
Male						
Masculine (N = 23)	T1	T2	T3	T1	T2	T3
Mean	2.0	1.7	4.74	15.61	17.91	13.35
S.D.	2.84	2.31	5.63	3.98	3.21	5.78
Androgynous (N = 11)						
Mean	2.0	3.27	5.27	13.73	14.73	13.36
S.D.	3.57	3.95	6.38	5.38	4.02	5.0
Undifferentiated (N = 13)						
Mean	1.23	2.23	4.15	10.62	15.46	13.69
S.D.	2.34	2.68	6.29	6.08	6.03	6.56
Female						
Feminine (N = 23)						
Mean	1.26	3.30	8.87	14.0	11.65	18.48
S.D.	2.74	4.52	9.72	4.97	5.40	2.8
Androgynous (N = 16)						
Mean	2.69	4.43	8.56	11.75	13.88	14.38
S.D.	4.46	3.91	9.38	6.21	5.92	6.67
Undifferentiated (N = 9)						
Mean	5.0	6.22	9.00	12.78	16.22	14.56
S.D.	5.02	7.72	7.28	6.99	3.86	5.24

Table 10. Summary of 2 X 3 X 3 ANOVA (with repeated measures on the third factor) on glances in Experiment IV.

Source	SS	df	MS	F	P
Total	9776.57	284			
Between subjects	5612.57	94			
Sex	361.32	1	361.32	6.26	$<.05$
Sex-roles	44.18	2	22.09	<1	
Sex X sex-roles	73.70	2	36.85	<1	
Error b	5133.36	89	57.67		
Within subjects	4164.00	190			
Trials	1121.03	2	560.51	35.16	$<.001$
Trials X sex	142.42	2	71.21	4.46	$<.05$
Trials X sex-roles	40.70	4	10.17	<1	
Trials X sex X sex-roles	22.43	4	5.60	<1	
Error w	2837.38	178	15.94		

Block 3 vs. Block 2 - $t(92) = 2.13$, $p < .05$; Female subjects - Block 3 vs. Block 1 - $t(94) = 3.70$, $p < .01$; Block 3 vs. Block 2 - $t(94) = 2.33$, $p < .02$), and that female subjects glanced significantly more than male subjects in Block 2 ($t(93) = 2.29$, $p < .05$) and Block 3 ($t(93) = 2.61$, $p < .05$) of the trials. A major hypothesis of the present experiment was that subject's glancing behaviour would be affected by the interaction between subject's sex, their sex-roles and the type of cues given across the 3 blocks of trials. However, contrary to expectation, the trials x sex x sex-roles interaction effect was found to be non-significant, $F(4,178) = <1$. Thus, the subject's glancing behaviour was not differentially affected by the interaction between sex, sex-role typing behaviour and the type of cues given across the 3 blocks of trials.

The data for performance (trials to criterion) have been graphed in Figure 3. To test the effects of sex and sex-role typing behaviour on trials to criterion, a three factor ANOVA (sex x sex-roles x Blocks of trials, with repeated measures on Blocks) for unequal cell frequencies was applied to the trials scores. The results of the ANOVA are shown in Table 11. The major hypothesis was that subject's performance on the 3 blocks of trials would be differentially affected by the interaction between subject's sex, their sex-roles and the type of cues given. This hypothesis was supported by the significant trials x sex x sex-roles interaction effect yielded by the ANOVA, $F(4,178) = 2.94$, $p < .05$. Thus the ANOVA indicated that subject's performance on each trial was affected by the type of cues given in each

Figure 3. Mean trials to criterion as a function of subject's sex, sex-roles and type of cues given in Experiment IV.

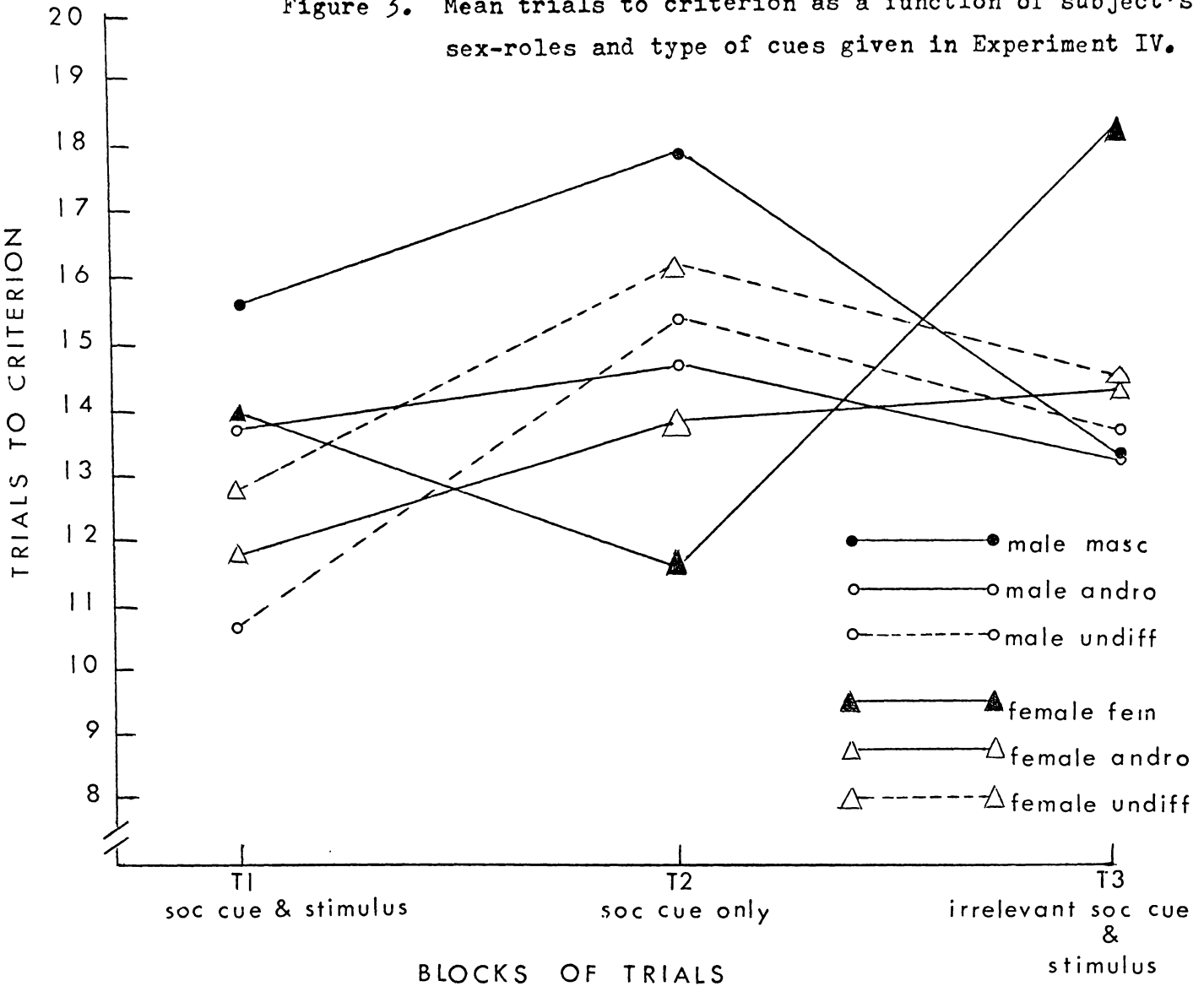


Table 11. Summary of 2 X 3 X 3 ANOVA (with repeated measures on the third factor) on trials to criterion in Experiment IV.

Source	SS	df	MS	F	P
Total	8579.98	284			
Between subjects	2473.98	94			
Sex	9.19	1	9.19	<1	$>.05$
Sex-roles	161.50	2	80.75	3.19	$<.05$
Sex X sex-roles	52.16	2	26.08	1.03	
Error b	2251.12	89	25.29		
Within subjects	6106.00	190			
Trials	140.76	2	70.38	2.49	$<.05$
Trials X sex	457.56	2	228.78	8.09	$<.001$
Trials X sex-roles	144.38	4	36.09	1.27	$>.05$
Trials X sex X sex-roles	333.10	4	83.27	2.94	$<.05$
Error w	5030.16	178	28.25		

trial, the subject's sex and the subject's sex-role typing behaviour. Post Hoc t-tests were used to evaluate the specific expectations of this experiment.

Based on the conception of the androgynous person, the male masculine and female feminine subjects represent opposing extremes of sex-typed individuals. As such, it would be expected that the biggest difference in performance would be between these two groups of subjects on block 2 (social cue only) and block 3 (irrelevant social cue) of the trials. Male masculine subjects, because of their task orientation would not attend to the experimenter, and thus should perform worse than female feminine subjects, who are socially oriented, on block two of the trials. Alternatively, female feminine subjects, because of their attention to social cues, would be misled by the irrelevant cue on block 3, and thus should perform worse than the task oriented male masculine subjects, who would be attending to the stimulus dimension instead. Simple t-tests confirmed these two expectations - Block 2 - $t(44) = 4.77$ $p < .01$; Block 3 - $t(44) = 3.82$, $p < .01$. There was no significant difference in performance between male masculine and female feminine subjects in block 1 of the trials, where both relevant social cue and stimulus dimension were present.

As for androgynous subjects, it was expected that regardless of sex, they would do equally well on all three blocks of trials. Again t-tests confirmed this expectation with the finding of no significant differences in performance between male and female androgynous subjects across all three blocks of trials. As male androgynous subjects

represent a shift towards femininity, it would be expected that they would perform better than male masculine subjects on block 2 (social cue only) of the trials, but equally well on block 3 (irrelevant social cue) of the trials. The results from the t-tests supported this - Male androgynous vs. male masculine on block 2 - $t(32) = 2.48$, $p < .05$; on block 3 - $t(32) = < 1$, $p > .05$. Similarly, as female androgynous subjects represent a shift towards masculinity, it would be expected that they would perform better than female feminine subjects on block 3 of the trials, but equally well on block 2 of the trials. The results from the t-tests again confirmed this - Female androgynous vs. female feminine on block 3 - $t(37) = 2.64$, $p < .05$; on block 2 - $t(37) = 1.21$, $p > .05$.

As for the undifferentiated subjects, the results obtained are interesting. Based on the concept of androgyny, the undifferentiated subjects are those who are low in both masculinity and femininity, and as such should perform worse than the androgynous subjects on experimental tasks such as the one used in the present experiment. However, it is important to note that, although androgynous individuals score high on both masculinity and femininity, while undifferentiated subjects score low on both, the androgynous and undifferentiated individuals do not partition their self-concept into the two categories of masculine and feminine. According to Bem et al (1976) it remains unclear whether the 2 groups differ fundamentally in their basic assumptions about gender. In other words, androgynous and undifferentiated individuals are still alike in not being

sex-typed. This suggestion is supported by the results obtained for the undifferentiated subjects in the present experiment. Statistical analyses showed that there were no significant differences in trials to criterion between undifferentiated and androgynous subjects for both sexes. Thus, it appears that although theoretically the undifferentiated individual is low in both the masculine and feminine trait of task-orientedness and outerdirectedness, they still managed to perform as well as the androgynous subjects, and on experimental tasks designed specifically to favour the androgynous personality.

Discussion (4.2)

Overall, the results from this experiment corroborate the findings from Experiment III and support the assumption that sex-role typing behaviour results in differential problem-solving within the sexes. The results from the glancing behaviour variable however, are in contrast to the findings from Experiment III, in that females were found to engage in more glancing behaviour than males in the present experiment, i.e. females appeared to be more socially oriented. One reason for this difference in findings between Experiment III and Experiment IV could be due to the type of cues given. It is highly probable that the cues given in the concept-identification task, as provided by the experimenter's face and eyes, were considered to be more social than the cues provided by the experimenter's hands in the object-assembly task. As such, it appears that the socially oriented female subjects in this study engaged in MORE

glancing behaviour than the male subjects only when the cues provided by the experimenter were considered to be 'social' by the female subjects. The findirgs of the non-significant interaction effect between sex, sex-roles and blocks of trials for glances does not support the hypothesis that sex-role typing behaviour results in differential glancing behaviour within the sexes. Sex, rather than sex-role typing behaviour was the main determinant of outerdirectedness.

The significant sex x sex-roles x trials interaction effect for performance scores, together with the various Post Hoc comparisons between specific sex-groups lend strong support to the hypothesis that children's problem-solving ability is differentially affected by their sex-role typing behaviour. The finding that the biggest difference in performance was between male masculine and female feminine subjects, together with the findings that androgynous subjects of both sexes not only performed equally well across all three blocks of trials, but also better than sex-typed subjects on specific tasks, support Bem's (1975) hypothesis that the androgynous person is more flexible in their choice of behaviours than sex-typed individuals. The results from the present experiment have clearly demonstrated both the adaptability of the androgynous individual, as well as the behavioural restriction of the person who is not androgynous.

While the effects of sex-role typing behaviour on children's problem-solving ability have been clearly demonstrated in the present experiment, the findings

generate two important questions which must be answered before any definite conclusions can be made. First, the question of whether the female feminine subjects inferior performance in the irrelevant cue conditions was due to a sequential or to a fixed effect. In other words, was the decrease in performance of female feminine subjects from block 1 (relevant cue) to block 3 (irrelevant cue) due to a consistent dependence on external cues (regardless of whether the cues were relevant or irrelevant) or was it because their performance in block 1 had sensitized them to the social cues which were irrelevant in block 3.

The second question again concerns female feminine subjects, and arises from the finding concerning glancing behaviour on block 3 of the trials. All female subjects, regardless of sex-role typing behaviour engaged in about the same amount of glancing behaviour yet only the female feminine subjects were misled by the irrelevant cues and took more trials to reach criterion than the other female sex-groups. This finding may suggest that performance on experimental tasks is not dependent on glancing behaviour per se, but rather on whether the cues given are perceived by the subjects as being relevant or not. However, even the female feminine subjects must know that the cues given in block 3 must be irrelevant after failing in so many trials. Thus their persistence in selecting the cued stimulus, even through their responses were not reinforced, and the readiness of the other sex-groups to give up their reliance on the irrelevant cue must suggest that the utilization of cues in a problem task is influenced by the subject's sex-

role orientation, and more important, the type of learning strategy they use. Some people are over-reliant on concrete situational cues in problem-solving, while others rely on active attempts to educe abstract relationships among problem elements. The fact that the female feminine subjects performed differently from other sex-groups across block 2 (relevant social cue) and block 3 (irrelevant social cue), suggests differences in learning strategy when confronted with a problem. It would be both interesting and important to find out what type of learning strategy different subjects utilize when solving a problem, and how this may be affected by their sex-role typing behaviour.

EXPERIMENT V

Having obtained data from Experiment IV that demonstrated the effects of sex-role typing behaviour on problem-solving ability, Experiment V was designed to investigate whether the decrease in performance of female feminine subjects from block 1 to block 3 of the trials in Experiment IV was due to a sequential or to a fixed effect. It was unclear from the results of Experiment IV as to whether the inferior performance of the female feminine subjects in block 3 of the trials (cue-irrelevant) due solely to a fixed sex-role orientation, which resulted in their dependence on external cues regardless of whether the cues were relevant or irrelevant, or whether it was due to an increase in sensitivity to social cues as a result of

their successful attendance to the social cues on block 1 of the trials, prior to the presentation of block 3 of the trials. To test this, a modified version of the concept-identification task was used, with the order of the cue-relevant and cue-irrelevant conditions reversed. Only the two groups of male masculine and female feminine subjects were tested as the results from Experiment IV showed that the biggest difference in performance was between these two groups. If the cue-dependent orientation of the female feminine subjects is indeed operative, then there should be a significant difference between the performance of female feminine and male masculine subjects, regardless of the order of presentation of the blocks of trials. If female feminine subjects performance on the cue-irrelevant condition was the result of an increase in sensitivity to social cues as a result of their attention to the relevant social cue in block 1 in Experiment IV, then the difference in performance in the present experiment between female feminine and male masculine subjects for the cue-irrelevant condition should not be significant.

Method

Subjects

100 children (50 boys, 50 girls) were given the C.A.S. and on the basis of their scores were classed into the various sex-groups. The C.A.S. yielded 20 male masculine boys and 19 female feminine girls. Their age ranged from 8 - 10 years. None of the subjects participated in the previous experiments.

Apparatus

The same apparatus used in the concept-identification task in Experiment IV was employed. However, in this experiment, the 'stimulus dimension and relevant social cue' (block 1) condition was omitted.

Procedure

The procedure was the same as that in Experiment IV. Each subject participated in the concept-identification task, but only under two conditions - irrelevant social cue and stimulus size, and relevant social cue only. The subjects were given the irrelevant social cue condition first.

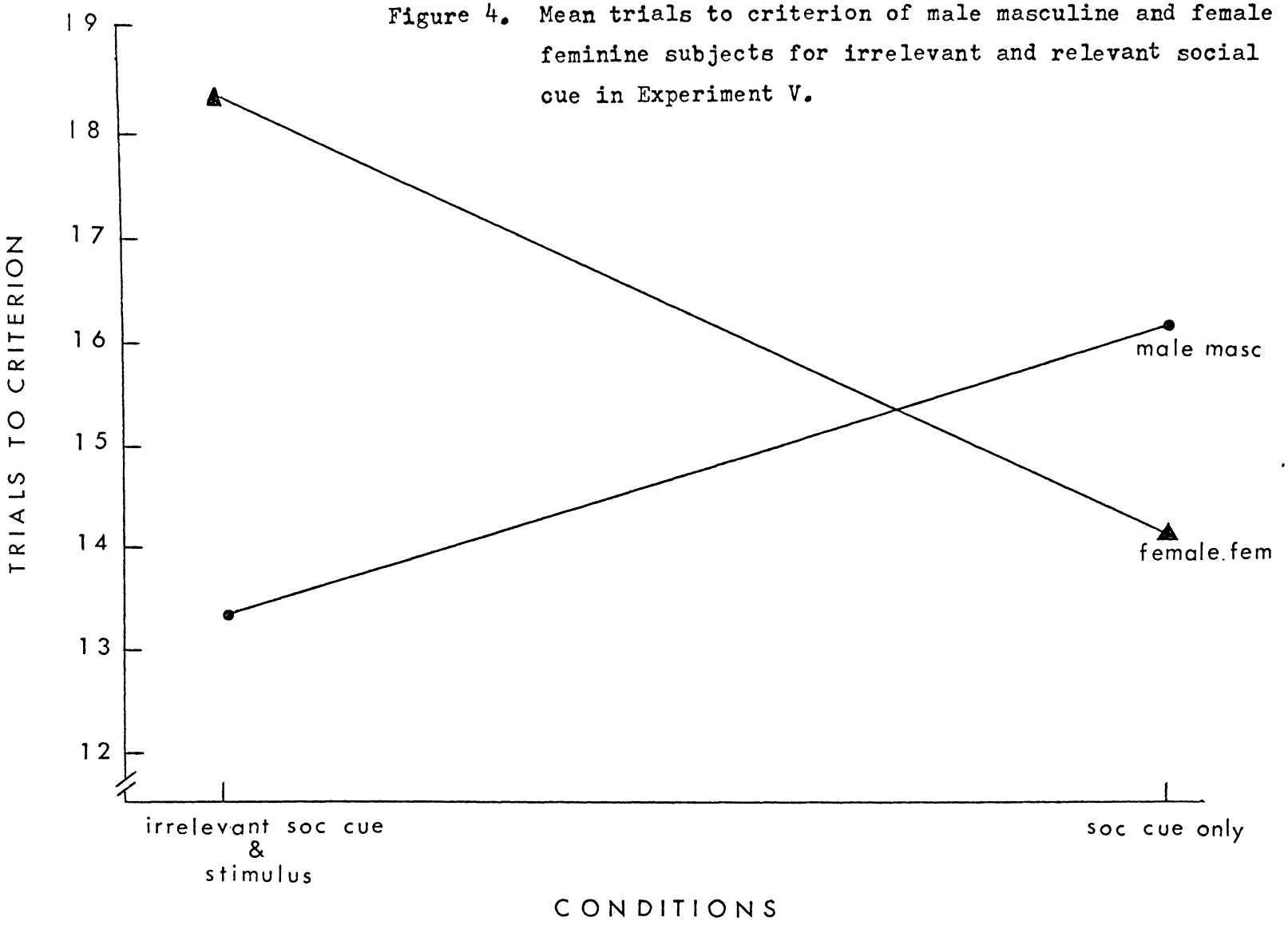
Results (4.3)

The means and standard deviations for trials to criterion for the two sex-groups have been recorded in Table 12. The data have been graphed in Figure 4. To test the specific hypothesis of the present experiment, t-tests were used to compare the performances of the two sex-groups. The results showed that female feminine subjects took significantly more trials to reach criterion than male masculine subjects on the cue-irrelevant condition, $t(37) = 3.30$, $p < .01$. The results also showed a significant improvement in the female feminine subject's performance when the social cue given was relevant, $t(36) = 2.53$, $p < .02$. These two findings are similar to the results obtained for the female feminine subjects in Experiment IV and suggest that female feminine subject's performance on the cue-irrelevant condition in Experiment IV was due to their cue-

Table 12. Means and standard deviations for trials to criterion in Experiment V.

Sex groups	Irrelevant soc.cue	Soc. cue only
Male masculine	Trials to crit.	Trials to crit.
Mean	13.3	16.15
S.D.	5.84	6.11
Female feminine		
Mean	18.36	14.15
S.D.	3.30	6.43

Figure 4. Mean trials to criterion of male masculine and female feminine subjects for irrelevant and relevant social cue in Experiment V.



dependent orientation, rather than to the sequential effect of attending to the relevant cues in block 1 of the trials in Experiment IV. Thus, the results from the present experiment support the assumption that female feminine subject's problem-solving ability is characterized by a cue-dependent orientation.

The results also showed that male masculine subjects took more trials to reach criterion when only the social cue was relevant, and that they also performed worse than the female feminine subjects for this condition. These differences however, failed to reach statistical significance.

EXPERIMENT VI

This experiment was designed specifically to explore the different types of learning strategies utilized by different subjects in problem-solving. Past works have pointed to a distinction between two contrasting learning strategies that can be defined in terms of degree of reliance upon situational cues as guides to behaviour (Achenbach & Zigler, 1968):

(1) The cue learning strategy which is defined as problem-solving behaviour characterized by a reliance on concrete situational cues, with little attempt to educe relations among problem elements.

(2) The contrasting strategy which is defined as problem-solving behaviour characterized by active attempts to educe abstract relations among problem elements in order to

proceed from these relations to the solution of the problem. The purpose of the present experiment was to investigate the question of whether the reliance on situational cues by female feminine subjects in Experiments IV and V is a characteristic of their learning strategy, and if so how this cue-learning strategy differs from the learning strategies of other sex and sex-role groups. From the results of Experiments IV and V, there is reason to believe that, when solving a problem, male masculine and female feminine subjects would use opposing learning strategies. It was expected that male masculine subjects, because of their task orientation, would utilize a problem-learning strategy when solving a problem. Alternatively, it was expected that female feminine subjects, because of their reliance on external cues, would utilize a cue-learning strategy when solving the same problem. A secondary purpose of this experiment was to see how subjects will respond to cues given by an apparatus (physical cues) as compared to cues given by a person (social). Research into this area is still inconclusive with some researchers suggesting that cues provided by human models may be more salient to an outer-directed child than are physical cues (Turnure & Zigler, 1964), while others have argued that outerdirectedness embodies not only responsiveness to human cues, but an excessive reliance on other types of cues as well (Balla et al, 1971; Sanders et al, 1968; Yando & Zigler, 1971).

Method

Subjects

The subjects were the same 100 children employed in Experiment V. They were classed into the various sex-groups on the basis of the C.A.S. In the present experiment, subjects were categorized in the standard four categories of the C.A.S. for each sex: male-masculine, androgynous, undifferentiated and feminine; female-feminine, androgynous, undifferentiated and masculine.

Apparatus

To investigate the learning strategies of the subjects, the 'Discrimination task' was used. The apparatus for the Discrimination task was a modified version of the one used by Achenbach and Zigler (1968) and Massari and Mansfield (1973) in their studies and is illustrated in Figure 5. It was constructed of wood and rested on a table with subject seated before it. The experimenter stood behind the apparatus and operated the guillotine door manually. Three small instrument panel bulbs were mounted on the rear wall of the apparatus, with the bulbs being visible to the subject when the door was raised. Three switches on a panel behind the apparatus allowed the experimenter to select the light he wished to be activated. The stimuli consisted of 18 cardboard squares. They progressed by 1.3 cm ($\frac{1}{2}$ inch) intervals from 3.7 cm ($1\frac{1}{2}$ inch) to 10.1 cm (4 inches) in size, and there was one blue square, one green square and one red square of each of the six sizes. A stopwatch was used to keep time.

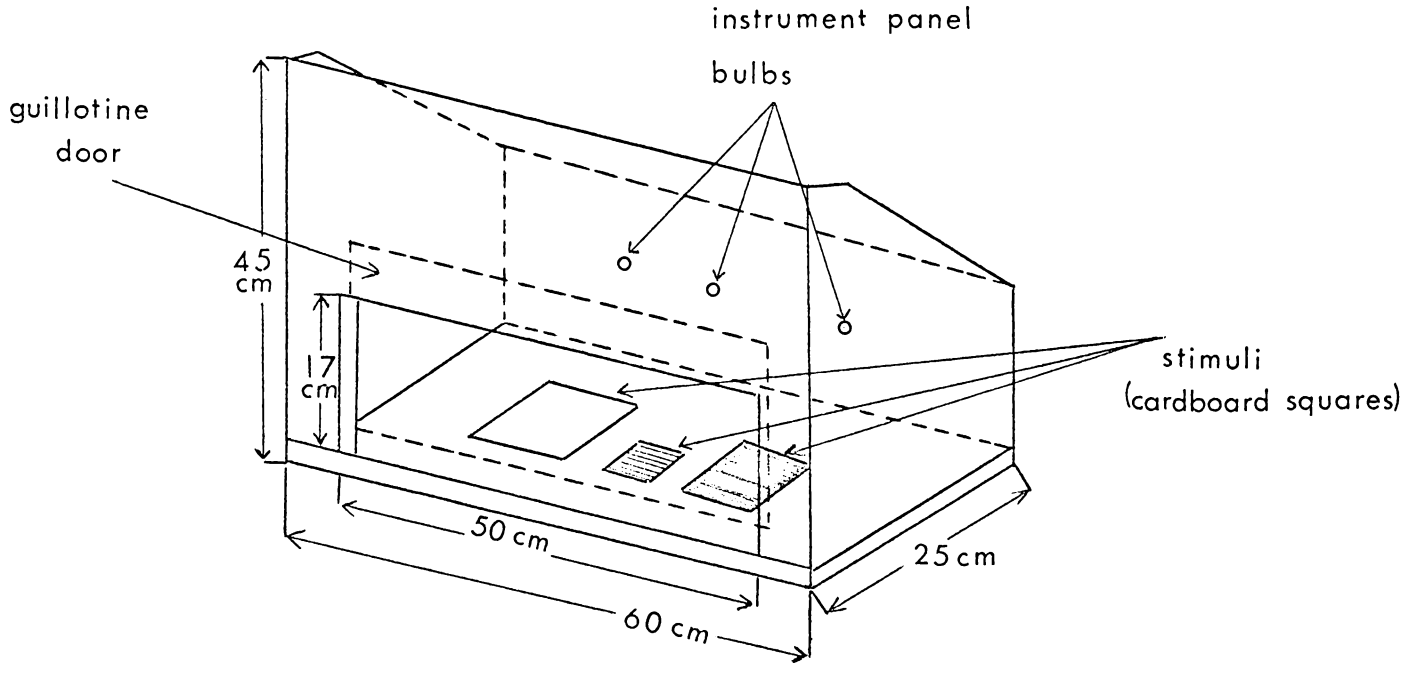


Figure 5. Discrimination apparatus for Experiment VI (From Achenbach and Zigler, 1968).

Procedure

The Discrimination task involved the subject picking a correct square out of three squares which varied in size and colour. Each subject was tested individually. After the subject had been seated directly infront of the apparatus, the following instructions were given:

> "Every time I raise the door, you will see three squares, one of which will be correct and the other two wrong. Your job is to learn which is the correct square. After you have figured out which is the correct square, put your finger on the square you think is correct. Try to pick the correct square as soon as you can after the door opens. Okay? Do you have any questions?".

The experimenter then went behind the apparatus, selected the three squares programmed for trial 1, and laid them in a row on the floor of the apparatus beneath the three bulbs in the rear wall. The experimenter raised the guillotine door and fixed it in the open position. If subject put his finger on the correct square, the experimenter said "Right". If subject put his finger on an incorrect square, the experimenter said, "No, that's wrong". The door was left open while the experimenter recorded subject's response. When the delay interval programmed for that trial had expired, the door was lowered, and the stimuli were arranged for the next trial. If subject failed to respond within 25 seconds, the experimenter said, "Put your finger on the square you think is correct". The experimenter kept his eyes focused directly downward into the apparatus, averted

from subject and the lights were not mentioned to the subjects. For all subjects, the largest of the three squares on a trial was always correct, with colour, position and absolute size being randomly varied, irrelevant dimensions.

The light located over the largest square was activated by the experimenter after the door opened. In order first to build up an association between this situational cue and the correct response, and thereafter to provide progressively more opportunity to give up dependence on the cue, the delay between the opening of the door and the onset of the light was programmed as follows: Trials 1 - 5, 1 second; Trials 6 - 20, 3 seconds; Trials 21 - 40, 5 seconds; Trials 41 - 60, 7 seconds; Trials 61 - 70, no light. The procedure was intended to create a somewhat ambiguous situation in which the subjects either could continue waiting for the light (cue-learning strategy) or could begin responding to the abstract relation among the problem elements. To reach criterion, the subject must give five consecutive correct responses before the onset of the light. The session was terminated when subject reached this criterion or trial 70, which ever came first.

Results (4.4)

As in the Achenbach and Zigler (1968) study, a subject's learning score was defined as the trial of his fifth consecutive correct response within the pre-light interval. Subjects not reaching criterion were assigned a learning score of 70. The mean and standard deviations for trials to

criterion for each sex-group are presented in Table 13. The data have been graphed in Figure 6. The general expectation was a sex x sex-role interaction effect. If the over-reliance on situational cues by female feminine subjects (as suggested by the findings from Experiments IV and V) is a characteristic of their learning strategy, then it would be expected that female feminine subjects would rely on the light cue longer and would also take more trials to reach criterion than the male masculine and androgynous sex-groups. From the findings of Experiment IV, it would be expected that the undifferentiated subjects would perform as well as the androgynous subjects. As for the sex-reversed group, it would be expected that male-feminine subjects would utilize a cue-learning strategy and as a result would take more trials to reach criterion than male masculine and androgynous subjects. Alternatively, it would be expected that female masculine subjects would utilize a problem-learning strategy, and as a result should perform better than female feminine subjects.

The results were subjected to a 2 x 4 ANOVA (sex x sex-roles) for unequal cell frequencies. The results of the ANOVA are shown in Table 14. The ANOVA revealed that the expected sex x sex-roles interaction effect was significant ($F(3,88) = 3.15$, $p < .05$, i.e. performance on the Discrimination task was affected by both sex of subject and their sex-role typing behaviour. However, contrary to expectations, statistical comparisons revealed that female feminine subjects performed as well as male masculine and that both male and female androgynous subjects recorded the

Table 13. Means and standard deviations for trials to criterion in Experiment VI.

Male	Masculine (N=20)	Androgynous (N=11)	Undifferentiated (N=11)	Feminine (N=8)
Mean	23.45	18.45	38.81	29.87
S.D.	15.81	10.04	25.63	19.44
Female	**Feminine (N=19)**	**Androgynous (N=13)**	**Undifferentiated (N=10)**	**Masculine (N=8)**
Mean	18.21	14.69	18.7	42.75
S.D.	8.69	6.15	16.06	21.19

Figure 6. Trials to criterion for different sex groups for Discrimination task in Experiment VI.

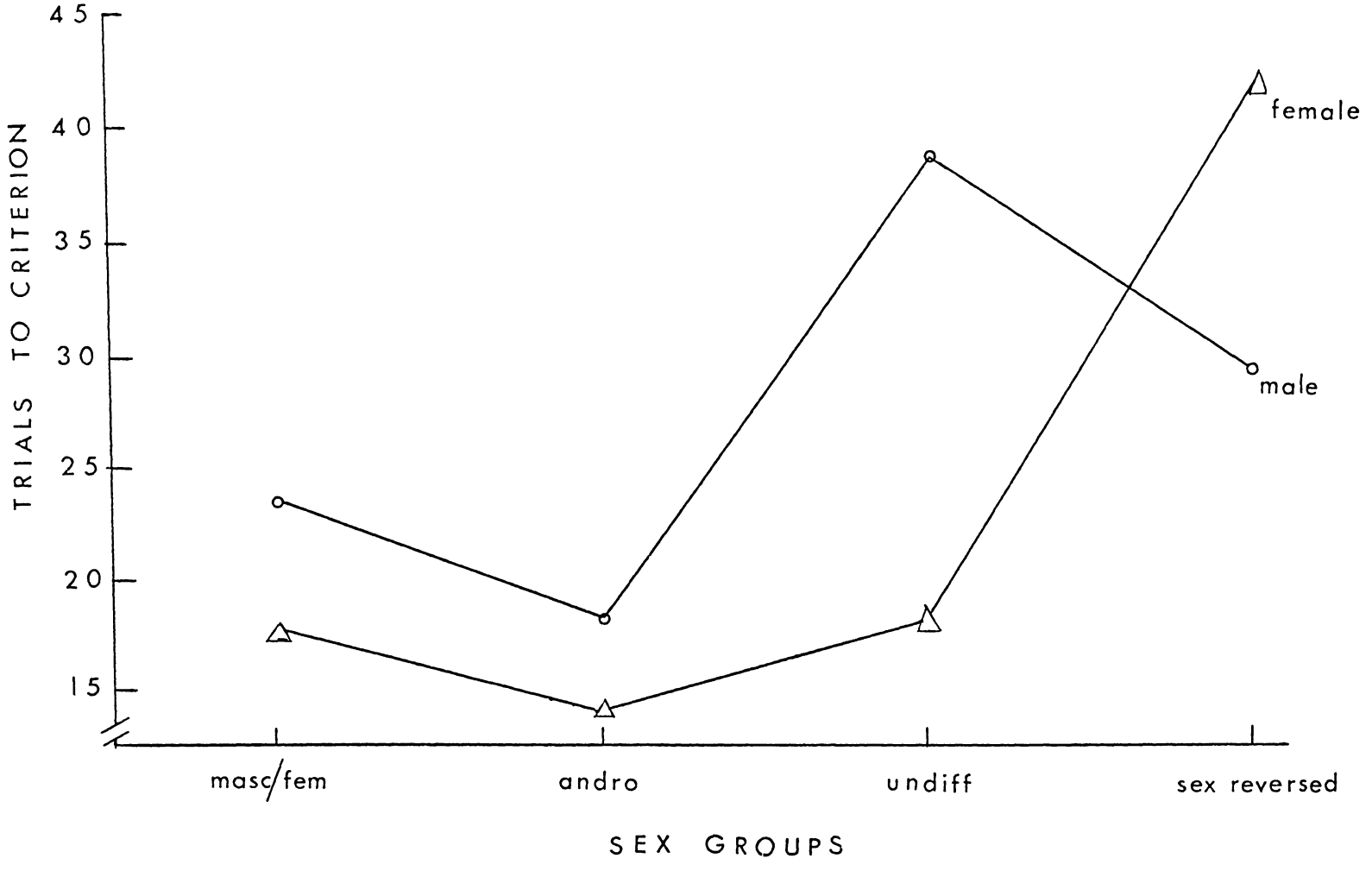


Table 14. Summary of 2 X 4 ANOVA for unequal cell frequencies on trials to criterion in Experiment VI.

Source	SS	df	MS	F	P
Total	30151.84	99			
Sex	739.84	1	739.84	3.05	$>.05$
Sex-roles	4757.17	3	1585.72	6.55	$<.01$
Sex X sex-roles	2395.11	3	798.37	3.29	$<.05$
Error	22259.71	92	241.95		

lowest number of trials to criterion among the various sex-groups. This finding is in fact in line with the expectations related to a cue-learning strategy. It appears that female feminine subjects did rely on the light cue when choosing the correct square as expected, but instead of hindering their performance, their sensitivity to external cues may have resulted in their learning to associate the light cue to the correct stimulus early in the task resulting in their low number of trials to criterion. Thus, it appears that although female feminine subjects did utilize a cue-learning strategy, they did not rely on the light cue longer or took more trials to reach criterion than the male masculine and androgynous sex-groups. It was expected that undifferentiated subjects of both sexes would perform as well as the androgynous subjects, but the results indicated that this expectation was only partially supported. Although female undifferentiated subjects performed as well as the androgynous subjects, male undifferentiated subjects took significantly more trials to reach criterion than the androgynous subjects (male undifferentiated vs. male androgynous - $t(20) = 2.45$, $p < .05$; male undifferentiated vs. female androgynous - $t(22) = 3.29$, $p < .05$.) In the light of the results obtained for the female feminine subjects, the expectations related to the sex-reversed subjects must be revised. It could be expected that the sex-reversed male feminine subjects would also use a cue-learning strategy when choosing the correct square resulting in their performing as well as the male and female sex-typed and androgynous sex-groups. Statistical analyses supported this

with the differences being non-significant. It would also be expected that the sex-reversed female masculine subjects would utilize a problem-learning strategy, and as a result would perform as well as the sex-typed and androgynous subjects of both sexes. The results are however contrary to expectations, with female masculine subjects taking significantly more trials to reach criterion than the sex-typed and androgynous sex-groups (female masculine vs. female feminine $t(25) = 4.33$, $p < .01$; female masculine vs. male masculine $t(26) = 2.65$, $p < .02$; female masculine vs. female androgynous $t(19) = 4.53$, $p < .01$; female masculine vs. male androgynous $t(17) = 3.34$, $p < .01$).

Discussion (4.5)

The primary finding that female feminine subjects performed as well as the male masculine and androgynous sex-groups suggest that they did rely on the light cue when choosing the correct square and thus supporting the assumption that female feminine subjects' problem-solving behaviour is characterized by a cue-learning strategy. Further support for this suggestion can be found in comparing the results obtained from Experiments IV and V with those obtained from the present experiment (Experiment VI). In Experiments IV and V, for the cue-irrelevant conditions, utilization of the cue-learning strategy by the female feminine subjects led to their continued reliance on the irrelevant cues, resulting in their inferior performance. In the present Experiment VI, female feminine subjects again used a cue-learning strategy but this time their performance

was markedly improved. As the light cue given was relevant to the task problem, it appears that female feminine subjects, through their cue-learning strategy (sensitivity to cues), learned early in the game to associate the light cue to the correct square, and as a result of this successful association, they performed well on the task. The findings obtained from Experiments IV and V, and those obtained from the present experiment, are congruent with the expectation of differential performance when utilizing a single learning strategy for different task problems that require more than one strategy. This finding lends strong support to the suggestion that female feminine subjects problem-solving behaviour tends to be characterized by a predominant cue-learning strategy. For the male masculine and androgynous sex-groups, the results indicated that their use of either the cue-learning or problem-learning strategy resulted in their successfully choosing the correct square. Alternatively, for the male undifferentiated and sex reversed female masculine subjects, their inferior performance could indicate that they may not have used either strategy effectively.

Human vs. non-human cues

Although no direct comparison can be made between this experiment (non-social or physical cues) and Experiments IV and V (social cues) due to the different number of trials given to subjects (30 in the concept-identification task versus 70 in the Discrimination task), the results show quite clearly that the subjects were able to use the physical

cues. The finding that 85 subjects out of the total 100 tested reached criterion before or at the half-way mark (35th trial) supports past findings (Yando & Zigler, 1971, 1972) that non-social cues are used as readily as cues given by humans. One reason for this could be attributed to the subject's differentiation of non-social and social cues. As noted by Yando and Zigler (1972), there may be a considerable difference between the experimental designation of conditions as 'social' and 'non-social' and the phenomenological experience of a child in these conditions. For the Discrimination task, the adult was continuously present, stood behind the apparatus which emitted the 'non-social' light cues, and possibly led the child to perceive these cues as under the control of the experimenter and therefore 'social'. If this analysis is correct, then the subjects could have been responding to what they thought were 'social' cues in the Discrimination task, i.e. cues perceived as under the control of the experimenter.

Finally, the 2 x 4 ANOVA yielded a marginally significant sex effect ($p < .10$) with females performing slightly better than males. This finding, coupled with the findings in Experiments IV and V not only support the hypothesis that females are more socially oriented and cue dependent than males, but that they may be more efficient in the utilization of external cues than males.

CHAPTER V

Table 15. Summary of findings from Experiment I (5.1)

	Sex and number	Age	Glancing behaviour	Performance
Rod and Frame Test	20 male 20 female	18-24 years		1. Male performed better. 2. No differences between field dependent and field independent subjects of both sexes.
Object Assembly tasks	20 male 20 female	18-24 years	1. No sex difference. 2. Field dependent subjects engaged in more glances than field independent subjects. Difference was marginally significant	1. No sex difference. 2. No difference between field dependents and field independents. 3. No difference in performance between puzzle 1 and puzzle 2 for all subjects.
Concept Identification task	20 male 20 female	18-24 years	1. No sex difference. 2. No difference between field dependent and field independent subjects. 3. No difference between female field dependents and male field independents.	1. No sex difference. 2. No difference between field dependents and field independents. 3. Subjects, regardless of cognitive style and sex, took significantly more trials to reach criterion for the 'social cue only' block of trials.

Table 16. Summary of findings from Experiment II (5.2)

	Sex and number	Age	Performance
Rod and Frame Test	47 male 48 female	8-10 years	1. Boys performed better 2. No effect of sex role typing behaviour on subjects's performance was demonstrated.

Table 17. Summary of findings from Experiment III (5.3)

	Sex and number	Age	Glancing behaviour	Performance
Object Assembly task	47 male 48 female	8-10 years	1. No sex difference. 2. Marginal interaction effect between sex an sex roles. Female androgynous subjects glanced significantly less than female feminine subjects. No difference between female androgynous and female undifferentiated subjects. 3. For all subjects, there were more glances for puzzle 1 than for puzzles 2 and 3.	1. Males performed better across the 3 puzzles. 2. Subjects, regardless of sex and sex roles performed better on puzzle 1 than on puzzles 2 and 3. 3. Sex role typing behaviour within the sexes did not result in differential performance. 4. Male masculine subjects performed better than female feminine subjects across the 3 puzzles.

Table 18. Summary of findings from Experiment IV (5.4)

	Sex and number	Age	Glancing behaviour	Performance
Concept Identification task	47 male 48 female	8-10 years	1. Female subjects glanced more than male subjects. 2. For both sexes, there were significantly more glances in block 3 (irrelevant cue) than in block 1 (social cue and stimulus) and block 2 (relevant social cue). 3. Female subjects glanced more than male subjects in block 2 and block 3 of the trials. 4. No interaction effect between sex, sex role typing behaviour and types of cues given on subject's glancing behaviour was demonstrated.	1. Significant interaction effect between sex, sex roles and trials was found, i.e. subject's performance on each trial was affected by the type of cues given in each trial, the subject's sex and the and the subjects sex role typing behaviour. 2. Female feminine subjects performed better than male masculine subjects on the 'cue relevant' second block of trials. Male masculine subjects performed better than female feminine subjects on the 'cue irrelevant' third block of trials. 3. Androgynous subjects of both sexes performed equally well on all 3 blocks of trials. Male androgynous subjects performed better than male masculine subjects on block 2 of of the trials, but equally well on block 3 of the trials. Female androgynous subjects performed better than female feminine subjects on block 3 of the trials, but equally well on block 2 of the trials. 4. Undifferentiated subjects of both sexes performed as well as androgynous subjects on these tasks.

Table 19. Summary of findings from Experiment V (5.5)

	Sex and number	Age	Performance
Modified Concept Identification task	20 male 19 female	8- 10 years	1. Male masculine subjects performed better on the cue-irrelevant condition. 2. Female feminine subjects performed better on the cue-relevant condition than on the cue-irrelevant condition. 3. Trends indicated that male masculine subjects took more trials to reach criterion when only the social cue was relevant, and that they also performed worse than the female feminine subjects for this condition. These differences however, failed to reach statitical significance.

Table 20. Summary of findings from Experiment VI (5.6)

	Sex and number	Age	Performance
Discrimination task	50 male 50 female	8-10 years	1. Marginal sex difference with females performing better than males. 2. Performance was affected by the interaction between sex of subjects and their sex role typing behaviour. 3. Female feminine subjects performed as well as male masculine and androgynous subjects of both sexes. 4. Female undifferentiated subjects performed as well as the androgynous subjects. Male undifferentiated subjects performed worse than the androgynous subjects. 5. The sex reversed male feminine subjects performed as well as the sex-typed and androgynous subjects. The sex reversed female masculine subjects performed worse than the sex typed and androgynous subjects of both sexes.

CHAPTER VI

CHAPTER VI

GENERAL DISCUSSION AND CONCLUSIONS (6.1)

The results from the present research support the hypothesis that children's problem-solving ability is differentially related to their sex-role typing behaviour. Specifically, the results from Experiments IV and V are consistent with the various expectations related to the sex-typed and androgynous sex-roles. While the performance of the sex-typed subjects varied from block 2 to block 3 of the trials (relevant vs. irrelevant cues) in Experiment IV, the androgynous subjects performed equally well across both conditions and as well as the sex-typed subjects on those trials designed specifically to elicit 'masculine' or 'feminine' responses. This finding is in line with Bem's (1974) conception of the androgynous personality and suggests that androgyny may not be limited only to the explanation of social personality traits (e.g. nurturance, attitudes) but can be extended to cover intellectual processes such as problem-solving skills.

While the results do lend support to the effects of sex-role typing behaviour on problem-solving skills, the findings from the present research also suggest that these skills may vary with situational factors, for example, the type of task or cues involved. Experiments II and III can be said to involve tasks that favoured the spatial skills of males while not allowing for the use of the special

social skills of females. As such, the results were consistent in showing male superiority in both experiments. In Experiments IV, V and VI, the task problems involved were designed in such a way as to favour both the male's spatial skills and female's social skills, thus giving both sexes an equal chance in performance. The results indicated that both sexes performed equally well. Thus, while the findings from Experiments II and III may indicate that males have superior problem-solving skills than females, the findings from Experiments IV, V and VI show that the quality of performance between the sexes may depend not on sex-specific skills but rather on situational factors. This finding is in line with Cole et al's view (1971) on the cultural context of learning and thinking. The findings from the present research parallel their views that differences in performance between different groups may not be due to membership in a particular group or that certain 'deficits' of certain groups are present at birth or are genetically based. Rather, they subscribe to the view that the difference in performance between different groups (e.g. minority versus majority) is a result of various situational factors. In particular, they emphasised that,

> 'cultural differences in cognition reside more in the situations to which particular cognitive processes are applied than in the existence of a process in one cultural group and its absence in another'. (Pg. 233)

The results obtained from Experiments II and III and those obtained from Experiments IV, V and VI, support a situational

interpretation of performance difference between groups as outlined by Cole et al, and especially when comparing the performances of sex-typed subjects (both male and female) in Experiments IV, V and VI. Male masculine subjects, because of their task-oriented style of problem-solving, performed better when no external cues (relevant or irrelevant) were involved, but showed a marked decrease in performance when the cues presented were relevant to their performance. Alternatively, female feminine subjects, because of their cue-learning style of problem-solving, performed better on those tasks where relevant cues were available, but performed worse when irrelevant cues were involved. Thus it appears from these findings that the quality of performance of these subjects did not depend only on their specific skills, but also on the factors related to the situation that were relevant in varying degrees to their specific skills.

An interesting feature uncovered by the results of Experiment IV is the performance of the undifferentiated subjects. Past researchers (Spence, Helmreich & Stapp, 1975) have suggested that, implicit in the masculinity-femininity dichotomy (or the instrumental-expressive distinction of Parson and Bales, (1955)) is the assumption that each contributes to personal and social effectiveness. Some regard the most desirable state of affairs as 'androgyny' (Bem, 1974; Spence et al, 1975), defined as possession of a high degree of both characteristics. Conversely, a low degree of both is sometimes seen as least desirable. Past investigations have shown that undifferentiated individuals

do score lower than androgynous individuals on a number of 'desirable' social characteristics, such as self-disclosure, self-esteem, choice of appropriate behaviours and nurturance (Bem, 1975; Bem & Lenney, 1976; Bem, Martyna & Watson, 1976; Radloff & Helmreich, 1971; Spence et al, 1975; Zeldow, 1976). However, the results from Experiment IV showed that male undifferentiated subjects performed as well as male androgynous subjects, while female undifferentiated subjects performed as well as female androgynous subjects on all 3 blocks of trials.

A possible reason for this finding could be attributed to the differential socialization effects for males and females as versus their sex-role distinction. Even if people learn a particular sex-role, either sex-typed, androgynous, sex-reversed or undifferentiated, they are still either male or female and it is the biological sex that leads to the choice of 'masculine' or 'feminine' socialization by parents and others, rather than any psychological sex-role shown by the child. Children in society have been taught behaviours and skills which have been defined as appropriate for individuals of their sex, and thus regardless of their sex-role, they still tend to possess the skills common to their gender. Thus it appears that although other researchers have suggested that the undifferentiated individual is low on both masculinity and femininity and is thus less likely to perform well on certain tasks, the undifferentiated subjects when confronted with a problem still utilize the skills that are characteristic of his or her gender.

For glancing behaviour the results lend only partial support for the effects of sex-role typing behaviour. In Experiment III, it was found that female androgynous subjects engaged in significantly less glancing behaviour than female feminine subjects, indicating that a shift towards masculinity by the female subjects resulted in the decrease of the female-related trait of outerdirectedness. The findings that girls engaged in significantly more glancing behaviour than boys in Experiment IV across all three blocks of trials indicate that females may indeed be more socially oriented than males (Garai & Scheinfeld, 1968; Goodenough, 1957; Oetzel, 1967). However, the results from Experiment III demonstrated no such sex effect even when external cues were provided. In combination, these two findings suggest that female subject's glancing behaviour in a task problem may be dependent on the type of cues provided. In Experiment III the cues were provided by the experimenter's hands, and in Experiment IV, the cues were provided by the experimenter's face and eyes. As the face plays a central role in non-verbal communication (Argyle & Dean, 1965; Exline & Winters, 1965; Exline et al, 1961; Kendon, 1967; Mehrabian, 1968; Mobbs, 1967), it could be expected that females, because of their interest in people (Goodenough, 1957) would demonstrate more glancing behaviour than males under the more 'social' conditions of Experiment IV. Moreover, in similar studies by Achenbach and Weisz (1975) and Ruble and Nakamura (1972) it was suggested that glancing at the experimenter's puzzle for cues during the object-assembly task probably represents systematic

information seeking rather than socially oriented outer-directedness. As such, it might be expected that the socially oriented female would show more glances than males in Experiment IV (concept-identification task) but not in Experiment III (object-assembly tasks). The results from the present research confirmed this.

One of the main purposes of this study was to investigate the effects of sex and sex-role typing behaviour on glancing behaviour and more specifically, whether glancing behaviour is related to the quality of problem-solving. Past works have shown that males are more task-oriented (engaging in less glancing behaviour) than females and also display more successful problem-solving skills than females on certain types of tasks (Garai & Scheinfeld, 1968; Kagan, 1964). Thus it is possible to assume that sex differences in problem-solving skills are related to glancing behaviour. In the object-assembly tasks (Experiment III) there were no significant sex differences in glancing behaviour at the experimenter's hands, yet males scored higher on the puzzles than females. Moreover, in the concept-identification task (Experiment IV), it was found that females engaged in more glancing behaviour at the experimenter's face than males, and that female feminine subjects did better than male subjects on the social cue only block of trials. These two findings support past research which has shown that attention to external cues can have beneficial as well as detrimental effects depending upon the nature of the total situation (Cole et al, 1971; Mondani & Lutko, 1969; Turnure & Zigler, 1964; Ward, 1969).

This conclusion is similar to the one arrived at by Witkin and Goodenough (1977) concerning the value judgments of the field dependence - field independence dimension. They argued that the field dependence - independence dimension is bi-polar; each of the contrasting cognitive styles has components that are adaptive to particular situations, making the dimension value free. Similarly, for problem-solving skills, be it task-oriented or cue-reliant, their value can only be judged with reference to their adaptiveness in particular circumstances.

The finding in Experiment III that the subjects, regardless of sex and sex-role typing behaviour engaged in more glancing behaviour at the experimenter's hands in puzzle 1 than in puzzles 2 and 3 and also performed better in puzzle 1 than in puzzles 2 and 3 supports Ruble and Nakamura's (1972) conclusion that the likelihood that a child will utilize a cue depends on whether or not it is relevant. The cues given during puzzle 1 were known to the subjects to be directly relevant to their task and they successfully applied these cues to their assembling of puzzle 1. However, the cues given in puzzle 2 were also relevant, though unnoticed by the subjects. Thus, the failure to utilize the cues given in puzzle 2 may indicate that utilization of cues may depend not only on whether or not they are relevant, but more important, the subject's prior expectation concerning whether the cues might be relevant. In Experiments IV and V involving the concept-identification task, subjects were tested under both relevant and irrelevant cue conditions. The findings that

female feminine subjects failed to give up their reliance on the external irrelevant cue, while other subjects gave up their reliance on the irrelevant cue, suggest that utilization of external cues also depends on the learning strategy of the subjects. Some children are task-oriented while others rely on concrete situational cues. Thus, even with the knowledge that the cues provided are relevant (or irrelevant), the person's utilization of external cues will still depend on his or her task-approach orientation.

Overall, the results of this study have demonstrated both between and within-sex differences in problem-solving ability, outerdirectedness and efficiency in the utilization of external cues. The recurring theme appears to be that girls are cue-reliant and more efficient in the utilization of external cues than boys. In postulating reasons for these sex differences, several plausible explanations are possible. The most likely is that sex differences in behaviours are not innate, but rather, that they are learned through the socialization process within the society. Few differences in abilities and behaviours are present in the very young; however, differentiation by sex increases with maturation (Osofsky & Osofsky, 1972). Through the processes of reinforcement, modelling and identification (Mussen, 1969), girls learn to develop a special interest in people, while boys direct their interest towards objects. There is ample evidence to suggest that it is this people-object differentiation in attention that results in the frequent contention that females are more socially oriented,

outerdirected and cue-dependent than males (Garai & Scheinfeld, 1968). For example, girls as young as three have been found to respond appropriately to children in need (McGrew, 1972) while Witryol and Kaess (1957) and Goodenough (1957) and Oetzel (1967) have found that girls and women have a significantly greater interest in people and social matters than males. It is possible that this greater interest in people would produce a heightened sensitivity to the actions and opinions of other people, resulting in a more cue-reliant orientation to the environment than males. Boys, on the other hand, have been found to be more task-oriented (McGuinness, 1976) and independent in their approach to task problems. They show greater distractibility by novel objects and display more exploratory behaviour than girls (Cornell & Strauss, 1973; Kagan & Lewis, 1965; McCall & Kagan, 1970; Myers & Cantor, 1967; Pancratz & Cohen, 1970). It is possible that the saliency for boys of novel objects and their exploratory tendencies would result from their early manipulation and handling of novel objects, and through these manipulative skills, they learn to rely on task-specific cues rather than on external cues in solving problems.

Why should the heightened sensitivity to the environment of females (and especially sex-typed feminine females) lead to a cue-reliant strategy in their problem-solving? A possible reason has been suggested by Maccoby (1967). An individual who is dependent and conforming is oriented toward stimuli emanating from other people and as such will probably find it difficult to ignore these stimuli in

favour of internal thought processes. Also, analytic thinking which requires internal processing appears to be easily interrupted by their greater orientation toward external interpersonal cues (Rau, 1963). This orientation probably helps them in certain kinds of task performance, for example, in those problems in which relevant cues are incorporated. But tasks calling for sequential 'internalized' thought may be hindered by too heavy a reliance on external, interpersonal cues.

The finding that females are more cue-reliant and also scored lower than male subjects in the absence of cues in Experiments II and III suggests that they have less efficient spatial skills than males. In attempting to explain these discrepancies, it is necessary to look again at the differential socialization processes of males and females. It can be hypothesized that these discrepancies may be due to differences in encouraged interests, rather than in basic abilities (Osofsky & Osofsky, 1972). The reason for this explanation is that the differences have not appeared early in life (Witkin et al, 1959; Oetzel, 1967; Maccoby & Jacklin, 1974), but rather have occurred at an age when spatial ability has become socially more appropriate for males and less so for females. That boys respond more to novel objects than girls is well documented. Novel visual input produces a range of responses which extends from spontaneous vocalizations in infancy, to direct contact, manipulation and investigation in childhood. From years of early experience in contact with physical objects, they ultimately learn what can be done to objects and object

relations and also learn to restructure problems with greater alacrity than females. By puberty, much of this ability is internalized, resulting in a high degree of spatial ability. Encouraged interests may also account for sex differences in problem-solving skills. While there is little difference between the sexes in analytic ability (e.g. in mathematics, science) until the early teens (Maccoby & Jacklin, 1974), it appears that whereas males improve over females at this time, girls ability actually decline with respect to their previous performance (Ross & Simpson, 1971). The available evidence suggests that this analytic superiority in males occurs as the problems dealt with increase in their emphasis on spatial properties (Bock & Kolakowski, 1973). Although no systematic investigations have been done to clarify these issues, there is evidence to suggest that encouraged interests may play an important role. Kagan (1964) has noted that girls have lower motivation to do well in science and mathematics and he suggested that this is because girls have been taught to believe that they are less competent in these areas. Cultural definitions of the female sex-role have placed more emphasis upon interpersonal relationships than upon academic skills. For males, however, academic excellence has been a necessary antecedent to vocational success, and vocational success has tended to be more essential for the culturally appropriate sex-role identity. Thus, where boys have been encouraged to strive for intellectual achievement as the road to vocational success, similar encouragement for girls sometimes results in conflict with the cultural definitions

of the female sex-role. Therefore, girls at puberty may have inhibited intellectual performance; this inhibition increasing during adolescence and adulthood, except in those cases where some females have overcome strong cultural pressures. This suggestion is supported by research dealing with the 'fear of success' of women (Horner, 1969; Maccoby, 1966; Saradon 1960).

The findings of between and within sex differences in problem-solving skills in this study point to the strong cultural influences on the socialization process. It has often not been considered desirable for females to manifest the same degree of competency required of males. At the same time, males have been encouraged to inhibit passivity, dependency and conformity, all of which have been encouraged among females. Through the societal definitions of masculinity and femininity, men have not been expected to demonstrate warm, nurturant behaviours and have not been encouraged to be dependent upon others for support. Women have been taught to be nurturant toward children and submissive toward other people; they have been encouraged to be dependent rather than independent as individuals. Only by adhering to these societally specified norms are men and women considered to be masculine and feminine, i.e. 'real men' and 'real women' (Osofsky & Osofsky, 1972). Implicit in these definitions is the assumption that the healthy personality for males and females should be masculine and feminine respectively, with individuals who do not fit neatly into the appropriate category being labelled 'pathological' (Cowen, Staiman & Wolitzky, 1961; Ritchie et al, 1977).

The results from this study and a host of other studies do show that while cultural sex-roles are learned from early childhood, there is strong doubt that the sex-typed individual represents the ideal healthy personality. Empirical evidence from a series of studies carried out by Sandra Bem and her colleagues show that, far from being abnormal or pathological, both men and women who possess both masculine and feminine personality traits were found to be better than the sex-typed individuals in being able to cope with varying types of social situations. The finding of differential performance between sex-typed and androgynous subjects in the present research lends further support to this hypothesis, and suggests that the traditional restrictive process of socialization should be changed, with the socialization patterns being determined by individual inclinations and abilities rather than by the supposedly biological grounds of sex.

What are some of the implications of the findings from this study? Of primary importance is the finding concerning the various sex-roles. Together with past research, there is mounting evidence to suggest most societies would benefit from a shift from traditional sex-typed roles to a more flexible androgynous lifestyle (Bem 1974, 1975; Bem & Lenney, 1976; Bem, Martyna & Watson, 1976; Osofsky & Tobias, 1971; Osofsky & Seidenberg, 1970). To be sex-typed may necessarily limit the range of behaviours available to the masculine and feminine individuals as they move from situation to situation, while to be androgynous may enable the individuals to engage in situationally effective

behaviour without regard to its stereotype as masculine or feminine. Such an androgynous lifestyle may result in a more well-adjusted and healthy personality. For example, a well-adjusted male may enjoy being a responsible executive, but he may also like being nurturant to children and being sensitive to the needs of others. Similarly, a well adjusted female may enjoy her household responsibilities and child rearing, but she may also enjoy working full time in a responsible executive position. Men and women should be allowed to draw from the same pool of personality traits. Options which include assertive, competitive and independent behaviours should not be closed to women, while options which include dependent, passive and nurturant behaviours should not be closed to men. As Bem (1975) has suggested, only when a successful integration of masculine and feminine traits have been achieved will there be fully effective human functioning, greater human satisfaction and fulfillment, and a fuller development of the potential of a greater number of individuals in the society.

The findings of this study that boys scored consistently better than girls on spatial mechanical task carry important implications for the differential education that boys and girls receive. On almost all levels as school progresses, females have been encouraged to be passive and sometimes achieving, while males have been encouraged to be independent and constantly achieving. It has been shown that many teachers prefer and differentially reinforce such behaviours, since active achievement is viewed as more important for males than females (Osofsky & Osofsky, 1972).

The fact that young boys are burdened by initial difficulties in reading and writing is well-documented (Taylor & Ounsted, 1972), but the important lesson is that they are taught and encouraged to keep up their pursuit of linguistic excellence as a necessity for future success. However, where parents insist that boys learn to speak, read and write, no such insistence induces the female to learn about spatial-mechanical relationships, (McGuinness, 1976). Thus, while the male overcomes his initial handicap at school through encouragement, the female misses out on the opportunity to develop spatial skills through discouragement. Spatial ability ought to be taught like speech at an early age, for without this early help females will be disadvantaged at tasks that require these sort of skills. Help and encouragement should be directed by skills and by abilities and not by the sex-typed standards of masculinity and femininity. Such a process in education may well lead to better performances for both boys (having a diminished incidence of early learning problems in school) and girls (developing their skills in accordance with their abilities).

Several implications relating to the outerdirectedness variable can be derived from the findings of the present study. First, the findings that children will respond best in cue-rich situations especially if they have prior knowledge of whether the cues are relevant or not may be relevant to the education field. Teachers of young children may provide relevant cues in a learning situation, but unless the children know that the cues are directly relevant

to their task, they may not use them. Thus, in order for the children to achieve maximum performance, teachers of young children need to provide not only relevant cues, but also information concerning the cues.

The findings that outerdirected and task-oriented children can perform as well as each other depending on the nature of the situation are relevant to practical applications in education. As Glaser (1973) points out,

> 'new educational methods that are insensitive to individual differences can account for only a small part of the variance in instructional effects; and it is likely that strong instructional strategies will necessarily be adapted to a learner's background and educational history'. (Pg. 562)

The findings support the idea that there are differences among children in their awareness of the social environment and suggest that teachers of young children should be aware of such differences in their development of teaching programmes. As a child's glances away from the task may represent instances of help seeking, as opposed to inattentiveness (Turnure, 1970), teachers should adjust their demands for independent work and the amount of personal attention they give to meet individual needs.

Finally, the overall findings from this study carry important implications for the socialization process. The traditional norms and standards of sex-role development produce inequality between the sexes and more and more people are now questioning the validity and morality of a

process which inhibits one-half of the population from achieving their potential. It appears that to achieve equality between men and women, the very root of sex-role development, the socialization process must be changed. For if sex differences in abilities and behaviours are products of the socialization process, it is logical to assume that changes in the traditional sex-role learning of males and females can be accomplished by altering the socialization practices of parents, schools and other institutions in our society, which would lead to different patterns of sex-role development. Beginning when the child is very young, patterns of socialization and education can be changed. For example, at birth the clear differentiation in treatment of infants by sex can be eliminated. Female babies need not be dressed only in feminine clothes and male babies in more masculine outfits. As adults react to infants in ways that encourage masculine and feminine behaviours (Sloan, 1969), changes in adult behaviour toward infants would result in fewer sex-typed behaviours specifically assigned to females and males. When the child enters school, major changes in existing patterns could be made. Children should be encouraged to excel in tasks on the basis of their interests and skills and not on traditional societal standards of what is sex-appropriate. It is also logical that children should be taught through the use of text-books which depict females and males participating in equal roles in society and not only in traditionally prescribed roles which have usually been depicted in text-books. Both women and men will likely be shown participating in work, homemaking and child-rearing

activities. It is highly probable that such changes in child-rearing and education would lead to children learning many different non sex-typed life styles based primarily on abilities and interests. The advantages of such a non sex-typed lifestyle are obvious from the findings of this study and from those which have dealt with androgyny. It is anticipated that children brought up with new patterns of socialization may develop alternative directions for individual growth. This in turn would result in increased development of talents of all individuals, regardless of sex leading to a realization of potential. On a larger scale, new patterns of socialization would be beneficial not only to the individual, but as suggested by Kagan (1964), especially for countries interested in the maximization of intellectual potential.

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APPENDIX 1

CHILDREN'S ANDROGYNY SCALE

Read each statement and decide if it is Never, Not very often, Sometimes, Often, or Very often true about you. Then, for each statement, put an X in the box in front of the word that seems to describe you best.

1. I am kind

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

2. I like sport

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

3. I am tidy

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

4. I am a bully

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

5. I cry easily

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

6. I am noisy

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

7. I am gentle

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

8. I use bad language

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

9. I am weak

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

10. I like tinkering with gadgets

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Not very often

11. I like sewing

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

12. I am strong

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

13. I am sympathetic

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

14. I am rough

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

15. I am helpful

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

16. I like taking risks

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

17. I am easily upset

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

18. I act as a leader

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

19. I am loving

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

20. I am brave

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

21. I am shy

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

22. I am active

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

23. I like to make others happy

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

24. I like woodwork

- [ ] Never
- [ ] Not very often
- [ ] Sometimes
- [ ] Often
- [ ] Very often

APPENDIX 2

One reason for this could be due to the categorization of subjects as either field dependent or field independent on the basis of the Rod and Frame Test (RFT) alone. It is possible that the scores on the RFT alone may not necessarily give an accurate indication of the cognitive style of the subjects, and if this is the case, then the categorization of subjects in the present experiment as either field dependent or field independent on the basis of the RFT alone may limit the generalization of the results. In order to achieve a valid and reliable categorization of subjects as either field dependent or field independent, more than one measure of cognitive style could be used (e.g. combining scores obtained from the RFT with those obtained from the Embedded Figures Test).

APPENDIX 3

The development of the Children's Androgyny Scale (C.A.S.) initially involved fifty four Form 2 children (mean age = 12.63 years) who were asked to rate 63 adjectives or adjectival phrases (in a forced-choice situation) as to whether the words described boys or girls (Ritchie, Villiger & Duignan, 1977). From the frequencies of 'feminine' and 'masculine' ratings, and using a one-sample chi-square test, levels of significance were calculated for each item, based on an expected value of 50% 'feminine' and 50% 'masculine' ratings. Of the 63 adjectives, 35 were rated as more 'feminine' or more 'masculine' at the .001 level of significance. These 35 items, the authors mentioned, can be said to represent real stereotypes held by the children. Of these 35 items, 12 were 'masculine' and 23 were 'feminine'. From these, 10 masculine and 10 feminine items were selected for the C.A.S. The C.A.S. was then administered to a sample of 148 children (77 females and 71 males) with a mean age of 10.08 years. From the results, the reliability of the feminine and masculine scales of the questionnaire was calculated using the Kuder-Richardson Formula. The feminine scale yielded an r of 0.63 while the masculine scale yielded an r of 0.55. These reliability coefficients are as high as can be expected with the number of items used in the present scale. Questionnaire reliability could be increased by adding more items to a maximum of 20 for each scale. For the present research, the number of items included in the 'masculine' and 'feminine' scales of the C.A.S. was increased from 10 to 12 per scale, using 4 extra items which were shown to discriminate in the appropriate direction in the Ritchie, Villiger and Duignan (1977) study.

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