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Sex Differences and Specialization in the Divergent-Thinking Styles of Gifted Children

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A Thesis

in

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ABSTRACT

Sex Differences and Specialization in the Divergent Thinking of Gifted Children

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Concordia University, 1988

It has been repeatedly found that boys are given more freedom than girls. Since freedom has been found to be positively associated with creativity in children it can be predicted that boys should be more creative than girls. However, the literature does not support this expectation.

An explanation of this apparent contradiction is based on the theory developed by J. H. Block (1981, 1983) and J. Block (1982). This theory postulates that sex-differentiated socialization experiences result in sex-linked differences in personality and cognitive structures. Consequently, when presented with new situations, boys should be more prepared than girls to respond by developing new cognitive structures (accommodation) and girls should be more likely than boys to respond by relying on existing cognitive structures (assimilation).

Three hypotheses based on this theory were tested using divergent-thinking tests with two levels of

familiarity to measure creativity in 250 gifted chidren.

The hypothesis that girls would excel over boys on divergent-thinking tasks employing familiar stimuli, and that boys would excel over girls on tasks involving unfamiliar stimuli was not upheld. Instead, girls earned higher scores on all divergent-thinking tests. The hypothesis that the personality measures of dependence proneness, affection and inclusion would predict the extent to which scores on familiar tasks exceeded scores on unfamiliar tasks, received only limited support: Girls' inclusion scores were significant positive predictors of the extent to which scores on familiar tests exceeded scores on unfamiliar tests. The third hypothesis, that subjects who earned high total divergent-thinking scores would have lower discrepancies between scores on familiar and unfamiliar tests than subjects with average or low total divergent-thinking scores also was rejected. Instead the trend was in the opposite direction.

Additionally, analyses revealed that IQ scores were significantly correlated with divergent-thinking scores on unfamiliar tasks for all subjects and for the subgroup of high-IQ girls. Girls' IQ scores were significantly correlated with scores on familiar tasks.

The discussion considered that the subjects' age, giftedness, and attendance at a summer program may have restricted the variance in the test scores, and the

hypotheses were reconsidered in the light of related research.

DEDICATION

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INTRODUCTION

When the literature on three related topics is examined, an apparent contradiction is found. Creativity in children is associated with freedom in adult-child relationships, and boys experience greater freedom from adult control than girls experience, but boys are not more creative than girls. In this section, the evidence supporting the above statements will be examined, and a theory that may resolve the apparent conflict will be described.

Creativity has been defined in many ways. Weisberg's (1986) definition, "a person's producing a novel response that solves the problem at hand" (p. 4) contains the two elements common to most definitions: that it involves novelty and that it satisfies some criterion. Differences among definitions concern the questions of how new and new to whom, and how stringent a criterion should be used. Views concerning newness range from "new in the sense of being unique, without specific precedent .... in the totality of its aspects, in the constellation of its component elements" (Ghiselin, 1963, p. 36), to the newness embodied in the spontaneity of children's dance or drawing (Taylor, 1975).

In research with children, judges' ratings of the creativeness of children's responses to an assigned task,

such as creating a collage (Amabile, 1983) or executing a painting (Koetsner, Ryan, Bernieri, & Holt, 1984) is occasionally used to measure creativity. However, in most studies, including the one reported here, creativity is defined in terms of scores on divergent-thinking tests. Divergent thinking is "a free and open type of intellectual operation, in which the distinguishing characteristic is the large number of possible associations or problem solutions" (Gallagher, 1985, p. 277). The concept was developed by Guilford and considered by him to be a "key aspect" (Guilford, 1967, p. 166) of creativity.

Creativity is one of three basic clusters of human traits which interact to produce giftedness (Renzulli, Reis, & Smith, 1981). The other two traits are above-average general ability and high levels of task commitment. Renzulli, Reis, and Smith define gifted and talented children as "those possessing or capable of developing this composite set of traits and applying them to any potentially valuable area of human performance" (1981, p. 27). However, unless otherwise stated, this report will employ the definition of giftedness set forth by the U.S. Office of Education (Marland, 1972): "Gifted and talented children are those identified by professionally qualified persons who by virtue of outstanding abilities are capable of high performance ..."

(Gallagher, 1985, p. 5).

Creativity and Freedom

Because creativity involves producing something new and original, it has frequently been postulated that it is more likely to occur when individuals are given relatively greater freedom from external constraint and correspondingly greater control over their activities (e.g. Rogers, 1959; Koestner, Ryan, Bernieri, & Holt, 1984). There are several lines of evidence that support the hypothesis that this is so both in childhood and early adolescence.

Parent-Child Relationships

In a seminal study of creative architects, McKinnon (1962) noted that as children they had been granted considerably more freedom than the less-creative architects in the matched control group. In particular they were given very much more freedom to roam and explore their community, and they were granted unusual freedom to make their own decisions. Two integrative reviews of the literature related to children (Miller & Gerard, 1979; Rejskind, 1982) concluded that the relationships between creative children and their parents were marked by independence and freedom. Scores on divergent-thinking tests consistently have been reported to be positively related to freedom in parent-child relationships in

preschool children (Dreyer & Wells, 1966), children of elementary-school age (Aldous, 1973; Busse, 1967; Dewing & Taft, 1973; Domino, 1979; Weisberg & Springer, 1961) and secondary-school subjects (Dauw, 1966; Getzels & Jackson, 1961; Nichols, 1964). In two studies of secondary-school adolescents, actual products were rated to establish students' creativity, with the same results (Datta & Parloff, 1967; Halpin, Payne, & Ellett, 1973).

Children from homes in which both parents work are likely to have less supervision than their peers (Gold & Andres, 1978). They are also reported to be more creative than their peers from single-income homes (Dewing & Taft, 1973; Getzels & Jackson, 1961). Aldous (1973) did not find a relationship between creativity in children and their parental work status. His results suggest that social class may also be a factor, since this was the only study to use lower-class subjects.

Teaching Methods

Children taught in ways that permit them to have greater control over their activities generally earn higher divergent-thinking scores than children taught in more traditional classrooms, according to several reviews (Giaconia & Hedges, 1982; Peterson, 1979; Rejskind, 1982). Crabtree (1967) showed that a program structured by both pupils and teachers resulted in greater pupil creativity than a similar program planned entirely by the teacher.

When compared to highly controlling teachers, low-control teachers were found to have more creative pupils on verbal but not figural tests (Wodtke & Wallen, 1965).

Three studies compared the creative abilities of pupils taught by teachers with direct and indirect teaching styles (Soar, 1968; Weber, 1968; Wood & Larsen, 1976). Direct teachers lecture more, give more directions and criticize pupils more often than do indirect teachers. Indirect teachers more frequently discuss and clarify pupils' ideas, and they praise and encourage pupils' ideas more than direct teachers do. All three studies reported that indirect teaching had positive effects on creativity. In one study (Weber, 1968) indirect teaching was found to enhance verbal but not figural creativity. The latter was enhanced by direct methods. This study, taken in conjunction with similar results reported by Wodtke and Wallen (1965) described above, suggests that responses to figural tasks may be less influenced by freedom than are responses to verbal tasks.

Many studies have compared the creativity of children in open and traditional classrooms. One of the core concepts of open education is that of giving pupils greater control over their learning activities. Consequently, it is reasonable to expect that open classrooms will be more conducive to creativity than traditional ones. Although the reported outcomes are not

totally consistent, the weight of the evidence supports this expectation, according to an evaluative summary of the literature (Rejskind, 1982) and two meta-analyses (Giaconia & Hedges, 1982; Peterson, 1979). Giaconia & Hedges reported that a child-centred emphasis was present in more than 80% of studies that strongly favoured open classrooms. This emphasis was defined as including elements such as giving the children an active role in controlling learning methods, material, and pacing. The authors reported creativity, measured by a variety of divergent-thinking tests, was enhanced by .25 to .50 of a standard deviation in open classrooms compared to traditional classrooms. In the 22 studies of open education that included measures of creativity, 69% of the comparisons favoured open classrooms, 19% favoured traditional classrooms, and 12% were neutral (Giaconia & Hedges, 1982).

Cultural Effects

Cultural differences between countries may have an influence on divergent thinking. Aviram and Milgram (1977) compared three groups of Israeli children aged 12-14 years. One group was composed of native Israeli children, the second group had emigrated from Russia and the third group had emigrated from the United States. The immigrant children, who had been educated in their native country at least until age 10, were tested in their native

languages. American and Israeli children were more creative than the Soviet children, which led the authors to conclude that children who grow up in societies that permit greater individual freedom will be more creative than children who live in more restrictive societies.

Experimental Evidence

Experimental settings have also produced results indicating that freedom from restrictions is positively associated with increased creativity levels. The paintings of children who were not given restrictive instructions were more creative than those of children who did receive restrictive instructions (Koestner, Ryan, Bernieri, & Holt, 1984). Amabile (1983) reported that the collages made by children who selected for themselves which 5 of 10 boxes of materials they would use were more creative than the collages made by children who did not choose which boxes of materials they would use.

Summary

Divergent thinking and creativity are positively related to the amount of freedom children experience in adult-child relationships. Although the effects are often small, they are found in home, school, and laboratory settings.

Sex Differences in Freedom

There is some evidence that boys experience greater freedom from adult control than do girls. Several studies have reported that girls spend more time in close proximity to parents in infancy and early childhood (Brooks & Lewis, 1974; Eagot, 1974, 1978; Goldberg & Lewis, 1969; Messer & Lewis, 1972) and to teachers (Serbin, Connor, & Citron, 1981). Girls engage in activities that are structured by adults more often than boys do in the pre-school years (Carpenter & Huston-Stein, 1980; Fagot, 1973; Huston & Carpenter, 1985) and in middle childhood (Huston, Carpenter, Atwater, & Johnson, 1986).

School-aged boys are subjected to fewer restrictions in exploration and come under less adult supervision than girls do (Block, 1978; Gold & Andres, 1978; Medrich, Roizen, Rubin, & Buckley, 1982; Moore, 1986; Newson & Newson, 1976; Newson, Newson, Richardson, & Scaife, 1978; Preusser, Williams, & Lund, 1985; Roberts, 1980). For example, in a study of 764 sixth-grade students in 20 neighbourhoods in Oakland California, Medrich et al. found that girls more than boys restricted their play to their home or yard, or that of a friend, or to the adjacent street. Boys more frequently than girls played in public spaces such as school yards, parks and recreation centers, and were more likely than girls to go to parks, movies and restaurants unaccompanied by adults. Boys were also more

likely than girls to go on unaccompanied excursions outside their immediate neighbourhood. Similar data concerning the use of public spaces and the freedom to move around their larger neighbourhood unaccompanied by adults was reported by Moore (1986) in his study of children in three metropolitan communities in England, and Roberts (1980) in a study of 438 10- and 11-year year old children in Aberdeen. Based on data collected in interviews with 700 British mothers, Newson et al. (1978) have reported that parents of 7 and 11 year old girls desire to restrict their contacts with opposite-sex strangers, and accomplish this by giving them less freedom to move around the community at large. Girls are more likely than boys to be accompanied to school by an adult, and they are more strictly subjected to the rule that they must state their destination before leaving home (Newson et al. 1978). Gold and Andres (1978) also reported that sons of employed mothers are more likely than daughters to be left unsupervised for two or more periods during the day.

Girls are more likely than boys to be given tasks that keep them in the house, such as cleaning up or helping to cook, and boys are more likely than girls to be given tasks that take them outside, and, presumably, further away from adult supervision, such as working in the yard or being sent on errands (Newson et al., 1978; Medrich et

al, 1982). This has been reported in several societies (Edwards & Whiting, 1980; Whiting & Edwards, 1973). Even the imaginary locations of fantasy play are closer to home in girls' play than in boys' (Brooks-Gunn & Matthews, 1979; Newson & Newson, 1976).

Sex Differences in Creativity

A number of writers have reviewed the effects of sex on creativity, with inconsistent results. Kogan concluded there were no sex differences (1974), then two years later concluded that females have a slight edge (1976). Maccoby and Jacklin (1974) concluded that on verbal tests girls have the advantage but that there are no differences on figural tests. Torrance and Allioti (1969) also reported that girls excel on verbal tests, but concluded that boys excelled on figural tests. The survey of research carried out for this study suggests that Kogan (1976) was correct and that girls do have a slight edge over boys.

The studies included in the following survey were identified in two ways. First a search was made of the last 10 years of the Current Index to Journals in Education and of Psychological Abstracts for studies listed under Divergent Thinking and Creativity which made reference to sex differences. Second, all the research reports that were read in the preparation of this report were perused for references to sex differences. In all,

41 studies of children in grades one to eight were surveyed. Almost all of the research surveyed used divergent-thinking tests to measure creativity. The exceptions were Koestner, Ryan, Bernieri, and Holt (1984) who used ratings of paintings, and Bruce (1974) and Torrance (1963) who both used science activities.

When the comparisons of male and female performance on divergent-thinking tests or creative production from all the 41 studies were combined, a total of 395 comparisons were noted (See Table 1). The large number of comparisons involved made it difficult at times to evaluate the meaningfulness of the data. Consequently, several chi-square analyses of the comparisons were made to aid in the interpretation of the literature.

In a clear majority of the 359 comparisons, the sex differences in creativity did not reach significance. There were 121 significant differences; the remaining 238 comparisons (66%) were not significant. However, the 121 significant comparisons were considerably more than the 18 that one would expect by chance, given the .05 alpha level that was adhered to in the studies under consideration. When a chi-square analysis of the difference between the observed number of significant differences (121) and the number expected by chance (18), the results were significant, $X^2(1, N = 359) = 591.60$, $p < .01$.

When the 121 comparisons that reached significance

Table 1

Summary of Reported Sex Differences in the Creativity of Elementary and Junior High School Students

Author	S	Differences	Measures
Aldous 1973	Grade 3 (620)	None	1 figural
Aviram & Milgram 1977	12-14 years (137)	None	1 total[a]
Bachtold 1974	Grades 5-6 (58)	None	3 verbal
Belcher 1975	Grades 4-5 (92)	None	2 verbal
Bhavnani & Hutt 1972	7-9 years (120)	Girls	1 verbal, 1 figural, 1 total
		None	1 verbal, 1 figural, 1 total
Bruce 1974	Grades 4-7 (90)	Girls	1 verbal
		None	1 figural, 1 total, 2 science activities
Cicirelli 1967	11 year-olds (609)	None	2 verbal, 2 figural
Dewing 1970	Grade 7	None	1 total
Favero et al 1979	Grades 2-6 (152)	None	5 behavioral measures
Hargreaves 1974	mean years 10.7 (boys) 10.6 (girls) (124)	None	2 verbal, 4 figural

Continued ...

Table 1 (Continued)

Author	Ss	Differences	Measures
Hargreaves 1977	10-11 years (135)	None	2 figural
	(101)	None	2 figural
Hargreaves 1982	7-12 years (199)	None	1 verbal, 1 figural
Hargreaves & Bolton 1972	10-11 years (117)	None	8 verbal, 3 figural
Hargreaves et al 1981	9-11 years (147)	None	1 verbal
Hattie 1980	12 grade 6 classes	None	6 verbal, 4 figural
Jaquish & Ripple 1980	Mean age 10.8 years (58)	None	3 auditory
Kershner & Ledger 1985	9-11 years (30 gifted,	Girls (gifted)	1 verbal, 1 figural
	39 average)	Girls (average)	1 verbal, 1 figural
		None	2 verbal, 3 figural
Klausmeier & Wiersma 1964	Grade 5&7 (320 gifted)	Girls	5 verbal
		None	5 verbal
Klausmeier & Wiersma 1965	Grade 7 (270)	Girls	3 verbal
		Boys	1 verbal
		None	6 verbal

Continued ...

Table 1 (Continued)

Author	S	Differences	Measures
Koestner et al 1984	Grades 1&2 (44)	None	3 ratings of paintings (figural)
Kogan & Morgan 1969	Grade 5 (4 classes)	Boys	1 verbal
		None	2 verbal
Mearig 1967	Grade 7,8 (55, New York;	Girls	2 verbal
		None	3 verbal
	(75, Isle of Skye)	Girls	1 verbal
		None	4 verbal
Milgram & Milgram 1976a	Grades 4-8 (310 non-gifted,	Boys (nongifted)	1 total
	182 gifted)	Girls (gifted)	1 total
Milgram & Milgram 1976b	Grades 4-8 (159 gifted)	Girls	1 total
Ogletree 1971	Grades 3-6 (479 English	Girls (English)	4 verbal, 4 figural
	493 German	Girls (German)	4 verbal, 4 figural
	193 Scottish)	Girls (Scottish)	4 verbal, 3 figural
		None (Scottish)	1 figural
Persaud & Stimpson 1986	Grades 4,7, & 10 (96)	Girls	3 figural

Continued ...

Table 1 (Continued)

Author	Ss	Differences	Measures
Rotter, Langland & Berger, 1971	Grade 2 (61)	None	1 verbal, 1 verbal
Speller & Schumacher 1975	Grade 5 (36)	None	2 verbal
Tetenbaum & Houtz 1978	Grades 4-6 (127 gifted)	Girls	1 fluency factor (verbal)
		Boys	1 rearrangement (verbal & figural)
Thomas & Berk 1981	Grades 1 & 2 (225)	Girls	3 figural
		None	1 figural, 1 verbal
Torrance 1963	Grades 4-6 (75)	Boys	2 science tasks
		None	2 science tasks one year later
Torrance 1965 (1)	Grades 7, 8 (75 gifted)	Girls	1 verbal
		Boys	1 verbal, 3 figural
		None	10 verbal
(2)	Grade 6 (50 gifted)	Boys	1 figural
		Girls	1 figural, 2 verbal
		None	1 verbal, 2 figural
(3)	6-11 years (555)	Boys	4 verbal
		Girls	4 verbal
		None	28 verbal

Continued ...

Table 1 (Continued)

Author	S	Differences	Measures
Torrance (4)	6-11 years (320)	Girls	11 figural
		Boys	3 figural
		None	46 figural
(5)	Grades 3-6 (100 above average)	Girls	.1 verbal
Torrance & Allioti 1969	10 years (118)	Girls	10 verbal, 2 figural
		Boys	3 figural
		None	5 figural
Van Mondfrans et al 1971	Grades 5, 8, & 11 (319)	Girls	2 verbal, 3 figural
		None	10 verbal, 13 figural
Vernon 1972	Grade 8 (387)	Girls	1 verbal
		None	5 verbal, 3 figural
Wallach & Kogan 1965	Grade 5 (151)	Boys	2 verbal
		None	4 verbal, 3 figural
Wardrop et al 1969	Grade 5 (44 classes)	Girls	9 verbal
		None	9 verbal

Note. Numbers in brackets are Ns for each sample.

[a]Total scores are figural and verbal scores combined.

were examined, it was seen that the outcomes favoured girls more often than they favoured boys. Girls earned the higher scores in 98 (81%) of the comparisons that resulted in significant differences. Boys were higher in the remaining 23 (19%). When a chi-square analysis was carried out, it revealed that girls earned higher scores than boys significantly more often than boys earned higher scores than girls $X^2(1, N = 121) = 46.49$, $p < .01$.

These results lead to the conclusion that in the majority of comparisons the differences between boys and girls were not significant. When there were significant differences girls were more likely to earn higher scores than boys. There are a number of possible explanations of these sex differences in children's creativity, including such factors as the nature of the test materials employed, the characteristics of the subjects in each comparison, cultural influences, and the recency of the study. Therefore, the studies were examined to determine the influence of these variables on sex differences in creativity.

Test Material

Some writers have concluded that sex differences depend on the type of test material employed. Both Maccoby and Jacklin (1974) and Torrance and Allioti (1969) concluded that girls excel on verbal divergent-thinking tasks. However, although Torrance and Allioti reported

that boys excel on figural tasks, Maccoby and Jacklin found no differences on figural tasks. In the studies surveyed here, girls excelled on both verbal and figural material. When the significant verbal comparisons were considered, girls earned higher scores on 58 (87%) comparisons and boys excelled on 9 (13%). When significant figural comparisons were examined, girls earned the higher score in 37 comparisons (79%) and boys in 10 (21%) comparisons. A chi-square analysis revealed that sex differences were not significantly influenced by the verbal or figural nature of the test materials, $X^2(1, N = 114) = .73$, $p > .05$. Even the results reported by Torrance and Allioti are not consistent with their conclusion. In that study, girls excelled on all 10 verbal test scores and boys excelled on none. However, boys excelled on only 3 of 10 figural measures and girls excelled on 2 of the 10. Consequently it can be concluded that the test material employed on divergent thinking tests (figural or verbal) is not a factor in sex differences.

Only three studies rated children on their performance on activities instead of using divergent-thinking test scores. Koestner et al. (1984) rated children's paintings, and Bruce (1974) and Torrance (1963) rated children's science activities. Neither Koestner et al. nor Bruce found sex differences on their creativity

ratings. Torrance reported that in his first study boys had more ideas that were creative than girls had, but when the study was repeated one year later significant sex differences were not revealed.

Recency

Becker and Hedges (1984) and Rosenthal and Rubin (1982) analyzed data on sex differences in verbal, quantitative visual-spatial, and field articulation abilities in upper elementary and high school students. They concluded that cognitive gender differences are changing over time, with girls' scores improving relative to boys' scores. No time trends in sex differences in creativity could be discerned from examining the results summarized in Table 1, and a chi-square analysis confirmed this impression. The proportion of significant comparisons reported in the last 10 years (24%) was compared with the proportion reported prior to 1977 (35%). The difference is not significant, $X^2(1, N = 359) = 2.16$, $p > .10$. It may be that both the difference in content under consideration and the age of the subjects contributed to the difference between this body of literature and the studies analyzed by Becker and Hedges and by Rosenthal and Rubin. Both those reports examined samples of older subjects; the survey reported here was limited to subjects of elementary and junior high school age. The author also noted that there are fewer

comparisons made in recent studies than in earlier ones. The recent reports were less likely than earlier studies to examine sex differences unless there was a specific reason to do so.

Sample Selectivity

Becker and Hedges (1984) reported that cognitive sex differences were greater among gifted children than in unselected samples. In the survey reported here sex differences were not found with significantly greater frequency in gifted samples than in unselected samples. Of the 31 comparisons made in samples of gifted children, 13 (42%) were significant. Of the remaining 328 comparisons of nongifted or unselected subjects, 108 (33%) yielded significant differences. A chi-square analysis of the two sets of comparisons indicated that the difference in proportion is not significant, $X^2(1, N = 359) = 1.03$, $p > .05$. Thus, in this survey of studies of divergent thinking, sex differences did not differ between samples of gifted and nongifted children. Furthermore, Becker and Hedges reported differences favouring males, whereas in this survey the majority of significant differences (61.5%) favoured females. The difference in outcomes between this survey and the work of Becker and Hedges may have resulted from the different abilities under consideration as well as the difference, noted above, in the ages of the subjects in the two samples.

Culture

Torrance (1963, 1965) has stressed the importance of cultural values in establishing and maintaining sex differences in divergent thinking. He explained girls' superior performances on verbal tests as resulting from the fact that Americans consider verbal activities to be female-sex-role appropriate (Torrance, 1965). Boys' superiority on science tasks was interpreted as resulting from the identification of science as a male-appropriate activity (Torrance, 1963). If these sex differences did result from cultural factors, then they were surprisingly sensitive to fairly minor manipulations. The differences that favoured boys on science activities disappeared after one year during which Torrance made teachers aware of the importance of the effects of labeling science as a "male" activity, and addressed a parent-teacher meeting on the topic (Torrance, 1963).

When the studies summarized in Table 1 were examined for cross-cultural influences, the superiority of females emerged even more clearly in studies conducted outside of the United States. The results of British studies were mixed, but none reported male superiority and Hargreaves and his associates (Hargreaves, 1974, 1977, 1982; Hargreaves & Bolton, 1972; Hargreaves, Stoll, Farnworth, & Morgan, 1981) consistently reported no sex differences.

However, Ogletree found a clear superiority for girls in both England and Scotland. Mearig (1967) reported one of five measures favoured girls in the Isle of Skye, and Bhavnani and Hutt (1972) found girls superior on one of two comparisons.

Studies from other countries also reported that girls had higher scores than boys more often than boys had higher scores than girls. Milgram and her associates in Israel reported the only non-American comparison in which boys excelled (Milgram & Milgram, 1976a), but a second comparison in the same study favoured girls, and a third comparison (1976b) also favoured girls. Aviram and Milgram (1977) reported no sex differences among the 137 12 to 14 year old Israeli subjects in their study. Both Dewing (1970) and Hattie (1980) reported no sex differences in Australian children, and girls excelled in Germany (Ogletree) and Canada (Kershner & Ledger, 1985; Vernon, 1972).

Almost all of the comparisons that favoured boys were obtained in studies carried out in the United States. A chi-square analysis was used to evaluate the difference between the American studies and studies from other countries in the proportion of comparisons favouring boys. The results indicated that the proportions were significantly different, $X^2(1, N = 121) = 6.93$, $p < .01$. However, even when only American studies are considered

girls' scores exceeded boys' scores more often than vice versa, $X^2(1, N = 86) = 20.51$, $p < .01$.

Summary

This survey of 41 studies and 359 comparisons has led to the conclusion that girls earn higher scores than boys on divergent thinking tests more often than vice versa. This was true in recent studies and in older ones, in gifted and nongifted samples, and on figural and verbal tests. The effect was more pronounced in studies conducted outside of the United States, but it was significant in American studies as well. However, in the majority of comparisons (66%) the differences between boys and girls were not significant.

Development of the Research Questions

In light of the research that links freedom and creativity in children it is surprising that boys, who experience greater freedom than girls, are not consistently more creative than girls. A possible resolution of this apparent contradiction may be found in the theory of J. H. Block (1979, 1981, 1983) and J. Block (1982), which was based on an extensive review of the developmental psychology literature. They have identified two modes of responding to new experiences: assimilation

and accommodation. The two modes are based on the Piagetian concepts of the same name but they differ from Piaget's usage in that the two strategies are described as separate and distinct, although Piaget described them as simultaneous. Assimilation "involves the fitting of new information or experiences into preexisting cognitive schemas" (J. H. Block, 1983, p. 1346) in ways that are consistent with prior understandings. The process of accommodation involves the restructuring of cognitive schemas, or the formation of new ones, and is "capable of encompassing new information or experiences at variance with prior understandings" (J. H. Block, 1983, p. 1346).

As a result of sex-differentiated socializing experiences, including the greater freedom noted earlier, the Blocks theorize that boys and girls develop different cognitive and personality structures for dealing with new information and problem situations. Girls more than boys are socialized in ways that encourage the use of assimilative strategies, and they rely on existing cognitive structures more than boys do. Boys are socialized in ways that make them more ready than girls to use accommodative strategies, modifying existing structures or creating new ones.

Two Types of Creativity

J. Block (1982) and J. H. Block (1983) consider that

both assimilation and accommodation may be used creatively, and they discuss the differential impact of the two strategies at the social and cultural level. Creative assimilative solutions to problems conserve existing social structures, provide continuity with the past, and support traditions and accepted values. Creative accommodative solutions result in social and cultural innovation and change.

Assimilative Creativity

Acommodative responses to problems are readily recognizable as deserving the label creative, because they break with tradition and stand out as new. The question of whether assimilative responses to new situations can be labelled creativg (1985) has pointed out that although newness is central to creativity, the degree of newness needed in creativity is not necessarily limited to complete novelty but also may include "rearranging things in a better way" (p. 80). This definition of creativity is consistent with assimilative processes. Two examples, one from literature and one from science may help clarify this point. It would seem possible that many of Shakespeare's later love sonnets are examples of assimilative creativity. They utilize a known form (the sonnet) and are concerned with a familiar topic. As such,

they could easily be the product of assimilative processes, written within the context of preexisting cognitive structures. Similarly, many scientific achievements result from assimilative processes. Whether developing a new vaccine or identifying a new galaxy, the scientist follows established procedures and works within a given body of knowledge. The process is consistent with the assimilative process of attempting "to fit new, discrepant information or experience into existing structures" (J. H. Block, 1981, p. 150).

Taylor (1975) has identified five distinct psychological processes that are termed creative, and assimilative creativity is consistent with several of these. The first level, expressive creativity, involves spontaneity and freedom in expression as exemplified by free dance or impromptu talks. The second level, technical creativity, is characterized by proficiency in creating products and is not concerned with novelty. Both these types of creativity would generally be the result of assimilative processes.

Taylor's third level, inventive creativity, could result from either assimilative or accommodative processes. Inventive creativity is characterized by ingenuity, and is reflected in novels, cartoons and inventions. It does not result in new basic ideas, and whether or not the rearrangement of existing cognitive

structures is extensive enough to demand accommodation probably varies from case to case. Developing the 10th Nancy Drew plot probably demanded only assimilative processes, but inventing the telephone may have involved accommodation even though it depended very heavily on existing insights.

Innovative creativity, the fourth level of Taylor's hierarchy involves modifying basic principles of established schools of thought. It is exemplified by Copernicus' modification of Ptolemy's views of the universe, and Adler's modification of Freud's system of psychology. Accommodative processes are implicated at this level because modifications of theories are involved. However, Koestler (1964) describes the work of Copernicus, as "not so much a new departure as a last attempt to patch up an outdated machinery by reversing the arrangement of its wheels" (p. 427). This is very similar to the assimilative process in which "attempts are made to fit new, discrepant information or experience into existing structures" (J. H. Block, 1981, p. 150).

The fifth level, emergentive creativity, is clearly limited to accommodative creativity. This level involves establishing new principles and assumptions that lay the foundation for new schools of thought. Examples include the works of Einstein and Picasso.

Creativity has been defined in many ways. From

Taylor's description of five distinct uses of the word it can be seen that assimilative processes may indeed be considered creative.

Assimilation and Accommodation on Divergent-Thinking Tests

Creativity in childhood and early adolescence is almost always operationalized as scores on divergent-thinking tests. These tests present subjects with a wide range of stimuli, some of which are very familiar and can be successfully responded to in assimilative ways using past experience and existing cognitive structures. The Unusual Uses test, which asks subjects to list uses for common objects such as a pencil or tin can, is an example of a commonly-used divergent-thinking test based on familiar stimuli. On tests such as these, subjects could earn high scores simply by listing uses recalled from past experience. Typically, the Unusual Uses test is scored for fluency, which is the total number of responses, and originality, which is the unusualness of responses. High scores for originality as well as fluency may be achieved through assimilation, because both large numbers of responses as well as unusual responses may be based on a prior experience. For example, uses for a tin can that are given credit for originality include using it in a game of kick the can, using it to hold fish bait, making a toy telephone from it, or using it as a planter (Torrance,

1974c). All these are uses that a child might easily have seen, and they should be considered example of assimilative creativity. Consequently, subjects who specialize in assimilation would be expected to earn higher scores than other subjects on this type of test. Subjects specializing in assimilation could also be expected to earn higher scores on these tests that employ familiar stimuli than they would earn on tests based on unfamiliar stimuli.

Although some divergent-thinking tasks use familiar stimuli, other tests present subjects with problems that are outside normal experience and which would be difficult to respond to solely through assimilative strategies. An example of such a test based on unfamiliar stimuli is the Consequences task that asks subjects, for example, to list possible consequences that would arise if clouds had strings attached to them that allowed them to be pulled down to earth. This question can more readily be answered through accommodative processes that transform or restructure previous schemas because it is a situation that has not been experienced before. On these tests, subjects who specialize in accommodation would be expected to earn higher scores than subjects who specialize in assimilation. Specialists in accommodative strategies would also be expected to earn higher scores on these tests than they would earn on tests based on familiar

stimuli.

Gender Specialization in Divergent-Thinking

If the Blocks' theory of gender specialization is correct, one would predict that boys would earn higher scores than girls on divergent-thinking tests that use unfamiliar stimuli while girls would be expected to earn higher scores than boys on tests employing familiar tasks. No research was found that examined this possibility, possibly because researchers generally do not distinguish between the two types of test material. However, related lines of work lend support to the hypothesis of two types of creativity and of sex differences in their use.

One source of support for the idea that there are two types of creativity which are engaged in differentially by males and females comes from Kirton (1976). He has identified two kinds of creative managers: adaptors and innovators. Adaptors "do things better" (p. 622) by finding solutions to problems within existing structures. Innovators "do things differently" (p. 622) by finding solutions that demand new structures. His description of adaptors is similar to that of assimilators in the Block theory. The adaptor "seeks solutions to problems in tried and understood ways .... with maximum of continuity and stability" (Kirton, 1976, p. 623). Adaptors are

"vulnerable to social pressure and authority; compliant". Innovators can be equated to accommodators. The innovator queries assumptions and "often challenges rules, he has little respect for past custom" (p. 623).

Kirton has found a higher proportion of women managers among the adaptors than among the innovators, which is consistent with the theory of gender specialization. He postulates further that the adaptor-innovator distinction is applicable to any situation in which creativity, problem solving, or decision-making is called for. For example, in Kuhn's (1970) analysis of scientific progress, the adaptors (assimilators) work to refine existing paradigms while the work of the innovators (accommodators) reveals the limitations of old paradigms or requires the production of new ones.

Kirton's research (1976) gives some support to the hypothesis that there are sex differences in the type of creative thinking at which males and females excel. One purpose of this research was to test this hypothesis on a sample of children and young adolescents, with divergent-thinking tests being used to measure creativity. The finding that boys excel on tasks based on unfamiliar stimuli and that girls excel on tasks based on familiar ones, would provide support for the theory of gender specialization, and it could provide an explanation of the surprising findings concerning sex differences in

divergent thinking.

Personality and Divergent-Thinking Specialization

According to the Blocks' specialization theory, personality and cognitive structures are inextricably linked. The same socialization experiences that cause some children, more often boys, to specialize in an accommodative cognitive style also cause them to have more independent personalities than other children. The greater emphasis on proximity to others and interaction with them that produces a preference for assimilative strategies in children, more often girls, also produces a greater investment in interpersonal relationships (J. Block, 1982; J. H. Block, 1981).

If personality and cognitive style are linked in this way, then children who specialize in assimilation would be expected to be less independent and more concerned with interpersonal relationships than are children who specialize in accommodation. Applying this to divergent-thinking tests leads to the prediction that the assimilators, who specialize in familiar tests, will be more dependent and interpersonally oriented than the accommodators who specialize in unfamiliar tests.

It was hypothesized above that the personality correlates of creativity should vary, depending on whether assimilative or accommodative creativity is being

examined. It has also been suggested above that subjects could earn high scores on some divergent-thinking tests by using assimilative thinking, but that on other tests, subjects who use accommodative thinking would be more likely to earn high scores. From this it follows that one would predict inconsistency in the personality correlates of creativity reported by research studies that employ total scores from divergent-thinking tests to measure subjects' creativity rather than examining the familiar and unfamiliar scores separeately.

Studies of children and young adolescents almost always rely on divergent-thinking tests to measure creativity in their subjects, and the predicted inconsistencies in the personality correlates of the test scores are indeed reported.

Several studies have considered the relationship in children between creativity and traits related to independence of judgement and action. Singer and Rummo (1973) studied the personality correlates of divergent-thinking test scores in 79 kindergarten children, using teacher ratings of personality. They reported a significant negative correlation between independence and divergent-thinking on a measure of the unusualness of responses but not on a measure of fluency, which was a count of the number of responses. Bosse (1979) failed to find a significant difference in

independence between high-creative and low-creative gifted children in grades 4, 5, and 6.

Studies of slightly older children produce similarly inconclusive results. Lett, Williams, and Poole (1979) compared a group of grade 8 students with high scores on the Torrance Tests of Creative Thinking to a a control group of the same age. There were no significant differences between the two groups on nonconforming achievement. On a measure of achievement through conformity the creative group earned significantly higher scores. Furthermore, the highly creative subjects did not highly value nonconformity and independence, valuing instead such characteristics as obedience, attentiveness, and cooperation (Williams, Poole, & Lett, 1979). Vernon (1972) reported mixed results in a sample of 287 grade 8 students: Boys high in divergent-thinking were more conforming than other boys, but girls high in divergent-thinking were more independent than other girls.

Creativity and independence were positively correlated in one other study. Sussman and Justman (1975) examined the correlations between teacher ratings of personality characteristics and creativity in 210 boys in grades 4, 5, and 6. Students rated high on creativity were also rated as being more independent, individualistic and assertive than other students.

In related research, Cohen and Oden (1974) and Houtz,

Denmark, Rosenfield, and Tetenbaum (1980) studied the relationship between divergent-thinking and locus of control in kindergarten subjects. Their results showed that low internality was correlated with high creativity, but reached significance on only one of two measures. By grade two, high internality was significantly correlated with one of two measures of divergent-thinking. In a study of gifted children in the intermediate grades, Houtz et al found that the group high in divergent-thinking were more internally oriented than the low divergent-thinking group. In contrast, McHenry and Shouksmith (1970) reported a highly significant correlation between creativity and suggestibility in 147 10-year-old children. The children who scored high on Guilford's Unusual Uses and Word Association Tests were much more likely to change their responses to match other children than were their less-creative peers.

There is less evidence concerning the relationship between interpersonal orientation and creativity. In their extensive study of 151 fifth grade students, Wallach and Kogan (1965) found that girls who placed above the median on both the intelligence and creativity measures were more likely than others to seek companionship. In contrast, girls in the top group for creativity but in the bottom group for intelligence were less likely to seek companionship. The kindergarten girls in Singer and Rummo

(1973) who were high on divergent-thinking were seen by their teachers as being less well integrated into the peer group. However, they did not investigate the interpersonal orientation of their subjects.

The conclusion that creative children and young adolescents are not more independent than their peers is at odds with similar studies of older adolescents (Milgram, 1984) and adults (Perkins, 1981), which do find a positive correlation between creativity and independence. It is possible that the conflicting results are attributable to the age differences between samples. Another explanation, consistent with the Block theory, is that the different methods used to measure creativity in two age groups are responsible for the inconsistent outcomes.

Studies of creativity usually identify their subjects in one of two ways. Some researchers identify highly creative subjects on the basis of their creative achievements. This approach is commonly used with older adolescents and adults, and it is more likely to select creative individuals who have an accommodative style. Because assimilative creativity is less visible than accommodative creativity, subjects who have an assimilative style are less likely to be nominated as creative than those whose work is creative in an accommodative style. On the basis of the Blocks' theory

one would expect that subjects selected on the basis of their creative achievements would be relatively independent individuals.

Instead of nominating subjects on the basis of their creative achievements, studies of children almost always use divergent-thinking tests to identify their creative subjects. Depending on the specific test items employed, these studies could select highly creative subjects who were either assimilators or accommodators, or both. Because creative assimilators and creative accommodators would be expected to have different personalities, no clear pattern of personality correlates of creativity would be likely to emerge from these studies.

It is possible, then, that the different personality correlates of creativity that have been reported in studies of children and adults have resulted from the differences in the methods used to identify creative subjects. If this is indeed the explanation, then the independence noted in creative adults may be associated with their accommodative style rather than with their creativity per se. Several of the studies referred to above concerning personality correlates of divergent-thinking show different patterns for girls and boys (Cohen & Oden, 1974; Singer & Rummo, 1973; Vernon, 1972; Wallach & Kogan, 1965). Barron and Harrington (1981) and Helson (1978) have also noted sex differences

in studies of adults. This lends indirect support to the hypothesis that creativity arises out of different personality patterns in males and females.

Summary. The Blocks' specialization theory leads to the prediction that differing divergent-thinking styles will be associated with differing personality patterns. While no direct test of this hypothesis has been made, and consequently there is no direct evidence for it, reports of the personality correlates of divergent-thinking and creativity are not inconsistent with it. The second goal of this research was to test this possible explanation by examining the personality correlates of both assimilative and accommodative creative subjects.

Specialists Versus Generalists

Although boys may be seen as specializing in accommodation and girls in assimilation, most individuals should be capable of using both strategies when the situation demands it. Specialization in assimilation and accommodation refers to a preferred or dominant approach rather than implying an incapacity to use the other mode. Overreliance on one strategy for processing information may be dysfunctional, with the most effective individuals probably being capable of using either strategy readily (U. Block, 1982; J. H. Block, 1981, 1983).

If the most effective individuals are able to use

either strategy with equal facility, then they should earn similar scores on familiar and unfamiliar divergent-thinking tests when standardized scores are used to control for the difference in fluency resulting from stimulus familiarity. If effectiveness in divergent thinking is defined as earning high total scores when the results of several divergent-thinking tests are combined, then one would hypothesis that effective children should be more likely to show less discrepancy between divergent-thinking tests using familiar and unfamiliar stimuli than do children whose total scores are less high. Conversely, children who are more highly specialized in accomodative or assimilative strategies, as evidenced by large discrepancies between their scores on the two types of tests, would be expected to have lower total scores than subjects whose scores are more evenly balanced. The final purpose of this research was to test this hypothesis.

Statement of the Hypotheses

J. Block (1982) and J. H. Block (1981, 1983) have developed a theory of the cognitive and personality specialization that arises from the differential socialization experiences of boys and girls and that has implications for the understanding of children's performance on measures of divergent-thinking. The

present research was designed to test three hypotheses arising from their theory.

Hypothesis One: Gender Specialization

Due to their preference for accommodative approaches to new situations, boys are predicted to earn significantly higher divergent-thinking scores than girls on tests employing unfamiliar stimuli. Because of their specialization in assimilative approaches to new situations, girls were predicted to earn significantly higher divergent-thinking scores than boys on tests employing familiar stimuli.

Hypothesis Two: Personality and Divergent-Thinking Specialization

The tendency to specialize in accommodative modes of thinking arises out of socializing experiences that encourage independence, and experiences that give rise to a preference for assimilative modes of thinking are characterized by a greater emphasis on interpersonal relationships. This leads to the expectation that subjects who specialize in assimilative creativity will be higher in interpersonal orientation than subjects who specialize in accommodative creativity. The latter, however, will be more independent than assimilators. Accordingly, it was hypothesized that dependency and

interpersonal orientation would be significant predictors of specialization in divergent-thinking style. Because previous research has reported different patterns of relationships for males and females, this hypothesis was tested separately for boys and girls.

Hypothesis Three: Balance and Effectiveness

J. Block (1982) and J. H. Block (1981, 1983) have postulated that the most effective thinkers are individuals who can use assimilative and accommodative modes of thinking equally well. Therefore, it was hypothesized that when total divergent-thinking scores are used as a measure of effectiveness, subjects whose total divergent-thinking scores fall into the top one third of the total sample of children would have significantly lower discrepancies between their scores on familiar and unfamiliar tests than subjects with lower total divergent-thinking scores would have.

Supplementary Analyses

The central purpose of the research reported here was to test hypotheses arising from the application of the Blocks' theory of cognitive specialization to the field of divergent-thinking in children. However, the data collected for this purpose lent itself to a supplementary analyses which was subsequently undertaken. This analysis

examined the correlations between IQ and scores on two types of divergent-thinking tests.

Raaheim and Raaheim (1986) have reported that the ability to respond to unfamiliar situations was significantly correlated to IQ in female college students. A similar relationship was not found between IQ and responses to familiar situations. Extending this to divergent-thinking in children led to the hypothesis that IQ would be significantly correlated to scores on divergent-thinking tests that use unfamiliar stimuli but would not be significantly correlated to scores on divergent-thinking tests that use familiar stimuli.

Finally, the effects of grade and sex on the personality measures of independence and social orientation were explored.

METHOD

Subjects

All the students in grades 4 to 8 at the McGill-PSBGM (Protestant School Board of Greater Montreal) Summer School for Gifted Children and the Laurenval Summer School for Gifted Children were tested in July of 1984 as part of this study. Children from grade 4 up were selected to ensure that the subjects were sufficiently mature to permit group testing. The children's grade assignments reflected the grade that they would be in the following September, not the grade they had just completed.

This sample included 250 children. However, because some students were absent from one or more of the testing sessions, the number of subjects varies from measure to measure.

The criteria for admittance into the program were different at the two schools (Shore & Tsiamis, 1986). At the McGill-PSBGM school, applicants who fit any of three categories were accepted into the program: those in a recognized school program for the gifted; those identified as eligible for such a program, but not actually in one; and those recommended by a parent, teacher, principal, or other adult. Children who attended the Laurenval school were identified through two different routes: (a) being selected by their teacher on the basis of their scores on

the Renzulli-Hartman Scale, and scoring at or above the 90th percentile on the Canadian Test of Basic Skills; or (b) being nominated by parents and achieving a high score on the WISC-R, following which a committee of teachers and psychologists decided whether or not they would be admitted to the program.

Research carried out at the same time as this study compared the children from the two schools on a variety of measures, including IQ, divergent thinking, dependence, locus of control, self-concept, academic performance at regular school, and parental concerns. Two significant differences were found between the two groups: The Laurenval boys were more independent than their McGill counterparts and the McGill students earned higher scores on divergent figural tests (Shore and Tsiamis, 1986).

There were significantly more boys (156) than girls (94) in the sample, $X^2(1, N = 250) = 15.38$; $p < .01$, but the distributions of the sexes did not differ significantly across grades $X^2(1, N = 250) = 3.18$; $p > .53$ nor between schools $X^2(1, N = 250) = .15$; $p > .75$. (See Table 2.)

Demographic information was collected from parents through a questionnaire sent home with students and returned to the school by them. (See Appendix A.) Of the 159 families for whom information was provided, 134 (84.3%) came from two-parent homes, and 58 (38.7%) had

Table 2

Distribution of Subjects by Sex and Grade and by Sex and School

Variable	Sex		X^2
	Male	Female	
Grade			
4	43	18	
5	28	19	
6	35	28	
7	27	15	
8	23	14	3.18
School			
Laurenval	45	25	
McGill-PSBGM	111	69	.15

mothers who were full-time homemakers. Proportionately more mothers in the Laurenval sample were full-time homemakers, $X^2(1, N = 150) = 9.06$, $p < .01$. Appendix B shows the distribution of mothers' work status and Appendix C shows the distribution of two-parent families by school and by subject's sex.

The socioeconomic status of each child was calculated on the basis of the father's occupation using the Blishen-McRoberts (1976) scale, except when the child lived with the mother but not the father. In the latter situation the Blishen-Carroll (1978) scale was used to rate the status of the mother's occupation. The majority of families (63.4%) came from the two highest socioeconomic groups (Blishen & McRoberts, 1976), 16.6% came from the two middle groups, and the remaining 20% were from the two lowest socioeconomic groups. Again there were significant differences between the two schools, with proportionately more of the McGill students coming from the two top groups and more of the Laurenval students coming from the bottom third, $X^2(2, N = 145) = 6.79$, $p < .05$. There were also differences in the socioeconomic status of boys and girls, with proportionately more girls than boys being in the two lowest socioeconomic groups, and proportionately more boys than girls in the two middle groups, $X^2(2, N = 144) = 6.97$, $p < .05$. The socioeconomic data are shown in

Appendix D.

Educational levels were high; 48.4% of mothers and 62.7% of fathers had at least one university degree. The remaining 51.6% of mothers and 37.5% of fathers had completed high-school or less. Once again there were differences between the two schools. Children from McGill-PSBGM had more highly educated mothers than children from Laurenval, X^2 (2, N = 155) = 28.01, $p < .001$. The level of the fathers education was also higher at the McGill-PSBGM school than at the Laurenval school, X^2 (2, N = 153) = 18.5, $p < .001$. The data are shown in Appendix E.

Subjects from the two schools were combined into a single sample in spite of the differences in socio-economic status and parental education because these variables were not germaine to the study. There were no significant differences between the schools on the dependent variables. (See Appendix F).

Procedure

Since all the measures were designed to be administered as group tests, children were tested one class at a time by a male and female testing team. The divergent-thinking tests were administered on the second and third days of school. The guidelines followed the procedures described by Torrance (1974a), with one

exception: Subjects were allowed only 4 minutes to complete each of the verbal tasks and 8 minutes for each figural task instead of the 5 and 10 minutes respectively allotted by Torrance. These time allowances were chosen on the basis of previous work with children attending the McGill-PSBGM Summer School. The IQ and personality tests were administered separately on subsequent days during the second and third weeks of the four week session, following standardized procedures. (See Appendix G).

Instruments

Measures of Divergent Thinking

Test selection and development. Of the many divergent-thinking tests available, three were initially selected: Unusual Uses, which requires subjects to list as many uses as they can for a given object; Consequences, which asks subjects to list possible consequences that would arise if an unlikely event occur; and Repeated Shapes which presents subjects with multiple copies of a simple shape and asks them to use the shapes to make pictures.

There were several reasons for selecting these three tests. They were recommended by Hargreaves and Bolton (1972) on the basis of their study of the selection of suitable divergent-thinking tests for school children. Secondly, they are widely used and well established;

versions of each are included in both the Guilford battery (Guilford and Hoepfner, 1966) and in the Torrance Tests of Creative Thinking (TTCT) (Torrance, 1974a). Thirdly, all three allow the use of parallel forms with differing levels of familiarity, which was necessary for this study. Finally, all can be administered to groups of subjects within specified time limits.

Once the tests had been selected, it was necessary to identify two stimuli within each, one of which would be relatively familiar to the subjects, while the other would be less familiar. At the same time, it was necessary that all the stimuli used be as familiar or unfamiliar to girls as to boys. The choice among a number of possible stimuli was made on the basis of responses to a questionnaire completed by 39 students in grades 4, 5 and 6 in a Longueuil school. (See Appendix H for a copy of the questionnaire.) Pencils were selected for the familiar version of the Unusual Uses test, and bricks were chosen for the unfamiliar version. Although it was expected that all children would have seen bricks regularly, they were considered less familiar than pencils in terms of "hands on" experience, which is the criterion for familiarity that was used by Sawyers, Moran, Fu, & Milgram (1983). The familiar version of the Consequences test asked what might happen if the subjects won a million dollars; the unfamiliar version asked what might happen if clouds had

strings attached to them that could be used to pull them down to earth. For the familiar task in the Repeated Shapes test, subjects were presented with two pages with 28 pairs of short parallel lines; the equivalent unfamiliar task presented subjects with an equal number of open curved lines as the repeated shape. (See Appendix G.)

A chi-square analysis of the responses was carried out to verify that the tasks were differentially familiar to the subjects, and that there was no significant sex difference in responses. The small number of responses in some categories made it necessary to collapse some (see Table 3) in order to be able to carry out this analysis. The results indicated that the familiar and unfamiliar tasks of each test were differentially familiar (see Table 3) to the subjects answering the questionnaire and that there was no significant sex difference in response to the stimuli selected (see Table 4).

After the tests had been administered to children at the two summer schools, a final step was taken to confirm that the stimuli designated as familiar and unfamiliar were in fact differentially familiar to the subjects. This procedure was based on the finding that children give more responses to familiar than to unfamiliar stimuli (Sawyers et al, 1983). A t-test was carried out on the fluency scores (the number of interpretable and relevant

Table 3

Pre-test Subjects' Ratings of the Familiarity of Test Stimuli

Stimuli Seen or Used	Stimuli: Familiar	Stimuli: Unfamiliar	Chi-square
Repeated Shapes			
Often[a]	25	4	
Rarely[b]	13	34	22.30*
Uses			
Often	38	2	
Rarely	1	36	61.89*
Consequences			
Often	21	0	
Rarely	18	39	26.07*

[a]This includes the response categories of "Often" and "Very Often" (Uses and Repeated Shapes), and "A Few Times" (Consequences).

[b]This includes the response categories of "Once in a While" and "Never or Hardly Ever" (Repeated Shapes, Uses) and "Once or Twice" and "Never" (Consequences).

*$p < .01$.

Table 4

Comparison of Male and Female Pretest Subjects' Ratings of the Familiarity of Test Stimuli

Test	Stimuli Seen or Used: Often[a] Boys	Often[a] Girls	Rarely[b] Boys	Rarely[b] Girls	Chi-square
Lines	10	15	5	8	0.00
Curves	0	4	15	19	1.36
Pencil	16	22	0	1	0.00
Brick	1	1	14	22	0.00
Money	7	14	9	9	0.53
Clouds	0	0	16	16	0.00

[a]This includes the response categories of "Often" and "Very Often" (Uses and Repeated Shapes), and "A Few Times" (Consequences).

[b]This includes the response categories of "Once in a While" and "Never or Hardly Ever" (Repeated Shapes, Uses) and "Once or Twice" and "Never" (Consequences).

responses) on each pair of divergent-thinking tests to confirm that the familiar stimuli had elicited more responses than the unfamiliar stimuli had elicited. As can be seen in Table 5, the familiar items on both the Consequences and Repeated Shapes tests produced significantly higher fluency scores than did the unfamiliar items, indicating that they did indeed represent different levels of familiarity to the subjects. There was no significant difference in the number of responses to the two forms of the Unusual Uses test so this test was not included in the data analysis.

In keeping with current practice, responses on each test were scored for fluency only. Fluency is defined by Torrance and Ball (1984) as the number of interpretable relevant responses. Originality and flexibility scores were not employed, since these scores have been found to overlap considerably with fluency. In a sample of 117 10- and 11-year old children Hargreaves & Bolton (1972) reported the correlations of fluency with flexibility and originality to be .72 and .85 respectively on the consequences task, and .63 and .67 on the repeated shapes task. They concluded that the small amount of extra information gained by these additional scores did not justify the extra time and effort needed to calculate them. Milgram and Milgram (1976a) reached the same conclusion in their study of 145 high school seniors.

Table 5

Means and Standard Deviations of Fluency Scores on Three Divergent-Thinking Tests.

Test	Mean	SD	t	p
Uses				
Pencil[a]	6.00	3.18		
Brick[b]	6.07	2.95	-0.36	.72
Consequences				
Dollars[a]	7.80	4.16		
Clouds[b]	5.30	2.45	11.49	.00
Repeated Shapes				
Lines[a]	14.21	5.92		
Curves[b]	12.31	5.45	6.31	.00

Note. N = 244.

[a]Familiar stimuli.

[b]Unfamiliar stimuli.

They reported correlation coefficients between fluency and originality of .78 and .81 for males and females respectively. More recently, in a study of 230 9- to 14-year-old subjects, Runco (1985) reported that after controlling for fluency flexibility scores had low convergent validity and reliability when used in samples with IQs below 130. The partial coefficient in the high IQ group was .32, while in the other groups the coefficients ranged from .14 to -.12. Runco and Albert (1985) also reported that originality and flexibility scores were confounded with fluency in subjects with IQs below 130, in a study of 125 children in grades five through eight. Furthermore, in a factor-analytic study of the question, Borland (1986) was not able to derive flexibility or originality factors. He studied 59 gifted students in grades 4, 5, and 6 using Repeated Shapes, Unusual Uses and a story writing test to measure divergent thinking. Only fluency emerged as a distinct factor.

In light of these studies, it was decided to use fluency scores only.

All the divergent-thinking tests were scored blind as to sex by the writer. Scorer reliability was tested by selecting 20 protocols at random and rescoring them one year after the initial scoring. A Pearson's correlation coefficient was then calculated for the two sets of scores. Results on the two tasks of the Consequences test

were $r(20) = .98$; on both tasks of the Repeated Figures test $r(20) = .99$. This was judged to be acceptably reliable.

Reliability: Reliability estimates of fluency scores on the Consequences and Repeated Shapes tests vary considerably. Guilford and Hoepfner (1966) reported correlation coefficients of .75 between alternate forms of the Consequences tests in their study of 205 grade 9 students. Wodtke (1964) reported test-retest reliabilities over a 2 month period of .42 and .68 in grade 4 and 5 students respectively.

Two studies reported in Torrance (1974b) give reliability coefficients for the Repeated Shapes test ranging from .47 to .72. In one study subjects were tested three times, with 2 weeks between each testing session. Reliability coefficients were .72 between the first and second testing, .65 between the second and third testing and .47 between the first and third testing. Another study reported in Torrance (1974b) obtained a reliability coefficient of .69 on retesting 101 grade 9 students 1 week after the initial test session. Wodtke (1964) reported test-retest correlation coefficients of .60 and .61 for grade 4 and 5 respectively when the two testing sessions were separated by a 2 month period. Dewing (1970) found a correlation coefficient of .69 on alternate forms of the test given to 394 grade 7 students

6 weeks apart. Guilford and Hoepfner (1966), using alternate forms of the test, reported a reliability coefficient of .57 based on their study of 205 grade 9 students.

Validity. Validity estimates are not available for the specific tests used in this study, because validity studies examine batteries rather than individual tests. Furthermore, the specific tests included in each battery vary from study to study. None-the-less, there are many studies that, taken together, support the validity of divergent-thinking tests in general.

Several studies show divergent-thinking fluency to be a robust factor in intellectual functioning that is distinct from general intelligence. Borland (1986) suggested it could be considered a general factor analogous to, but distinct from, Spearman's g. This creativity factor has been found across studies which employed different sets of tests (Borland, 1986; Hargreaves & Bolton, 1972; Harvey, 1981).

Three factor-analytic studies using different tests found creativity to be a distinct factor. Borland (1986) studied 59 gifted fourth- fifth- and sixth-grade students in an attempt to derive flexibility and originality factors. The measures of divergent thinking employed in this study were Repeated Shapes, Unusual Uses and a story-writing test. Only fluency emerged as a factor.

Harvey (1981) tested 114 gifted and nongifted adolescents, using the Torrance Tests of Creative Thinking (TTCT) to measure divergent thinking, and the WISC-R to measure intelligence. When the results were factor-analyzed, two higher order factors were identified: general fluency, and general intelligence. The fluency factor, which was derived entirely from divergent-thinking scores, was interpreted as representing a general ability to produce either verbal or figural responses to divergent tasks.

Hargreaves and Bolton (1972) also found that creativity was distinct from intelligence. In a study of 117 10- and 11-year-old children, they employed a test battery that included 11 divergent-thinking tests, two IQ tests and four "non-divergent-thinking tests." Through factor analysis they identified a 'pure' creativity factor on which all of the divergent-thinking tests loaded about equally and the other tests loaded minimally. Consequently they concluded that creativity was unidimensional, with flexibility and originality being redundant with fluency. They concluded that the precise composition of a divergent-thinking test-battery is not of major importance. The three tests initially selected for this research (Unusual Uses, Consequences and Repeated Shapes) are recommended by them as being among those that load most highly on the creativity factor.

These three studies are consistent with earlier surveys which concluded that ideational fluency measured by divergent-thinking tests represents a distinct ability (Horn, 1976; Wallach, 1970).

Although the above research clearly establishes the factorial validity of divergent-thinking fluency, they do not demonstrate that it is a measure of creativity. However, there are many studies of the concurrent and predictive validity of divergent-thinking tests. Barron and Harrington (1981) referred to more than 70 studies in which a positive and significant relationship was found between divergent-thinking scores and one or more indices of creative achievement. Torrance (1972) summarized 14 studies of predictive validity that had reported significant correlations between TTCT scores and creative achievement or behavior in elementary or high school students. In a later publication, Torrance (1974b) summarized an additional 10 studies that had reported significant correlations between TTCT scores and concurrent measures of creative achievement or behavior in students.

Two recent studies employing only fluency scores examined the validity of divergent-thinking tests when used with gifted children. Runco (1986b) studied divergent-thinking in 212 gifted and nongifted students in grades 5 to 8. Fluency scores were significantly

correlated with performance in writing, art, performing arts, crafts and public presentation for the gifted students only. Runco (1984) also reported that teachers' ratings of creativity in 250 gifted and nongifted children were significantly correlated with the children's fluency scores on divergent-thinking tests in grades 5 to 8.

Studies of the validity of divergent-thinking fluency in children not selected for giftedness have reported similar outcomes. In a follow-up of 130 grade 7 pupils, Howieson (1981) reported that fluency scores from 1965 correlated significantly in 1975 with measures of achievement in science, art, and general achievement in males and with measures of creative writing, drama, and general achievement in females. Milgram (1983) reported that in children with a wide age and IQ range, ideational fluency predicted original problem solving in a laboratory setting.

The results of these studies support the contention that fluency scores on divergent-thinking tests have validity as measures of creativity and, furthermore, that they sample an ability not measured by IQ tests. In none of the studies that employed measures of intelligence did intelligence scores correlate significantly with the criterion measures (Howieson, 1981; Milgram, 1983; Runco, 1984). However, although the reported correlations between divergent-thinking measures and criterion measures

of creativity were significant, they were generally low, ranging from .21 to .35 in the above studies. Furthermore, the fluency scores were more successful predictors of creativity in the arts than of creativity in the sciences.

Fluency scores on divergent-thinking tasks generally increase with age (Hargreaves, 1982; Torrance, 1974b), although there may be temporary dips (Torrance, 1973/1981). Additionally, divergent-thinking scores have been found to be positively correlated with intelligence, but this correlation coefficient does not attain significance when subjects have IQ scores above 115 (Weinstein & Bobko, 1980).

Measure of Divergent-Thinking Effectiveness

A total fluency score was used as the measure of subjects' effectiveness. The fluency scores from each test were converted to standardized scores (z scores). This was done separately for each grade and sex to control for the effects of these variables. A total score for each subject was then computed by summing the standardized scores from each test. This score was used to measure subjects' overall effectiveness at divergent thinking.

The alpha coefficient of reliability for the total score was .75.

Measure of Specialization

The extent to which the subjects' response rates on either familiar or unfamiliar tests were superior to their

response rates on the other was used to measure divergent-thinking specialization. This specialization score was derived for each subject by subtracting the sum of the standardized scores on unfamiliar tests from the sum of the standardized scores on familiar tests. Positive scores indicated that subjects excelled on familiar tests; negative scores indicated specialization on unfamiliar tests.

The alpha coefficients of reliability of the familiar and unfamiliar scores on which the specialization score was based were .47 and .56 respectively.

Measure of Balance

A balance score was computed to measure the extent to which subjects were specialized in familiar or unfamiliar divergent-thinking styles, regardless of the direction of their specialization. This score was based on the specialization measure described above, in which positive scores indicated specialization on familiar divergent-thinking tests and negative scores indicated specialization on unfamiliar tests. For the measure of balance, the magnitude of specialization was relevant but the direction of the specialization was unimportant, so negative specialization scores were eliminated by multiplying them by -1. This resulted in a measure of the extent to which subjects were balanced or specialized in their divergent-thinking style regardless of the direction

of their specialization. Subjects who had approximately equal scores on the familiar and unfamiliar tests would have low balance scores and larger balance scores were indicative of greater specialization in divergent-thinking style.

Measure of Independence

The Dependence Proneness scale (Flanders, Anderson & Amidon, 1961) was used as the measure of independence. This is a forty-five item scale in which students are asked to indicate whether they agree or disagree with each item. The items represent social situations involving peers, student leaders, parents and teachers. The themes of the items include seeking help, affection and affiliation, conformity, compliance and seeking approval. High scores indicate dependent individuals while low scores are indicative of independence.

The final 45-item form was arrived at through four separate item analyses based on the responses of 1243 grade 8 students in Minneapolis and St. Paul to an initial set of 145 items. The first analysis (Flanders et al, 1961) used a contrasting group approach based on the differing reactions of students identified as dependent or independent by their teachers. The second analysis was based on the responses of students who shifted their opinions in a persuasion experiment in the intended direction, while the third analysis made use of the

students in the same experiment who shifted their responses away from the direction intended by the persuasion intervention. The criterion group for the final analysis was composed of students with scores in the top and bottom 8.05% of responses to the original 150 item form of the questionnaire. Items were selected for inclusion in the final form of the questionnaire if they discriminated significantly on at least two of the above analyses. Flanders et al report a reliability coefficient of .68 on the final form of the questionnaire.

Flanders et al (1961) provide additional evidence of the validity of the Dependence-Proneness Scale. Students who scored high on the scale were less likely than low-scoring students to express extreme positions on an opinionnaire.

Additional validity was provided by Amidon and Flanders (1961) in reporting an experiment in which the same teacher taught the same content to students using two distinct teaching styles. Students scoring high on the dependence-proneness test were more sensitive to the differences in style than were the low-scoring students. The dependent students learned more geometry when the teacher used an indirect style, with more praise, encouragement and clarification of students' ideas, than they did when the teacher used a direct style with more lecturing, direction and criticism. The achievement of

students who were average or low in dependence-proneness was not influenced by the teaching style. Dependent students also expressed a desire for more support and approval than did independent students.

In a study of the effects of open-area schools and open teaching, grade 7 and 8 graduates of open elementary schools earned lower scores on the dependence-proneness scale than did the graduates of closed schools (Shore & Tali, 1978). The same study also found that grade 6 students were more independent than students in grade 4. However, Yamamoto and Davis (1966) did not find a grade effect.

A significant sex difference in dependence-proneness scores has been noted, with males earning lower (less dependent) scores than females (Flanders et al, 1961; Shore & Tali, 1978). Flanders et al (1961) also reported an IQ bias, with high-IQ students making more dependent responses. The authors do not suggest an explanation for this rather surprising effect.

Measures of Interpersonal Orientation

Four scales from the FIRO-BC test (Fundamental Interpersonal Relations Orientation - Behavior - Children) (Schutz, 1978) were employed to measure the importance of interpersonal relationships to the subjects. The four scales are measures of wanted inclusion, expected inclusion, wanted affection, and expected affection.

Inclusion is defined by Schutz as the need to establish and maintain relations that are satisfactory in terms of interaction and association, while affection is defined as the need to establish and maintain relations that are satisfactory in terms of affection and love. A third pair of scales measuring wanted and expected control in interpersonal relationships was not employed.

The FIRO-BC is an adaptation of the FIRO-B for adults. It was scaled on the responses of grade 4, 5, and 6 students in New York. Each scale is a Guttman scale based on nine items. The reproducibility of both the inclusion and affection scales is .88, which Schutz (1978) presents as evidence for the internal consistency and construct validity of the scales. Katz and Dalby (1981) found test-retest reliabilities over a one-week period to be .85 and .66 for expected and wanted inclusion respectively, and .66 for both expected and wanted affection. Burton and Goggin (1984) gave the test to children aged 9 to 13 years in two testing sessions 5 weeks apart. They reported a test-retest reliability coefficient of .72 for the combined wanted and expected affection score and .56 for the combined wanted and expected inclusion score. On the basis of their research they concluded that the combined scores are the preferred unit of analysis for research purposes.

Schutz (1978) reported many studies in which the adult

scales differentiated in expected ways between groups, but data are sparse for the children's version. He cited one study of school children which reported that social isolates scored significantly lower than other children on the inc sion scales.

Burton and Goggin (1985) reported that sex differences among 9-, 10-, and 11-year-old subjects were not significant, but that 12- and 13-year-old girls scored significantly higher than boys of the same age on the affection and inclusion scales.

In this study the wanted and expected affection scores were summed to produce an affection score, and the wanted and expected inclusion scores were summed to yield an inclusion score. The alpha coefficients of reliability were .84 and .79 for inclusion and affection respectively.

Measure of Intelligence

The Otis-Lennon Mental Ability Test was used to measure intelligence. This is a group-administered test requiring approximately 50 minutes to complete. Each level of the test contains 80 items arranged in order of increasing difficulty. It is designed to measure pupils' abstract reasoning ability with both verbal and nonverbal content (Otis & Lennon, 1969). The Otis-Lennon converts raw scores to deviation IQs, with 16 percent of a normal student population expected to score at or above and IQ of 116 (Otis & Lennon, 1969).

The Elementary II level of the test, designed for use with children in grades 4, 5, and 6, was used for subjects in grades 4, 5, and 6, and the Intermediate level, designed for use with subjects in grades 7, 8, and 9, was used for grade 7 and 8 subjects. In both cases, form J was employed.

The standardization of the Otis-Lennon was based on a stratified sample of 200,000 American pupils from grades 1 to 12 tested in the fall of 1966. Test-retest reliability over one year ranged from .91 for students in grade 4 at the time of the first test, to .87 for those in grade 6 when first tested. Alternate-form reliability is .89, .92, and .93 for grades 4, 5, and 6 respectively, and .91, and .94 for grades 7 and 8. The correlations between scores on this test and on the Raven's Progressive Matrices was .61 for a sample of 284 grade 5 pupils. The correlation between scores on the Otis-Lennon and on the Stanford Binet was .60 for a group of 256 children tested on the Stanford Binet at the beginning of grade 1 and the Otis-Lennon at the end of grade 2 (Otis & Lennon, 1969).

Grossman and Johnson (1983) reported that the Otis-Lennon was a statistically valid predictor of Stanford Achievement Test scores in a group of 46 gifted elementary-school children.

RESULTS

All of the following analyses were carried out using programs from SPSS^{x}, release 2.1 for IBM OS and MVS, on an amdahl 5860 computer.

Preliminary Analysis

Before the effects of sex on divergent thinking were examined, the effects of grade (4 to 8) and material (verbal and figural) on divergent-thinking scores were inspected to ascertain whether or not they interacted with sex to influence divergent-thinking fluency. This was done through a 2 x 5 x 2 x 2 univariate analysis of variance for the effects of material (figural, verbal), grade (4 to 8), familiarity (familiar, unfamiliar) and sex (male, female) on divergent-thinking scores, with IQ employed as a covariate. Since all subjects completed both the figural and verbal tests, as well as both the familiar and unfamiliar tests, a repeated measures analysis was employed on the material and familiarity factors.

The results of this analysis are summarized in Table 6. Neither the interaction between sex and material nor between sex and grade was significant. Similarly the higher-order interactions between sex, grade, and material and between sex, grade, material and familiarity were not significant. However, the interactions between grade and

Table 6

Summary of Analysis of Covariance for the Effects of Sex, Grade, Material, and Familiarity on Divergent-Thinking Scores

Source of variance	df	MS	F
Between Subjects			
Regression (IQ)	1	39.94	.87
Sex (A)	1	467.69	10.20**
Grade (B)	4	172.82	3.77**
A X B	4	21.69	.47
Error	222	8.78	
Within Subjects			
Material (C)	1	9665.45	498.84**
A X C	1	34.30	1.77
B X C	1	51.58	2.66*
A X B X C	4	23.56	1.22
Error	222	19.38	
Familiarity (D)	1	1071.20	121.96**
A X D	1	8.64	.98
B X D	4	21.58	2.46*
C X D	1	26.10	3.24*
A X B X D	4	5.18	.59
A X C X D	1	1.84	0.23
A X B X C X D	4	9.49	1.08
Error	222	8.06	

Note. n_s = 152 males, 92 females.

*$p < .05$.

**$p < .01$.

material, grade and familiarity, and material and familiarity were significant.

The main effects of sex, grade, familiarity, and material were all significant (Table 6). An inspection of the means of the divergent-thinking scores (Table 7) shows that there was a general trend for scores to be higher in the upper grades. On the material factor, the scores were higher on figural tests than on verbal tests. Girls' scores on the divergent-thinking tests were higher than boys' scores.

Main Analyses

Hypothesis One: Gender Specialization

The first hypothesis predicted that boys would earn significantly higher scores than girls on unfamiliar divergent-thinking tasks while girls' scores would excel significantly over boys' scores when familiar tasks were used. Since material and grade did not interact significantly with sex, nor with sex and familiarity, it was not necessary to carry out separate analyses for each grade and material type. The 2 x 2 x 5 x 2 analysis of covariance described above for the effects of sex (male, female), familiarity (familiar, unfamiliar), grade (4 to 8), and material (verbal, figural) on divergent-thinking scores, with IQ scores used as a covariate was examined to test the first hypothesis.

Table 7

Means and Standard Deviations of Divergent Thinking Scores

	Familiar Tests		Unfamiliar Tests	
Grade	Males	Females	Males	Females
		Verbal Tests		
4	5.74 (4.68)	6.83 (4.32)	4.36 (2.41)	5.39 (3.16)
5	9.00 (5.46)	8.23 (2.36)	5.70 (3.11)	5.88 (2.09)
6	8.21 (3.41)	8.54 (4.50)	5.05 (1.93)	5.50 (2.20)
7	8.13 (3.03)	11.20 (4.25)	4.87 (1.91)	6.13 (1.96)
8	7.10 (3.05)	8.75 (3.79)	4.95 (1.90)	6.92 (2.23)
		Figural Tests		
4	11.62 (6.23)	14.67 (5.42)	9.64 (4.98)	12.44 (6.15)
5	11.50 (7.00)	13.82 (4.86)	11.25 (6.21)	13.88 (5.94)
6	14.32 (5.38)	14.54 (4.78)	11.47 (3.53)	11.96 (4.04)
7	14.48 (5.02)	16.73 (6.54)	11.65 (3.32)	14.73 (6.48)
8	15.45 (5.25)	18.42 (6.79)	14.25 (6.84)	13.75 (5.34)

Note. Standard deviations are in parentheses.

The hypothesis was not supported by the results. The main effects of sex and of familiarity were significant (Table 6), but the interaction between sex and familiarity did not reach significance. An examination of the means (Table 7) shows that, as predicted, girls did earn higher scores than boys on the familiar tasks. However, contrary to expectations, girls' scores were higher than boys' scores on unfamiliar tasks as well. The first hypothesis was therefore rejected.

Hypothesis Two: Personality and Divergent-Thinking Specialization

It was hypothesized that children who are relatively dependent and socially oriented will have higher specialization scores than children who are relatively independent and lower in social orientation. Regression analysis was employed to test this. The specialization score was the dependent variable, with positive scores indicating a specialization on familiar tests and negative scores indicating a specialization on unfamiliar tests. The independent variables were the IQ scores and the personality measures of dependence proneness, inclusion, and affection. Separate analyses were carried out for boys and girls because Barron and Harrington (1981) and Kogan (1976) have concluded that personality correlates of divergent thinking may be different in the two sexes.

The analyses were carried out in two steps. First, IQ

scores were forced into the equation. This was done to control for the effects of IQ before the personality variables were entered, because Raaheim and Raaheim (1986) have shown that IQ scores may be differentially related to scores on familiar and unfamiliar tasks, and Flanders et al (1961) found a relationship between IQ and dependence proneness. On the second step, forward entry was used to allow the personality variables of dependence proneness, affection, and inclusion to enter the equation. The probability of F to enter the equation was set at .05. All the personality variables that reached this level would enter the equation in order of increasing magnitude of the probability of F associated with each variable.

The results, summarized in Table 8, were different for the two sexes, and they provide only limited support for the hypotheses. For girls, IQ scores were not significant predictors of specialization scores. Of the personality measures, only the inclusion scores were significant predictors of specialization scores after IQ had been entered into the equation, R^2 change = .06; F change(1, 71) = 4.73, $p < .05$. As predicted, the regression coefficient for the inclusion scores was positive, $b = .07$, indicating that high inclusion scores were associated with specialization on familiar material.

For the boys, the regression analysis revealed IQ scores were significant predictors of specialization

Table 8

Summary of Regression Analysis of the Effects of Personality Variables on Specialization Scores

Variable	b	SE of b	t	F Equation	df
			Males		
IQ	-.03	.01	-2.94**	8.64**	1, 99
Dependence Proneness	-.04	.02	-2.06*	6.58**	2, 98
			Females		
IQ	-.01	.01	-0.66	0.29	1, 72
Inclusion	.07	.03	2.18*	2.52	2, 71

Note. N = 101 boys and 74 girls.

*$p < .05$.

**$p < .01$.

scores, F equation (1, 99) = 8.64, $p < .01$. (See Table 8.) The dependence-proneness scores were the only personality variable that significantly predicted divergent-thinking specialization after IQ had been entered into the equation, R^2 change = .04, F change(1, 98) = 4.23, $p < .05$. The regression coefficient for the dependence-proneness scores was negative, $b = -.04$, indicating that specialization scores increased as dependence-proneness scores decreased, that is, boys who were less prone to be dependent performed better on the familiar tests than on the unfamiliar tests. The direction of this relationship is contrary to the predicted direction. Table 9 shows the intercorrelations among the variables in the regression analysis and Table 10 shows the means and standard deviations. Intercorrelations among all the variables are shown in Appendix I.

Although the inclusion scores were statistically significant predictors of specialization scores in girls, and dependence-proneness scores were significant predictors of specialization scores in boys, neither personality measure explained very much of the variance in the specialization scores. The dependence-proneness scores accounted for 4% of the variance in boys' specialization scores, and the inclusion scores accounted for 6% of the variance in girls' specialization scores.

Hypothesis Three: Balance and Effectiveness

The third hypothesis predicted that children whose

Table 9

Intercorrelations Among Regression Variables

	2	3	4	5
Males				
1. Specialization	.03	-.21	-.08	-.28
2. Inclusion	-	.14	.62	-.25
3. Dependence Proneness		-	.40	.06
4. Affection			-	-.20
5. IQ				-
Females				
1. Specialization	.25	.08	.12	-.06
2. Inclusion	-	.19	.69	.05
3. Dependence Proneness		-	.25	-.13
4. Affection			-	-.21
5. IQ				-

Note. N = 101 males and 74 females.

total scores fall into the top one-third would have significantly lower discrepancies between their scores on familiar and unfamiliar tests than subjects who earned lower total scores. A 3 x 3 chi-square analysis on the variables of balance and total divergent-thinking scores was carried out to test this hypothesis.

The total scores, which measured the subjects' effectiveness, and the balance scores which measured the extent of each subjects' specialization on familiar and unfamiliar divergent-thinking tests, are described in the method section. Low balance scores were indicative of relatively equal performance on the familiar and unfamiliar tasks. There were no sex differences on the balance variable, $F(1, 233) = 0.04$; $p > .80$. There was a significant grade effect, $F(4, 233) = 2.93$; $p < .05$, but the interaction between grade and sex was not significant, $F(4, 233) = 1.00$, $p = .19$. Since the scores on each test were standardized separately for each grade and sex there were no sex or grade differences in total scores.

Both variables were divided into three approximately equal groups of high , medium, and low scores. If the hypothesized relationship were to occur, significantly more children with low balance scores would fall into the high total score group than into the low and medium total score groups.

The results of the chi-square analysis, shown in

Table 10

Chi-square Analysis of Total Scores by Balance Scores

Balance	Total Scores		
	Low	Average	High
Low	32.0 (26.6)	30.0 (26.9)	18.0 (26.6)
Average	29.0 (27.6)	26.0 (27.9)	28.0 (27.6)
High	20.0 (26.9)	26.0 (27.2)	35.0 (26.9)

Note. Expected frequencies are given in brackets.

$X^2(4, N = 244) = 8.71$, $p = .07$.

Table 10, did not support the hypothesis. Not only did the chi-square values fail to reach significant levels, but the trend was in the opposite direction to that hypothesized: Somewhat more than expected of the low-balance subjects fell into the low-total category, and slightly more high-balance subjects than expected fell into the high-total group.

Supplemental Analyses

IQ and Fluency on Familiar and Unfamiliar Tests

Raaheim and Raaheim (1986) reported that IQ scores were significantly correlated with problem solving ability when the problem to be solved is relatively novel to the subjects, but not when it is familiar to them. To test whether this relationship would be obtained in the present sample, correlation coefficients were computed between IQ scores and the fluency scores from familiar and unfamiliar tests. The results are shown in Table 11. In this and the following analyses a one-tailed test of probability was employed because the direction of the correlations was predicted. As expected, for the total sample of subjects there was a small but significant relationship between IQ scores and divergent-thinking scores on unfamiliar tests only, $r(N = 231) = .13$, $p < .05$. The difference between the correlation coefficients between IQ and familiar scores and IQ and unfamiliar scores is significant, based on the Z

Table 11

Correlation Coefficients Between IQ Scores and Divergent-Thinking Variables

Group	n	Divergent-Thinking Scores: Familiar Stimuli	Divergent-Thinking Scores: Unfamiliar Stimuli
All Ss	231	.00	.13*
Low IQ	51	-.09	.09
High IQ	180	.02	.07
Males	140	-.11	.07
Females	91	.18*	.24*
Low IQ			
Males	29	-.13	.15
Females	22	.05	-.01
High IQ			
Males	111	-.08	-.06
Females	69	.18	.27*

*$p < .05$ (one-tailed test).

score computed using the formula given by Glass and Stanley (1970, p. 313), $Z(N = 231) = 2.48$, $p < .01$.

Since Weinstein and Bobko (1980) reported that IQ and divergent-thinking fluency were not correlated in samples in which all subjects had IQ scores above 115, a second analysis computed correlation coefficients for subjects in high- and low-IQ groups. Subjects with IQ scores of 115 and below were included in the low IQ group and subjects with IQ scores above 115 were included in the high IQ group. In this analysis, none of the correlation coefficients reached significance. These results are consistent with the results reported by Weinstein and Bobko.

When the correlation coefficients between IQ scores and fluency scores on familiar and unfamiliar tests were computed separately for boys and girls, two different patterns emerged. In girls, both familiar and unfamiliar test scores were significantly correlated with IQ scores, but for the boys neither correlation coefficient reached significance. When the correlation coefficients for girls and boys were compared using Fisher's Z-transformation of the rs (Glass & Stanley, 1970, p. 311) the only significant difference was for the correlations between IQ scores and familiar scores, $z(n = 91, 140) = -2.137$, $p < .05$.

Finally, the correlation coefficients between IQ scores and the divergent thinking variables were computed for

high- and low-IQ girls and high- and low-IQ boys. The correlation between IQ scores and unfamiliar test scores reached significance only for high-IQ girls in this analysis, $r(N = 69) = .27$, $p < .05$.

Influence of Sex and Grade on Personality Variables.

Earlier writers have reported age and sex differences on FIRO-BC scores (Burton & Goggin, 1985) and dependence-proneness scores (Flanders, Anderson, & Amidon, 1961; Shore & Tali, 1978). To determine whether there were similar effects in this gifted sample, a 2 x 5 multivariate analysis of variance was carried out for the effects of sex (male, female) and grade (4 to 8) on dependence proneness, affection, and inclusion. The effects of sex were not significant, $F(3, 164) = 1.20$, $p > .80$. There was a significant grade effect, $F(12, 488) = 2.27$, $p < .05$, such that the scores on all three personality measures decreased as grade increased. The interaction between grade and sex was not significant, $F(12, 488) = .31$, $p > .90$. Subsequent examination of the univariate tests showed that the dependence proneness and affection scores were significantly lower in the higher grades; for dependence proneness, $F(4, 166) = 4.46$, $p < .01$, and for affection, $F(4, 166) = 3.16$, $p < .05$. The means and standard deviations of the personality variables by sex and grade are shown in Table 12.

Table 12

Means and Standard Deviations of Personality Variables by Sex and Grade

	Males			Females		
Grade	n	Mean	SD	n	Mean	SD
			Dependence Proneness			
4	36	27.39	5.46	18	27.83	7.53
5	21	26.76	5.69	16	28.5	5.34
6	13	30.23	5.15	17	29.65	3.89
7	14	28.07	3.17	12	25.92	5.65
8	18	23.83	6.46	11	23.82	4.98
			Inclusion			
4	36	11.64	5.03	18	10.88	5.22
5	21	10.52	5.22	16	11.31	2.98
6	13	10.23	4.66	17	11.71	4.27
7	14	8.71	4.43	12	9.33	4.40
8	18	9.83	4.51	11	10.36	3.70
			Affection			
4	36	11.00	4.30	18	10.89	4.85
5	21	10.29	4.52	16	10.56	3.90
6	13	10.62	3.95	17	11.59	3.76
7	14	8.86	3.21	12	9.08	3.09
8	18	8.06	3.61	11	8.27	3.32

Summary

Preliminary Analyses

Preliminary analyses revealed that subjects earned higher divergent-thinking fluency scores on figural tests than on verbal tests, and there was a tendency for scores to be higher in the higher grades.

Specialization Hypotheses

The hypothesis that boys will excel over girls on unfamiliar tests and that girls will excel over boys on familiar tests was not upheld. Girls earned higher scores than boys on both types of divergent-thinking tests.

There were two small but significant relationships between the personality measures and the specialization scores. In boys, the dependence-proneness scores were significant negative predictors of the specialization scores, indicating that independent boys earned higher scores on familiar divergent-thinking tests than on the unfamiliar tests. In girls, the inclusion scores were significant positive predictors of the specialization scores, indicating that high inclusion scores were associated with specialization on familiar divergent-thinking tests.

The hypothesis that children who had low balance scores, indicating relatively little specialization, would have higher total scores than children who had high balance scores was not upheld. Instead, the trend was in

the reverse direction to the one hypothesized.

Supplemental Analyses

There was a significant positive correlation between IQ scores and fluency scores on unfamiliar tests when all the subjects were included in the analysis, and between IQ scores and scores on familiar divergent-thinking tests for female subjects only. When the correlation coefficients were examined separately for girls and boys in low- and high-IQ groups, only the correlation between unfamiliar scores and IQ scores for the high-IQ girls was significant.

There were no significant sex differences on the personality scales, but the dependence-proneness and affection scores were significantly lower in the upper grades than in the lower grades.

DISCUSSION AND CONCLUSIONS

In the following discussion, the results pertaining to the three hypotheses of the study will be addressed first, followed by a discussion of the small but significant correlations between IQ and the divergent-thinking fluency scores on familiar and unfamiliar tests. Finally, the effects of sex, grade and material on fluency scores, and of sex and grade on personality measures will be discussed.

Specialization in Divergent Thinking

Three hypotheses had been developed based on the theory of cognitive specialization put forward by J. Block (1982) and J. H. Block (1981, 1983). None are upheld by the results of this research. Some possible explanations for the lack of support of the hypotheses include the characteristics of the subjects sampled, the measures employed, as well as the hypotheses themselves and the selection of the literature on which they were based.

Gender Specialization

The first hypothesis predicted gender specialization on divergent-thinking tasks. Girls were expected to excel over boys on tasks employing familiar content and boys were expected to excel on tasks using unfamiliar content. Instead, girls' scores were significantly higher on all tests. Consequently, the hypothesis that boys and girls

specialize in different styles of divergent thinking, as reflected by familiar and unfamiliar test scores, was not supported in this study.

Several factors, taken together, may account for this apparent lack of gender specialization. Two characteristics of this particular sample seem likely to have reduced the possibility of finding an interaction between the sex and familiarity factors. These are the subjects' giftedness and their self-selection into the summer schools which were used as a source of subjects. In addition, a broader review of the literature on which the hypotheses were based may facilitate the evaluation of the results.

Subjects' Giftedness. It may be that sex differences in the extent of cognitive specialization are reduced in gifted subjects relative to an unselected sample of children. If extreme specialization results in reduced cognitive efficiency, as J. Block (1982) and J. H. Block (1981, 1983) believe, then it is reasonable to suppose that a group of gifted children, who to some extent are selected for cognitive efficiency, would include fewer children with extreme specialization than would be found in the general population. If this is the case, there would be a decreased probability of finding a sex-by-familiarity interaction in the sample used in this research.

Summer School Students as Subjects. In addition to

being gifted, all the children who served as subjects in this research were voluntarily attending school during their vacation, a fact which also may have restricted the variance of specialization on familiar or unfamiliar tests over that of a more diverse sample. This in turn would reduce the probability of finding an interaction between the sex and familiarity variables. The summer school programs, as described in publicity material, demand much more intellectual independence than a typical school program. Consequently, children who are extremely specialized in the direction of assimilation and thus would be expected to score more highly than average on the familiar tests, are probably less likely to choose to attend. If, as hypothesized, girls prefer to use assimilation more than boys do, then there would have been more girls than boys in this group of potential subjects. At the same time, extreme accommodators who would be expected to score more highly than average on the unfamiliar tests may also be less likely to choose to attend a school program with its inherent structure. In this case, if boys prefer to use accommodative strategies more than girls do, then there would have been more boys than girls in this group of potential subjects. Consequently the range of scores on the familiarity factor may have been limited by the fact that the subjects voluntarily were attending a summer school. In addition,

the self-selection process may have eliminated girls and boys differentially in respect to the familiarity variable, thus further reducing the possibility of finding a sex-by-familiarity interaction.

Reconsideration of the Hypothesis. It must also be considered that the hypothesis needs to be re-examined. Two factors will be considered: the role of the peer group, and the possibility that boys and girls react differently to structure imposed by adults.

Much of the literature on which the specialization hypothesis is based, and which is reviewed in the introductory chapter, is concerned with adult-child interactions and their impact on cognitive style in children. However, during the elementary-school years, as the amount of time spent in close contact with parents or their surrogates decreases, the peer group becomes more influential (Berndt, 1979; Best, 1983; Bixenstine, DeCorte, & Bixenstine 1976; Brooks-Gunn & Matthews, 1979; Bronfenbrenner, 1970; Katz, 1979; Newson & Newson, 1976). This change from adult orientation to peer orientation may have a differential impact on boys and girls and it is possible that such a change serves to mitigate the tendency to cognitive specialization that results from the difference's in adults' socialization practices experienced by girls and boys.

The process by which children move from adult

orientation to peer orientation begins earlier among boys than girls, and has different consequences for the two sexes. Best (1983), who followed a group of primary-school children for a period of four years, noted that boys began to make the transition early in the second grade, and by the spring of that year they 'had completely transferred their needs for rewards from their teacher to their peers' (1983, p. 12). Among girls the transition did not take place until the fourth grade, and when it did occur, it was less extreme than among the boys. As girls turned more to their peers, they did not in the process reject the adult influence as completely as boys did. Among boys but not girls, defying adult authority was not only supported by the peer group, it was required for acceptance into the group.

Best (1983) concluded that the nature of peer loyalties was different among boys and girls. Boys' primary loyalties were to their peers as a group rather than to individuals within the group. Girls' relationships were more intense than boys, but they were usually with one or two other girls, and their loyalties to the larger peer group were weaker than among the boys. Consequently, peer group pressure was greater among the boys than the girls, with the result that more options were open to the girls than to the boys. For example, pressure to compete was intense among the boys, but much less so among the girls;

boys had to fight when they were challenged, but girls had the option to retreat; girls had a wider range of games open to them and greater individual control over what game they engaged in at any given time than boys had. Most striking was the extent to which traditional sex roles were more strictly enforced among boys than among the girls.

The peer group differences between boys and girls that Best (1983) reported have been confirmed and extended to older children by a number of studies. Girls have been reported to be more compliant than boys to adults during the elementary and junior-high school years (Berndt, 1979; Bronfenbrenner, 1970; Brophy, 1985; Medrich, Roizen, Rubin, & Buckley, 1982; Stake & Katz, 1982; Thompson, 1985). However, there is evidence that boys are more susceptible to peer pressure than girls are (Berndt, 1979; Bixenstine, DeCorte, & Bixenstine, 1976; Bronfenbrenner, 1970; Chocran & Gunnar, 1985; Pitcher & Schutz, 1983; Thompson, 1985). Consequently, it seems likely that boys' greater freedomy from adults'control is offset by the greater peer pressure they experience, particularly as peer groups are more exacting of conformity than adults are (Best, 1983; Newson, Newson, Richardson, & Scaife, 1978).

Although boys experience greater freedom than girls from adult structure, the activities that they substitute may provide an alternate source of structure. The study by Huston et al (1986) provides a good example. They reported

that girls at a summer camp spent significantly more time than boys in high-structure activities in proximity to adults. Boys spent more time than girls in unstructured activities away from adults, including board games "which, it could be argued, were the least structured of all activities because they were not part of the adult-prescribed agenda for the day camp and because there was little adult feedback available" (p. 1208). Counter to the authors' interpretation, it can be argued that board games are not unstructured activities even though they had little adult feedback. The structure, however, comes from the rules of the games themselves, and from the other children playing them, rather than from adults. Other research reports confirm that boys more often than girls engage in structured activities, particularly team sports, during their school years (Best, 1983; Lever, 1976, 1978; Medrich et al, 1982; Newson & Newson, 1976; Roberts, 1980). It is likely that the structure provided by peer group relationships and structured play encourage the development of assimilative problem-solving strategies in boys.

Not only is girls' play less structured than boys' play, it is also more spontaneous (Lever, 1978) and more inventive (Roberts, 1980). Girls also spend more time than boys in imaginative play involving role-taking and plot development (Lever, 1978; Newson & Newson, 1976). Furthermore, in the elementary-school years girls engage in

a wider variety of play and games than do boys (Best, 1983; Roberts, 1980). One reason for this difference is that girls have the option of engaging in "boys" games such as baseball and soccer (Best, 1983; Lever, 1976, 1978; Medrich et al, 1982; Roberts, 1980). Boys, however, often avoid "girls" activities (Best, 1983; Roberts, 1980; Sutton-Smith & Rosenberg, 1961/1971). A further difference between boys and girls is that girls have the options of playing the boys' games, of not playing them, or of playing them at some times but not others. Boys, however, have to play the team games to be accepted by their peers, and once accepted, they have to play whenever the group plays (Best, 1983). These differences between boys' and girls' play and the games they choose could be expected to permit girls greater freedom than boys to explore accommodative approaches to problem situations.

The wider choice of games that was available to girls represented only one of several ways reported by Best in which the peer group allowed girls greater freedom than boys in sex-role related activities. In order to establish themselves as sufficiently masculine to be accepted by the group, boys had to avoid female activities; even associating with boys who played with girls was not considered manly. Girls could be tomboys without loss of status; being considered a sissy led to ostracism for boys. Other reports confirm the observation that peers permit

girls greater latitude than boys are permitted in sex-role related behavior during the elementary school years (Roberts, 1980; Hemmer & Kleiber, 1981; Katz, 1979; Newson, Newson, Richardson, & Scaife, 1978).

This difference between boys and girls in sex-role flexibility has implications for cognitive specialization. One consequence of the difference is that there are some situations in which girls are permitted to accommodate and boys are encouraged to assimilate. Best (1983) has provided a vivid example. She described a primary-grade girl who, preferring boys' activities to girls', set out to pass all the tests that were necessary to be accepted into the boys' peer group. That done, she "asked the boys if they would let her become a boy. Yes, they said" (Best, p. 95). This is clearly an accommodative solution in which existing structures, both mental and social, were changed. It was not a solution that was open to the boys: When a boy who was much more comfortable with the female role announced he was going to be a girl, his classmates could not imagine such a possibility; it was treated as a joke.

In conclusion, it may be that the greater freedom from adult structure that boys experience in comparison to girls is countered by the greater structure of the activities that boys choose as well as the more stringent demands for conformity made by the male peer groups. Together, these may have the effect of decreasing the tendency towards sex

differences in cognitive specialization in elementary-school children.

There is also some evidence to suggest that boys and girls react differently to adult-provided structure, in ways that may decrease the tendency to sex differences in cognitive specialization. Carpenter and Huston-Stein (1980) noted that preschool girls spent more time than boys in activities structured by adults, however there was no difference in the amount of novel behavior engaged in by boys and girls. Bee, Mitchell, Barnard, Eyres, and Hammond (1984) found few differences in the interaction of 193 parent-infant pairs. However, mothers' developmental expectations, the extent of fathers' involvement, provision of appropriate play materials, and the extent of family-life change were stronger predictors of IQ or language development for boys than for girls. On the other hand, stronger predictions for girls than boys were found for a measure of restriction and punishment, leading the authors to conclude that the same experiences produce different effects for boys and girls. Cohen and Tomlinson-Keasey (1980) have reported that in a sample of 26 toddlers, boys engaged in their most creative play when playing with a peer, but girls' most creative play occurred when they were playing alone or in the presence of their mothers. Finally, in a study of the effects of the degree of formality of classroom environments on children's

creativity, Thomas and Berk (1981) found that informal classrooms enhanced girls' creativity more than boys' creativity. Although this evidence is indirect, it does suggest the possibility that the differential amount of adult structure experienced by girls and boys does not necessarily produce sex differences in cognitive specialization.

Conclusions. The hypothesis that sex differences in cognitive specialization would be reflected in an interaction between sex and divergent-thinking test familiarity was not upheld in this sample of subjects. In preschool or adolescent and adult subjects not selected for giftedness more positive outcomes might be obtained. For example, Gold, Crombie, Brender and Mate (1984) reported that both 4-year-old and 8-year-old girls performed more poorly than boys on a problem-solving task when the correct response was the opposite of a response modeled by adults, which is consistent with the Blocks' theory. Also consistent with the theory is the finding by Kirton (1983) that among his sample of managers proportionately more of the women than of the men were adaptors (assimilators) and proportionately more of the men than the women were innovators (accommodators).

However, a study of 80 grade 7 students revealed outcomes inconsistent with the Blocks' theory. In a computor-programmed probability game, Van Hecke, Tracy,

Cotler, and Ribordy (1984) found that more girls than boys chose the more probable response even when a less probable response was rewarded by an adult. This is not consistent with the Blocks' theory that girls are more susceptible to social pressure than are boys. It may be that during the elementary and junior-high school years the differential impact of peer influences on boys and girls mitigates the tendency for boys to specialize in the accommodative thinking that was demanded by the unfamiliar tasks and for girls to specialize in the assimilative thinking that is effective on familiar divergent-thinking tasks. In addition, the differential reactions of boys and girls to the same situations may reduce sex differences in cognitive specialization.

Personality and Specialization

The results of the regression analysis do not generally support the hypothesis that dependence proneness and social orientation scores would predict divergent-thinking specialization. For girls, one of the personality measures, inclusion, significantly predicted specialization on familiar tasks that could be responded to using assimilative strategies. For boys, dependence-proneness scores were significant negative predictors of divergent-thinking specialization scores. However the direction of this relationship was the reverse of that predicted, with the less dependent boys performing better

on the familiar (assimilative) tasks.

These results are in agreement with the survey of the literature in the first chapter, that reported no consistent personality correlates of divergent thinking in children. Two factors may be responsible for this outcome. First, it is possible that the characteristics of the subjects discussed earlier, particularly their giftedness and attendance at a summer program, may have influenced the results by limiting the range of personality and specialization scores. Secondly, it is possible that the fact that the subjects were not selected for the subject-matter in which they were most interested may have minimized the differences in personality resulting from specialization in assimilative or accommodative strategies. Finally, it may be that the role of independence and social orientation in creativity has been misinterpreted, and an alternate interpretation will be considered.

Summer School Students as Subjects. In the previous section it was suggested that the choice of gifted summer school students as subjects may have reduced the range of specialization compared to a more diverse sample. The same factors may also have reduced the range in personality variables in the subjects relative to a more diverse group. If that is the case, the probability of finding significant relationships between personality and specialization would also be reduced.

As previously suggested, if extreme specialization results in reduced cognitive efficiency, then it is reasonable to suppose that a group of gifted children, who to some extent are selected for cognitive efficiency, would include fewer children with extreme specialization than would be found in the general population. This could have reduced the variability in specialization scores.

The fact that the subjects in this research were voluntarily attending school during their vacation may also have eliminated children who were extreme in their level of independence or social orientation. On the one hand, children who are extremely independent and low in social orientation are probably less likely than average to choose to attend the comparatively highly-structured school environment. On the other hand, the school programs demand more intellectual independence than a typical school program. Consequently, children who are extremely dependent are also unlikely to choose to attend. Taken together, these two factors may have restricted the range of scores on the personality measures. If the range of personality and specialization scores was reduced, the possibility of finding the predicted relationships would also be reduced.

Subjects Not Selected for Interests. A second factor that may have contributed to the lack of significant findings is the wide range of subject-matter interests in

the subjects. It is widely accepted that creative individuals are characterized by a common set of personality traits (e.g. Barron & Harrington, 1981; Milgram, 1984). However, Perkins (1981) and Weisberg (1986) have challenged this interpretation of the literature, suggesting that it is an artifact of the research methods employed which generally limit their subjects to samples of more- and less-creative individuals within a particular occupation. However, when comparisons are made across these studies, the only personality trait that consistently distinguishes the more-creative from the less-creative subjects is that of greater independence (Perkins, 1981).

There is little research with children on this question, and even the work on adolescents is limited. Holland (1961) reported few similarities in the characteristics predicting creativity in science and those predicting creativity in the arts in a study of 994 junior high-school national merit scholarship finalists. Among the boys, creativity in both areas was correlated with high self-rating scores on independence, originality and perseverance. However, boys high on scientific creativity rated themselves low on the responsibility and status scales, while the boys high on the creative arts scale rated themselves high on the same scales. Among the self-ratings that predicted high creativity in science but

not in the creative arts were high scores on mastery, deferred gratification, initiative, and intellectuality. Among the self-ratings that predicted high creativity in the creative arts but not in science were high scores on esthetic sensitivity, breadth of interests, self-assurance, emotionality, and drive to achieve. Girls who had high scores on the creative science scale shared a high breadth of interest rating with girls who earned high creativity scores on the creative arts scale. However, high scores on sense of destiny, originality, and positive self-evaluation predicted high scores on the creative arts scale but not on the creative science scale among girls. Likewise, for girls high scores on mastery and drive to achieve predicted high scores on the creative scale but not on the creative arts scale.

Schaeffer and Anastasi (1968) and Anastasi and Schaeffer (1969) have reported that the biographical correlates of creativity differed when adolescents from different subject-specialties were compared. For example, in comparison to boys specializing in fine arts, boys specializing in maths-science had different family backgrounds, different relationships with their parents, and different interest patterns (Schaeffer & Anastasi, 1968). Differences were also found when the correlates of artistic and literary creativity in adolescent girls were compared (Anastasi & Schaeffer, 1969). In related

research, Karnes, Chauvin and Trant (1985) reported that the personality profiles of groups of gifted adolescents varied with the area in which they were gifted. One group, academically gifted, was characterized as excitable, assertive, enthusiastic and composed. The second group, gifted in the fine and performing arts, was characterized as tender-minded, reflective, internally restrained, and self-assured but tense and driven.

Kirton's study (1976) established a relationship in adults between personality and adaptive (assimilative) and innovative (accommodative) styles, but his subjects were restricted to business managers. The children who served as subjects in the study reported here were gifted in a wide variety of fields, from art and music to math and science. If the personality correlates of divergent-thinking variables vary with the child's field of interest, it is plausible to surmise that the differences between subjects from different content-areas outweighed any differences associated with divergent-thinking specialization.

Weisberg (1986) has suggested that the personality correlates of creativity are specific to the situation as well as to the content of the problem He states,

> A given personality type may facilitate creative achievement only in relation to a specific problem, and then only within a specific environmental situation

> .... the same personality characteristics which supposedly are necessary for creative achievement in one situation may actually interfere with creative achievement in another. (p. 144)

Even the greater independence of thought and action consistently reported to be associated with greater creativity, Weisberg has suggested, could be the result of creativity, particularly of successful creativity, rather than its cause.

Role of Independence and Social Orientation in Creativity. It is also possible that personality characteristics associated with creativity are important for the execution or recognition of creativity rather than for the creative thinking that is measured by divergent-thinking tests.

Independence consistently has been reported to be related to creativity in adolescents and adults selected on the basis of creative accomplishments, but not in children selected on the basis of divergent-thinking test scores. This suggests an additional possibility. It may be that the importance of independence is found not in the idea-generating stage of creativity which is measured by divergent-thinking tests, but at other stages of the creative process.

A study by Getzels and Csikszentmihalyi (1976) gives an indication of how independence may facilitate creativity:

In a follow-up to a study of art students, 31 were contacted 7 years after their graduation. At that time, 15 students had abandoned art, another 7 were working in art-related fields, such as teaching art, and 9 had succeeded in establishing themselves as artists. Only one personality characteristic predicted future success as an artist: successful artists initially had lower scores on a scale measuring conformity and concern with social approval.

It may have been that the greater independence and lower need for social approval of the successful artists was important in permitting them to establish and sustain situations that allowed them to devote the time and effort to their art that made success possible. It may have made it possible for them to resist social pressures to earn money through related work, or to establish a family, both of which would detract from the amount of time and effort they could devote to art.

A report by Rieger (1983) suggests that for women the ability to limit their family responsibilities is related to creative performance. In a 21-year follow-up of 83 students who had been identified as high or low in creativity on the Torrance Tests of Creative Thinking when they were in elementary school, the high-creative group had many more creative accomplishments than did the low-creative group. In addition, the two groups had -

established significantly different life styles, with more of the high-creative subjects having concentrated on careers only and more of the low-creative subjects having selected the family role exclusively. In addition, those high-creative subjects who had opted for combined career and family were more likely than low-creative subjects to share domestic tasks with others.

Since women in this society generally carry more family responsibilities than men do, this interpretation is also consistent with the fact that women are found less frequently than men among adults identified as creative in their field, even though sex differences in creative achievement are not generally noted in high school and college students (Hocevar, 1980; Holland, 1961; Milgram & Milgram, 1976a; Wallach & Wing, 1969). It is furthermore consistent with the reported observation by Torrance (1972) and Howieson (1981) that children's scores on divergent-thinking tests are more accurate predictors of adult creativity in males than in females.

Conclusion. The predicted relationships between divergent-thinking specialization and measures of independence and social orientation were not obtained. In part, this may have resulted from selecting the sample from gifted children attending a summer school, and from not controlling for the effects of the subjects' area of interest which may be associated with different patterns of

personality variables. However, consideration should also be given to the possibility that these traits are related to stages of creativity other than the idea-generating stage measured by divergent thinking.

Balance and Effectiveness

The third specialization hypothesis predicted that a high degree of specialization—in either assimilative or accommodative thinking styles would be less effective in divergent thinking than a lesser degree of specialization. It was predicted that the most effective thinkers, those who had earned the highest total divergent-thinking scores, would have low balance scores, indicating that they had performed equally well on familiar and unfamiliar tests. Subjects who had earned lower total scores were predicted to have greater specialization, as evidenced by a larger balance scores. A chi-square analysis revealed no significant differences in discrepancy among subjects who earned high, medium or low total divergent-thinking scores. Furthermore, there was a trend for the more specialized subjects to have earned higher total scores than subjects who were less specialized.

The reasons for these results are not immediately clear. However, it is possible that a moderate degree of specialization allows subjects to develop a greater proficiency in one thinking style that offsets the potential disadvantages of specialization.

A second factor may be that subjects with extreme specialization in divergent-thinking were less likely to be found in this gifted sample than would be found in a sample not selected for ability. As previously noted, these subjects were both gifted and had chosen to attend summer school, which may have restricted the variability of specialization scores, with the effect of also decreasing the probability of finding significant differences on this analysis.

In retrospect, this study may not have provided the most meaningful test of the hypothesis that cognitive specialization is less effective than a more balanced style, because the measure of effectiveness and the measure of balance were both derived from the divergent-thinking school marks or teacher ratings.

Supplemental Analyses

IQ and Divergent Thinking

The correlation coefficients between IQ scores and divergent-thinking scores attained significant levels of probability for all subjects only on the tasks that employed unfamiliar stimuli. This is consistent with Raaheim and Raaheim (1986) who reported that correlation coefficients between IQ scores and success on mental

puzzles reached significance only when the puzzles were neither completely unfamiliar to the subjects, nor very familiar to them. It extends their findings from college students to younger subjects and from convergent problem solving to divergent thinking.

Raaheim and Raaheim interpreted their results as demonstrating that intelligence, as measured by IQ tests, is the ability to master new tasks by bringing past experience to bear on them. This interpretation is consistent with the position of Sternberg (1986) that the ability to apply previously learned information and skills to new problems is one of the distinguishing characteristics of the gifted.

This research was not designed to determine which cognitive processes are responsible for the observed significant correlation between IQ and scores on unfamiliar divergent-thinking tests. However, it is reasonable to suppose that the ability to transfer knowledge and skills to novel situations would influence divergent-thinking scores. Furthermore, gifted children have a broader knowledge-base than nongifted children (Jackson & Butterfield, 1986), as well as superior ability to transfer a strategy learned in one situation to another situation (Scruggs, Mastropieri, Jorgensen, & Monson 1986; Scruggs, Mastropieri, Monson, and Jorgensen 1985). When gifted and nongifted fourth- and fifth-grade students were given

mnemonic devices to aid in memorizing facts about minerals, the gifted children were better able to transfer the mnemonic strategy to the task of learning a second list of facts for which mnemonic links were not provided (Scruggs et al, 1985). In a second study (Scruggs et al, 1986) only the gifted subjects were able to transfer the strategy from the task of learning facts about minerals to the task of memorizing the meaning of Italian words.

If the significant correlation between IQ and fluency on the unfamiliar tasks is the result of differential ability to transfer from one situation to another, further research would be needed to determine what is being transferred. For example, on the consequences task, it is possible that the high-IQ subjects knew more facts about clouds than the low-IQ subjects knew, or it may be that the two groups had essentially the same knowledge but the high-IQ subjects were more capable of using the information to solve an unfamiliar problem. On the figural task, differential use of strategies such as scanning the room for inspiration also might be implicated.

The correlation coefficient under consideration is quite low (.13) and reached significance only because a large number of subjects were involved. However, the result can still be considered meaningful when the fact that all the subjects in this study were gifted is taken into consideration. This would reduce the variance and

thus would minimize the correlation coefficient. Even those subjects whose IQs were relatively low had been identified as gifted on the basis of a variety of criteria not studied in this research (J. Gambino, personal communication, April 1986). For example, some subjects who had relatively low scores on the Otis-Lennon had earned high scores on individual tests of intelligence. Others had earned high scores on the Ravens Progressive Matrices or demonstrated their giftedness through academic achievement. Presumably, then, even the low-IQ subjects would be better than nongifted children at transferring skills and knowledge to unfamiliar situations.

Previous research has established that IQ scores and divergent-thinking scores are significantly correlated when subjects having a broad range of IQ scores are considered (Hargreaves & Bolton, 1972; Weinstein & Bobko, 1980). The correlations reported here suggest that this relationship would be found between IQ and divergent-thinking scores only when unfamiliar tasks are included in the divergent-thinking test battery. It would be worthwhile to test this in a sample not selected for giftedness.

It has been reported that IQ and divergent thinking scores are significantly correlated only in subjects with average or below average IQs (Hargreaves & Bolton, 1972; Weinstein & Bobko, 1980). In this study, however, the correlation coefficients between IQ and divergent-thinking

fluency on both the familiar and unfamiliar tests were significant neither for the low IQ group nor for the high IQ group. The lack of significance may be attributed to the smaller sample sizes and to the reduced range in IQ scores.

Sex Differences in Correlation Coefficients. When correlation coefficients between IQ and fluency on familiar and unfamiliar tasks were computed separately for boys and girls an interesting pattern emerged. For the boys, neither of the coefficients reached significance, whereas for the girls both correlation coefficients were significant. However, this sex difference reached significance only for the correlation coefficient between IQ scores and the familiar test scores.

The most plausible explanation of this difference may simply be that the girls were more motivated than the boys were. If the boys were not trying their best, then differences in ability would be expected to have less influence on the results. The added fact that girls' scores were higher than boys' scores on all the divergent-thinking tasks lends support to this interpretation. It is also consistent with the research indicating that girls are more compliant to adults' requests than boys are (Berndt, 1979; Best, 1983; Brophy, 1985; Caplan, 1979; Medrich, Roizen, Rubin, & Buckley, 1982; Stake & Katz, 1982; Thompson, 1985).

Conclusion. The finding that IQ scores are significantly correlated to divergent-thinking scores only when unfamiliar tasks are used is an interesting one. It extends similar results reported for adults (Raaheim & Raaheim, 1986) to children, and from convergent thinking tasks (Raaheim & Raaheim; Scruggs et al 1985, 1986) to divergent thinking tasks. It would be worthwhile to explore the phenomenon through further research to determine if it would be replicated in a sample that included nongifted subjects as well as gifted subjects, and to explore the possible sources of the effect.

Effects of Grade, Material and Sex on Fluency Scores

Grade. The significant main effect obtained for the influence of grade on fluency scores is consistent with previous research. In this study there was a tendency for students in the higher grades to earn higher scores than those earned by students in the lower grades. On all the divergent-thinking tests, the mean scores in grade 8 exceeded the mean scores in grade 4, although there were some departures from this general trend. Similar patterns have been reported by other researchers. Hargreaves (1982) reported a significant age effect, and Torrance (1973/1981) reported a significant grade effect. In both the Torrance and Hargreaves studies, fluency scores generally increased with age or grade, though there were some irregularities to this pattern.

Material. A significant main effect for the material factor was also revealed. Scores on figural tests were higher than scores on verbal tests. The most reasonable explanation of this difference is found in the time limits imposed on the tests. A total of 8 minutes was allowed for the verbal material, in contrast to 16 minutes devoted to figural material. It seems reasonable to infer that the greater amount of time available to the subjects for the figural tests was responsible for the larger scores.

Sex. The superior scores earned by the female subjects compared to male subjects are also consistent with previous research, as summarized in the introduction. Although the majority of studies have reported no sex differences, when differences do occur they generally favour girls. The most likely explanation of this phenomenon is that the previously noted sex differences in compliance to adults resulted in girls making a greater effort on the tests. The differential pattern of correlations obtained for boys and girls between IQ scores and scores on the familiar and unfamiliar divergent-thinking tests also supports the possibility that the sex differences were influenced by differential effort.

Secondly, it is possible that the fact that girls are permitted greater deviation from traditional sex-role-appropriate behavior than boys are permitted is a factor in the higher divergent-thinking scores earned by

girls compared to boys. It has been demonstrated that children with androgynous or mixed sex-role patterns have higher divergent-thinking scores than other children (Biller, Singer, & Fullerton, 1969; Hargreaves, 1979; Milgram, Yitzhack, & Milgram; 1977). Hargreaves, Stall, Farnworth and Morgan (1981) have reported androgyny to be a significant predictor of divergent-thinking fluency in girls from 9 to 11 years old.

Effects of Grade and Sex on Personality Measures

The finding that dependence proneness decreased as grade increased is consistent with the research of Shore and Tali (1978), which also found a grade effect. However, this research did not confirm the sex differences in dependence proneness noted by Flanders et al (1961) and Shore and Tali (1978). Nor were the sex by age interactions on the FIRO-BC reported by Burton and Goggin (1985) replicated in this study. While there is some evidence to suggest that there are fewer sex differences in personality in the age group studied in this research, it is likely that the giftedness of the subjects is responsible for the lack of differences, since the subjects were approximately the same age as the subjects in the other studies noted above.

There is some evidence supporting the hypothesis put forward by Kerr (1985) that sex differences in personality may be fewer in gifted children than in the nongifted (Kerr

1985). In a study comparing gifted and average junior high school students, Bachtold (1968) found that the average boys valued independence more than the average girls did. However, gifted boys and girls did not differ in the value they placed on independence. Prior to adolescence, gifted girls may be less concerned with social conformity than they may be during their later years. Kerr (1985) writes "later on they will blend in with other girls and women" (p. 86) but the preschool to junior high school years are a "bright and florid phase" (p. 87) There is some evidence to support her views. Werner and Bachtold (1969) found that gifted girls aged 12 to 14 differed in personality from their age peers, but these differences disappeared during adolescence. In particular, the younger gifted girls were more outgoing, self-assured and venturesome than their peers. During adolescence, the gifted girls came to resemble their age mates more closely.

There is also evidence to suggest that there are fewer personality differences between boys and girls at this stage in their development than in later years. In their study of the FIRO-BC, Burton and Goggin (1985) found no sex differences prior to 11 years of age, but differences increased with age thereafter. Carlson (1965) studied the personality characteristics of 87 children in grades 5 and 6, then retested them six years later. In the lower grades there were no sex differences in interpersonal orientation,

but by the end of high school girls were more interpersonally oriented than boys. Both the boys' and the girls' scores changed, but in opposite directions: Girls' scores increased while boys scores decreased. Jaquish and Ripple (1980) found no significant sex differences in the self esteem of their preadolescent subjects. However, among their adolescent subjects, females had significantly higher self-esteem than males had.

It is also likely that the fact that the subjects had elected to attend a summer program served to reduce the personality differences among the subjects. Furthermore, as previously discussed, if the sex differences predicted on the basis of the Blocks' theory are true, this self-selection process would have the effect of reducing the sex differences in personality.

In conclusion, it seems likely that the lack of observed sex differences on the personality measures may be partly due to subjects' age but the giftedness of the subjects and their attendance at a summer program also probably had an influence on the outcome.

Summary and Conclusions

This research did not support three hypotheses concerning specialization in divergent thinking that were based on the theory of cognitive specialization proposed by J. Block (1982) and J. H. Block (1981, 1983). Instead of

finding an interaction between the effects of sex and task familiarity on divergent-thinking fluency scores, girls outperformed boys on both familiar and unfamiliar tasks. The second hypothesis, that the personality variables of dependence proneness and interpersonal orientation would be correlated with specialization on familiar or unfamiliar tasks was generally not upheld. The third hypothesis, that subjects with high total scores would have less discrepancy between familiar and unfamiliar scores than subjects with average or low total scores also was not supported by the results; the trend was in the opposite direction.

A major factor influencing the outcomes of all three hypotheses was the fact that subjects were voluntarily attending a summer school for gifted children, which probably reduced the variance in divergent-thinking specialization and personality variables. Additional factors also were considered for each hypothesis.

It was concluded that gender specialization in cognitive style would be more likely to be found in school children not selected for giftedness and attendance at a summer program. In addition it was suggested that cognitive specialization may be greater in younger or older children than those sampled here, and that the peer group and play activities of children in elementary school and junior high school may ameliorate the extent of cognitive gender specialization resulting from child-adult

interaction. In particular, it is possible that the structure imposed by the games boys play and the stringent peer demands for sex-role-appropriate behavior may encourage the development of assimilative strategies in boys, and counter the tendency to specialize in accommodation resulting from adult-child interactions. In comparison to boys' games, the play activities that girls engage in are relatively unstructured, and girls are given more latitude than boys in relation to sex-role related behaviors. This may permit the development of accommodative strategies and counter the tendency to specialize in assimilative techniques resulting from adult-child interactions.

Although the use of gifted summer school students as subjects undoubtedly reduced the possibility of finding a relationship between specialization in divergent-thinking style and the personality variables of independence and social orientation, two other possibilities were considered. First, it is likely that personality differences associated with the wide variety of academic areas of giftedness found in the subjects masked possible personality differences resulting from cognitive-style specialization. Future research should control for this possibility. However, it was also suggested that social orientation and independence may be not be related to divergent thinking, but may instead play an important role

in other stages of the creative process.

Finally, the serendipitous finding that there was a significant correlation between IQ and scores on the unfamiliar tests for the total sample is an important outcome that helps link research in creativity to current developments in the cognitive aspects of giftedness.

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APPENDICES

Appendix A

Family Questionnaire

(The following was part of a longer questionnaire that was used in another study of the same subjects.)

PART C FAMILY INFORMATION _____

PLEASE PRINT. Please answer all question or answer N/A-not applicable.

Mother:

_____

Surname First Name Occupation

Father:

_____

Surname First Name Occupation

Child lives with:

Both parents: _____ Father: _____ Mother: _____

Other: (please specify): _____

Circle Highest Level:

Mother's Education:

Elementary School High School Bachelors Graduate Degree

Father's Education:

Elementary School High School Bachelors Graduate Degree

Name of person who completed this form: _____

Address: _____

_____ postal code _____

Telephone: Home: _____ Work: _____

Name of child in Summer School: _____ Sex: _____

Date of Birth: _____

day/month/year last grade completed

School: _____

School Board: _____

Appendix B

Mothers' Work Status by School and by Child's Sex

Independent Variable	Mothers' Status: Homemaker	Mothers' Status: Other	Chi-square	p
School				
McGill-PSBGM	31 (30.1)	72 (69.9)		
Laurenval	27 (57.4)	20 (42.6)	10.18	.00
Child's Sex				
Male	37 (40.2)	55 (59.8)		
Female	21 (36.8)	36 (63.2)	0.17	.68

Note. Numbers in brackets are percentages.

Appendix C

Family Status by School and Child's Sex

Independent Variable	Family Status: Two Parent	Family Status: Other	Chi-square	p
School				
McGill-PSBGM	93 (83.8)	18 (16.2)		
Laurenval	41 (85.4)	7 (14.6)	0.00	.98
Child's Sex				
Male	86 (87.8)	12 (12.2)		
Female	47 (78.3)	13 (21.7)	1.82	.18

Note. Numbers in brackets are percentages.

Appendix D

Socioeconomic Status by School and by Child's Sex

Factor	SES			Chi-square
	Less Than 40	40 to 59	More Than 59	
School				
McGill-PSBGM	16 (15.8)	14 (13.9)	71 (70.3)	
Laurenval	13 (29.5)	10 (22.7)	21 (47.7)	6.79*
Child's Sex				
Male	14 (15.3)	20 (22.1)	57 (62.6)	
Female	15 (28.3)	4 (7.5)	34 (64.2)	6.96*

Note. Numbers in brackets are percentages.

*$p < .05$.

Appendix E

Parental Education by School

Education	School		Chi-Square
	McGill	Laurenval	
Mothers			
Elementary or High School	41 (55.2)	39 (24.8)	
First Degree	35 (30.4)	9 (13.6)	
Graduate Degree	31 (21.4)	0 (9.6)	28.01*
Fathers			
Elementary or High School	28 (39.1)	29 (17.9)	
First Degree	27 (26.1)	11 (11.9)	
Graduate Degree	50 (39.8)	8 (18.2)	18.50*

Note. Numbers in brackets are expected frequencies.

*$p < .01$

Appendix F

Summary of Analyses of Variance Examining the Effects of School and the Interaction Between Sex and School on the Dependent Variables

Variable	df	MS	F	p
School				
Divergent Thinking	1	151.49	.70	NS
Balance	1	2.11	1.32	NS
Specialization	1	2.10	.50	NS
Interaction Between Sex and School				
Divergent Thinking	1	12.01	.06	NS
Balance	1	.57	.36	NS
Specialization	1	.21	.06	NS

Appendix G

Testing Instruments

Note. The copies of the Dependence Proneness Scale have been reduced in size by approximately 10%.

Instructions for Administering the Divergent Thinking Test

Tester One

Introduce self and second tester. Then say:

> We think you will have a lot of fun doing the activities we have planned for this period. We are going to do some things that will give you a chance to see how good you are at thinking up new ideas and solving problems. They will call for all the imagination and thinking ability that you have, so think all the ideas you can and enjoy yourself.

Ask the class to clear off their desks. Pass out the booklets, and as you do, ask the class not to open them until they are told to. Have the students fill in the cover sheet of the questionnaire. Write the date on the blackboard.

Tester Two

Tell the students:

The activities in this booklet will give you a chance to use your imagination in thinking up ideas. There are no 'right' or 'wrong' answers like there are in most things that we do. We want you to see how many ideas you can think of and we think you will find this fun. Try to think of interesting, unusual and clever ideas - something that no one else will think of.

You will have three different things to do and you will be timed on each one, so make good use of your time. Work as fast as you can without rushing. If you run out of ideas before time is called, wait until instructions are given before going on to the next activity. Sometimes if you will just sit and think, morel come to you and you can add those. If you have any questions after we start, raise your hand and I shall come to you desk and try to answer your questions. Any questions?

Answer any questions they may have, then tell them to turn to the first page.

Tester One

Tell the class:

> This is called Uses for Things. Let's read the instructions. Don't start until I tell you to.

Read the instructions, and answer any questions they have. Tell them to start, and begin timing.

Tester Two

After four minutes, tell them:

> Time to stop working on this one and turn to the next page. Please don't start writing until I tell you.

Read the instructions to the next question. Ask for and answer any questions they have, then tell them to start, and at the same time, begin timing.

Testers One and Two

Continue in this manner, reading each question and with testers alternating. Time allowances are four minutes for each of the verbal questions and eight minutes for each of the figural questions. When they have

finished all the questions, thank them for their cooperation and collect the booklets.

Divergent Thinking Test

Name _____

Date _____

Grade _____

Male _____ Female _____

Age _____

Birthdate: Day _____ Month _____ Year _____

Uses for Things

A pencil is a common object that people use to write with, but it can be used in many other interesting and unusual ways. In the spaces below list all the uses for a pencil that you can think of. Don't limit yourself to only one kind of pencil or to uses you have seen or heard about. List all the uses you can think of.

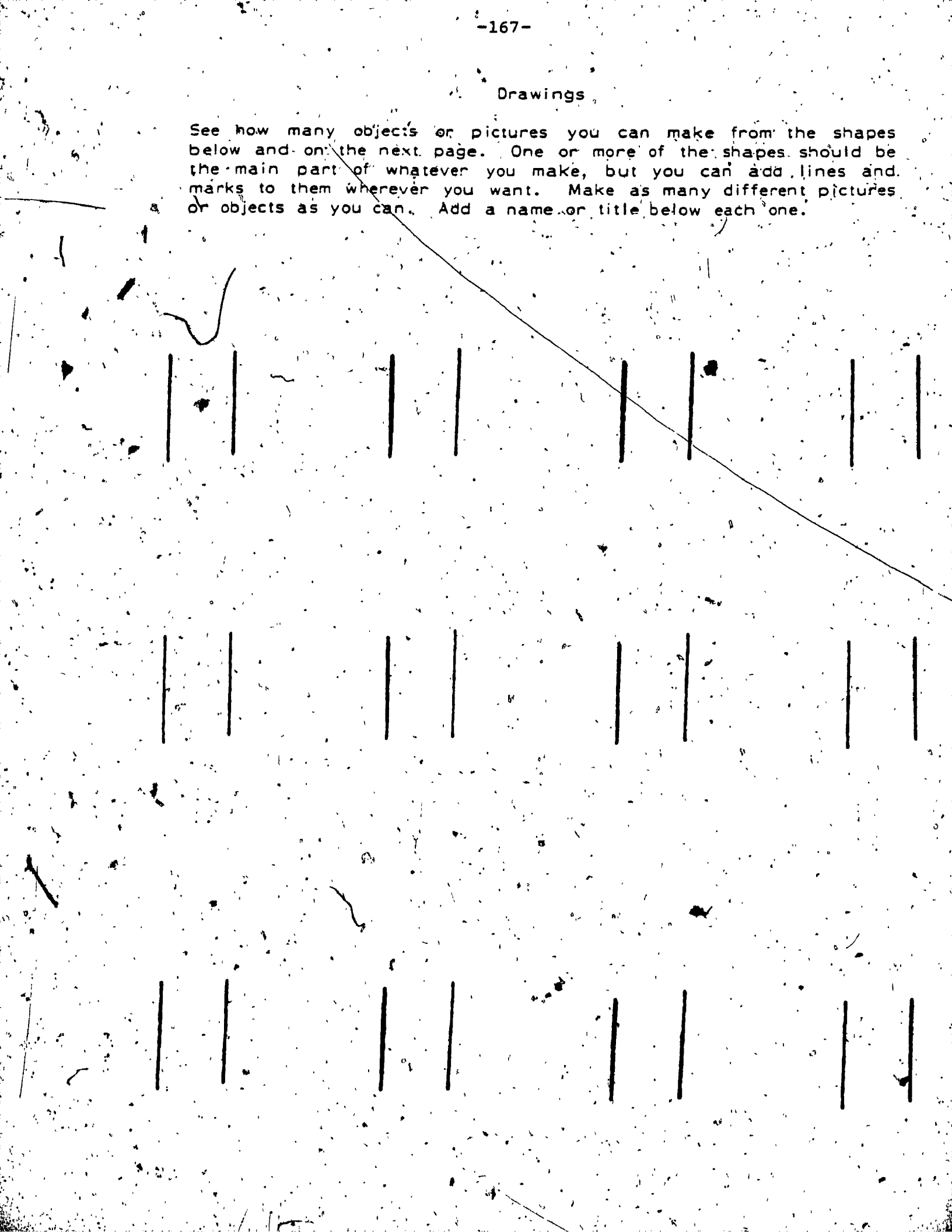
Consequences

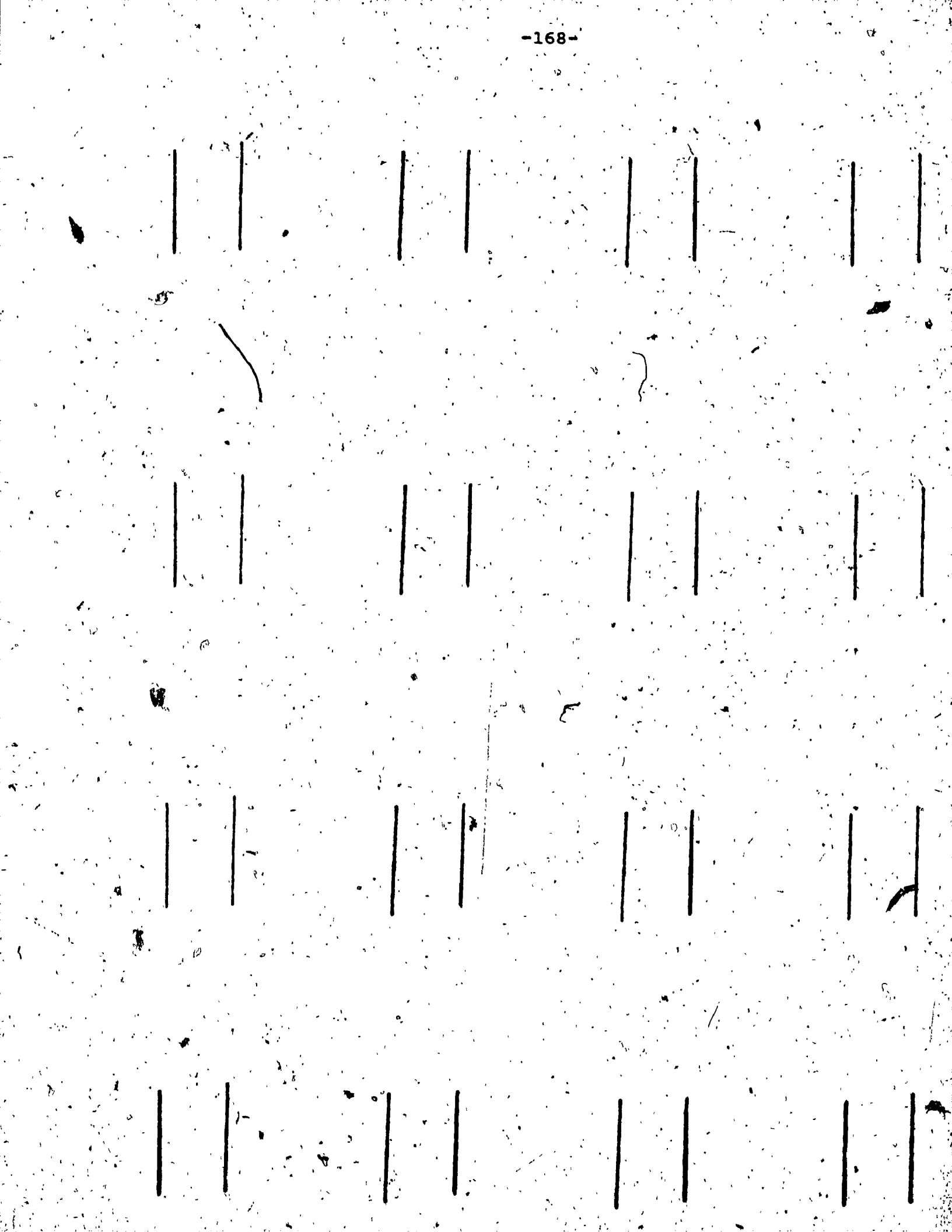
It is quite unlikely that you will win a million dollars. In fact, it will probably never happen. Use your imagination to suppose that it actually did come about, and think of all the other things that would happen as a result. In other words, what would be the consequence if you won a million dollars? List all the ideas and guesses you can think of.

Now think of all the things that would happen if clouds had strings attached to them that could be used to pull them down to earth. Even though it will probably never occur, use your imagination to suppose that it actually did come about, and think of all the other things that would happen as a result. In other words, what would be the consequences if clouds had strings attached to them that could be used to pull them down to earth? List all the ideas and guesses you can think of.

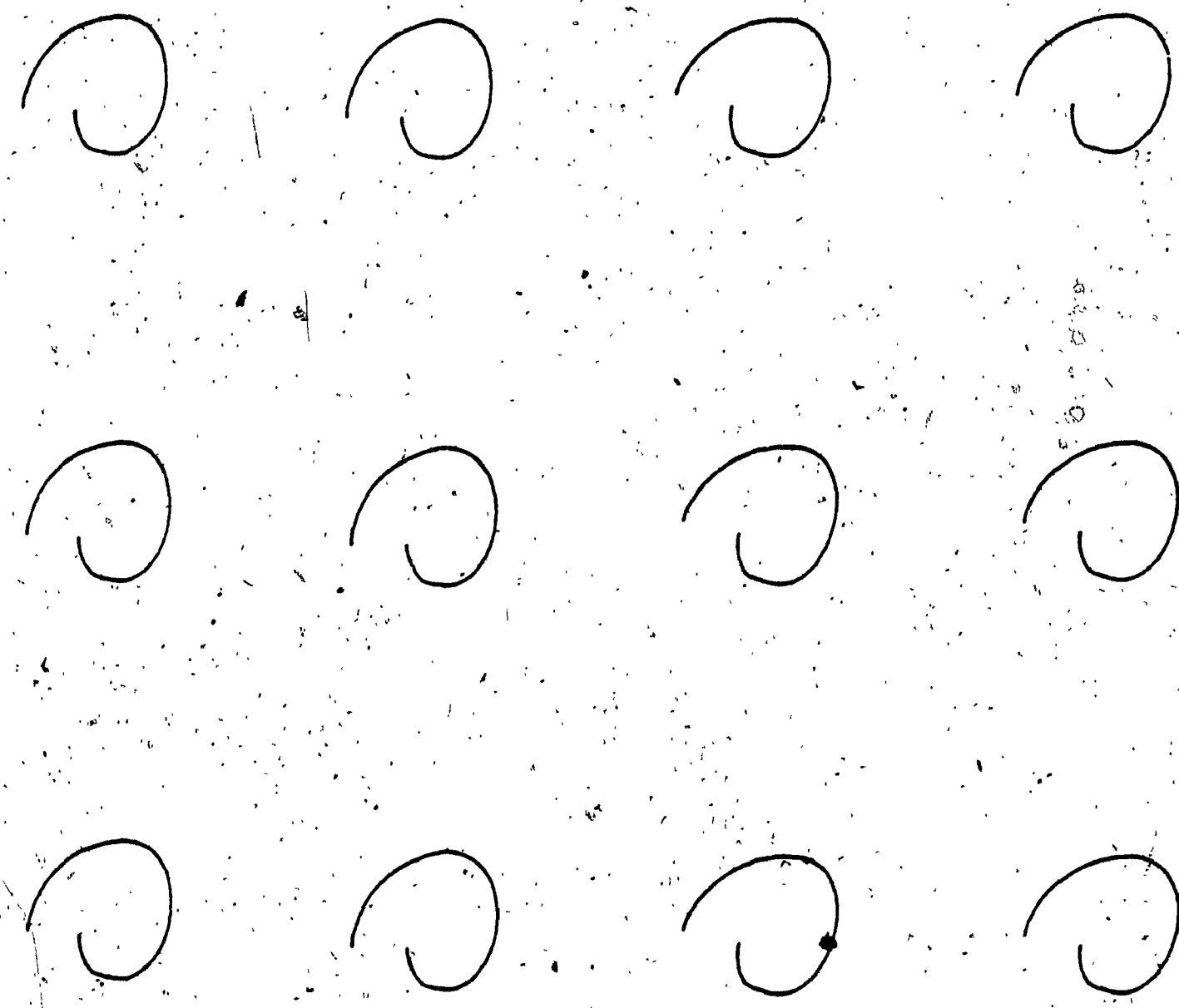
Drawings

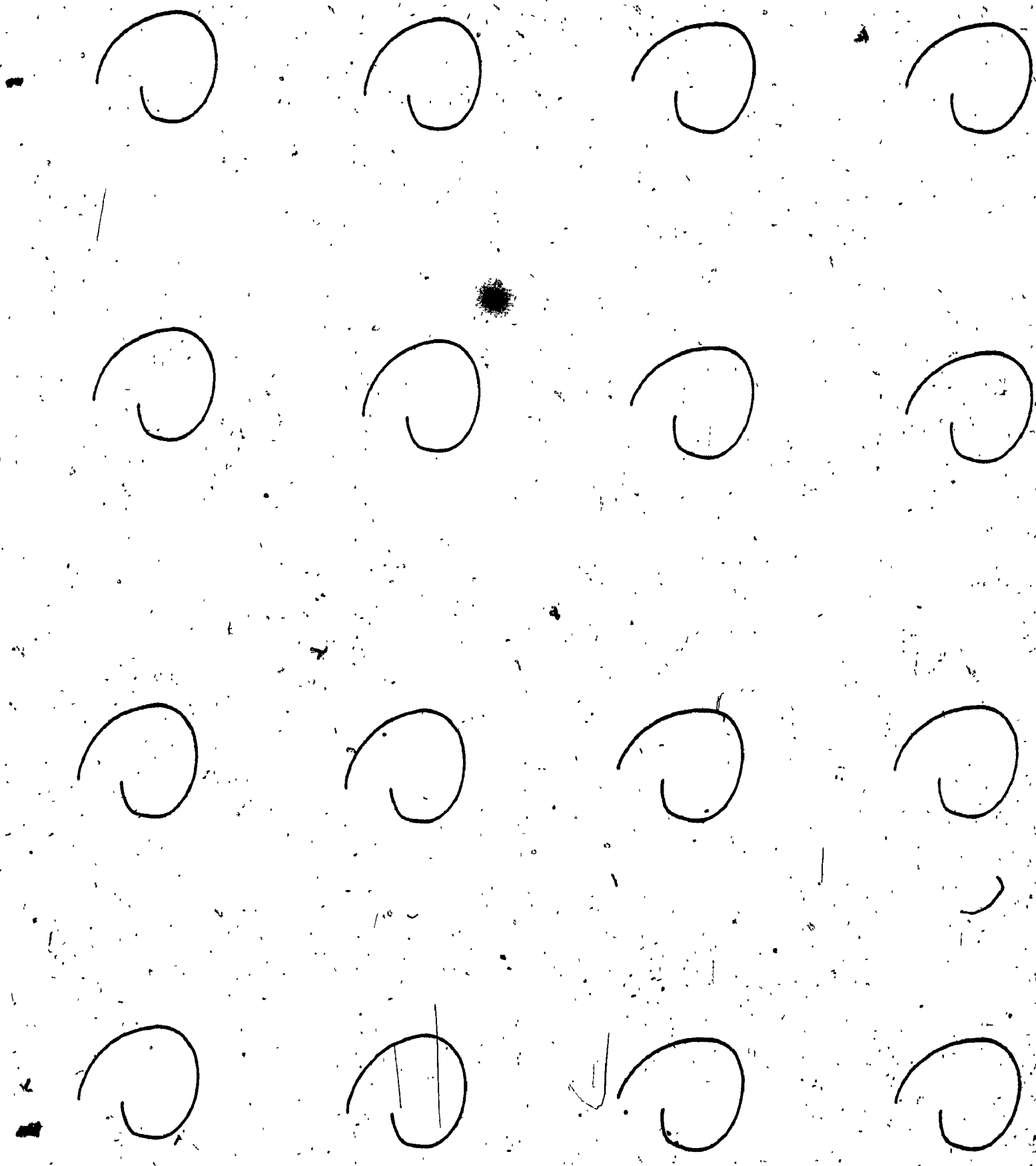
See how many objects or pictures you can make from the shapes below and on the next page. One or more of the shapes should be the main part of whatever you make, but you can add lines and marks to them wherever you want. Make as many different pictures or objects as you can. Add a name or title below each one.





Now see how many objects or pictures you can make using these shapes. Once again, the shapes should be the main part of whatever you make, but you can add lines and marks to them wherever you want. Make as many different objects or pictures as you can. Add a name or title below each one.





FIRO-BC

1977 Edition

WILL SCHUTZ, Ph.D.
MARILYN WOOD, M.A.

These questions ask about how you feel or act with other children. There are no right or wrong answers; everybody has his own ideas.

Try to tell how you really act, *not* how you wish you acted or how someone else wants you to act.

Please put a number in every box after you read the directions at the top of each page.

NAME _____

GRADE _____ AGE _____

DATE _____ BOY ____ GIRL ____

	I	C	A
e			
w			

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Place a number from 1 to 6 in the box in front of each question.
For the questions on this page, the numbers mean:

1. no children 2. one or two children 3. a few children 4. some children 5. many children 6. most children

☐ I try to make other children do what I want them to do.

☐ I try to be very friendly and to tell my secrets to other children.

☐ I like children to invite me to take part in what they're doing.

☐ What I do depends a lot on what other children tell me.

☐ I like children to act as if they don't know me very well.

☐ I try to take charge of things when I am with other children.

☐ I act unfriendly with other children.

☐ I like children to ask me to take part when they're talking about something.

☐ I let other children take charge of things.

☐ I like children to act friendly to me.

☐ I try to have other children do things the way I want them done.

☐ I don't get very friendly with other children.

☐ I like other children to choose me for a friend.

☐ I take orders from other children.

☐ I like children to act very friendly to me.

☐ I try to be friendly to other children.

☐ I like children to ask me to join in what they're doing.

☐ I follow what other children are doing.

☐ I like other children to get to know me very well.

☐ I try to have close, warm friendships with children.

☐ I let other children tell me what to do.

☐ I like children to act very friendly and tell me their secrets.

For the questions on this page, the numbers 1 to 6 mean:

1. never 2. almost never 3. once in a while 4. sometimes 5. a lot of the time 6. almost all the time

- ☐ When other children are playing games, I like to join them.
- ☐ I try to take charge of things when I'm with children.
- ☐ I try to have close, warm friendships with children.
- ☐ I like other children to invite me to their houses when they are having friends over.
- ☐ What I do depends a lot on what other children tell me.
- ☐ I like children to act as if they don't know me very well.
- ☐ When a group of children gets together to do something, I like to join in with them.
- ☐ I try to make other children do what I want them to do.
- ☐ I try to have close friendships with children.
- ☐ I like to be invited to parties.
- ☐ I take orders from other children.
- ☐ I like children to act very friendly to me.
- ☐ I try to take part in clubs and school-groups.
- ☐ I like to tell other children what to do.
- ☐ I try to have friends that I can be very friendly with and tell my secrets to.
- ☐ I like children to ask me to join in what they're doing.
- ☐ I let other children tell me what to do.
- ☐ I like children to act not too friendly to me.
- ☐ I try to include other children in my plans.
- ☐ I try to be the boss when I am with other children.
- ☐ I try to get very friendly with other children and to tell them my secrets.
- ☐ I like children to invite me to things.
- ☐ I follow what other children are doing.
- ☐ I like other children to get to know me very well.
- ☐ When children are doing things together, I like to join them.
- ☐ I try to have other children do things I want done.
- ☐ When I'm going to do something I try to ask other children to do it with me.
- ☐ I like other children to choose me for a friend.
- ☐ I like to go to parties.
- ☐ I try to have other children do things the way I want them done.
- ☐ I try to have other children around me.
- ☐ I join clubs.

Dependence Proneness Scale

School: _____

Name: _____

☐ Boy ☐ Girl

DIRECTIONS:

On the following pages are a series of statements people often use to describe themselves. Please read each statement carefully and decide whether or not it is true for you.

Il you think a statement is true for you or describes how you feel most of the time check the true square.

Il you think a statement is not true for you or does not describe how you feel most of the time check the not true square.

This is not a test and so everyone should express his own opinion for each statement. Therefore, since everyone is expected to think differently, there are not right or wrong answers. So respond to each statement as honestly as you can.

KEY	ITEM	TRUE	UNTRUE
D	1. I hesitate to ask for help from others.	☐	☐
A	2. I like to do things with my family.	☐	☐
D	3. It's fun to try out ideas that others think are crazy.	☐	☐
A	4. I enjoy working with students who get good marks.	☐	☐
A	5. Students ought to be allowed to help one another with their school work.	☐	☐
D	6. I don t need my friends' encouragement when I meet with failure.	☐	☐
A	7. I never argue with my parents.	☐	☐
D	8. My folks usually have to ask me twice to do something.	☐	☐
D	9. I don't like my friends to make a fuss over me when I'm sick.	☐	☐
D	10. I seldom do "little extra things" at home just to please my parents.	☐	☐
D	11. I want my friends to leave me alone when I am sad.	☐	☐
D	12. I often disagree with my parents.	☐	☐
A	13. I never do anything at home until I find out if it's okay.	☐	☐
D	14. What others think of me does not bother me.	☐	☐
D	15. Committee work is a waste of time.	☐	☐
D	16. I often disagree with what the class decides to do.	☐	☐

KEY	ITEM	TRUE	UNTRUE
A	17. You should always check to see if your parents approve of your friends.	☐	☐
A	18. A good friend will never disagree with you.	☐	☐
D	19. I enjoy studying about things that my parents don't like.	☐	☐
A	20. I am apt to pass up something I want to do when others think that it isn't worth doing.	☐	☐
D	21. I owe my greatest obligation to my family.	☐	☐
D	22. I don't like to show my friends how much I like them.	☐	☐
D	23. I like to make my own decisions.	☐	☐
D	24. My parents make unreasonable rules.	☐	☐
D	25. Rules are made to be broken.	☐	☐
D	26. I would rather be left alone when I am in trouble.	☐	☐
D	27. I would never tell on a student who has done something wrong.	☐	☐
D	28. It annoys me when my friends tell me their troubles.	☐	☐
D	29. I dislike lending things to my friends.	☐	☐
D	30. I like people who ignore the feelings of others.	☐	☐
D	31. I don't care whether or not I take home a good report card.	☐	☐
D	32. I often seem to do things my parents don't like.	☐	☐
D	33. My parents treat me more like a child than a teen-ager.	☐	☐

KEY	ITEM	TRUE	UNTRUE
D	34. I don't care if other students say nice things about me.	☐	☐
D	35. I sometimes break rules if it makes my friends like me.	☐	☐
D	36. I like to criticize people who are in charge.	☐	☐
A	37. I try never to disobey my parents.	☐	☐
A	38. I feel better avoiding a fight than trying to have my own way.	☐	☐
A	39. I like to follow instructions and to do what is expected of me.	☐	☐
D	40. My family does not like what I intend to choose for my life work.	☐	☐
D	41. I often disagree with what the teacher says.	☐	☐
A	42. In class it is best to go along with the majority even when you disagree.	☐	☐
D	43. I don't care if others are interested in the same things I am.	☐	☐
D	44. It is not always best to have the majority make the decision.	☐	☐
D	45. The playground is a poor place to really get to know your friends.	☐	☐

Appendix H

Pretest Questionnaire

(This questionnaire has been reduced in size from the original by approximately 15%.)

Grade _____

Male _____ Female _____

Age _____

Birthdate: Day _____ Month _____ Year _____

On the next pages are several questions asking you to rate how familiar you are with some objects, shapes and ideas: There are no right or wrong answers. We want to find out <u>your</u> opinions, and they may be quite different from other people's.

Thank you for your help.

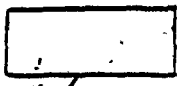
Circle the number that best describes how often you use each of the objects listed below. If it is something you use very often, circle 1. If you use it often, but not very often, circle 2. If you use it occasionally, circle 3 and if you never or almost never use it, circle 4.

	I use this			
	very often	often	once in a while	never or almost never
book	1	2	3	4
brick	1	2	3	4
pencil	1	2	3	4
paper clip	1	2	3	4
cardboard box	1	2	3	4

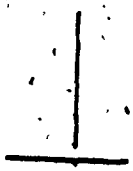
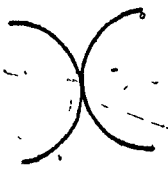
The situations described below are not very likely to come about, but you probably have thought about what would happen if some of them came true. Circle the number that best describes how often you have thought about each idea.

	I have thought about this		
WHAT WOULD HAPPEN IF:	a few times	once or twice	never
Children were in charge of schools instead of teachers.	1	2	3
A great fog fell over the earth and all you could see were people's feet.	1	2	3
You won a million dollars.	1	2	3
Clouds had strings attached to them that could be used to pull them down to earth.	1	2	3
People didn't need food but could take a pill a day instead of eating.	1	2	3

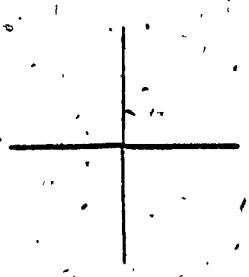
How often do you see each of these shapes, or something that has the shape as a part of it? For example, might be a rectangle in your math book, but is also the shape of a pound of butter, or a book. You probably see it very often.



I see this shape.

	very often	often	once in a while	never or hardly ever
	1	2	3	4
	1	2	3	4
		2	3	4
	1	2	3	4

I see this shape

	very often	often	once in a while	never or hardly ever
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4

APPENDIX I

Tables of Intercorrelations among Measures

Intercorrelations Among Cognitive Measures

		2	3	4	5	6
			Males			
1	IQ	-.11 (140)	.07 (140)	-.22 (140)	.02 (140)	-.04 (140)
2	Familiar	-	.68 (151)	.35 (151)	.91 (151)	.08 (151)
3	Unfamiliar		-	-.44 (151)	.92 (151)	-.07 (151)
4	Special-ization			-	-.06 (151)	.19 (151)
5	Total Score				-	.01 (151)
6	Balance					-
			Females			
1	IQ	.18 (91)	.24 (91)	-.08 (91)	.23 (91)	.01 (91)
2	Familiar Scores	-	.68 (92)	.38 (92)	.91 (92)	.38 (92)
3	Unfamiliar Scores		-	-.42 (92)	.92 (92)	.21 (92)
4	Special-ization			-	-.03 (92)	.20 (92)
5	Total Scores					.32 (92)
6	Balance					-

Note. Numbers in brackets are Ns.

Intercorrelations Among Personality Measures

		1	2	3
	Males			
1	Affection	-	.62 (107)	.40 (103)
2	Inclusion		-	.14 (102)
3	Dependence Proneness			-
	Females			
1	Affection	-	.69 (75)	.25 (74)
2	Inclusion		-	.19 (74)
3	Dependence Proneness			-

Note. Numbers in brackets are Ns.

Intercorrelations Between Cognitive Measures and Personality Measures

Cognitive Measures	Personality Measures: Affection	Inclusion	Dependence Proneness
Males			
IQ	-.18 (108)	-.25 (107)	.07 (112)
Familiar Scores	.10 (108)	.19 (107)	-.18 (120)
Unfamiliar Scores	.13 (108)	.18 (107)	-.04 (120)
Specialization	-.04 (108)	.01 (107)	-.20 (120)
Total Scores	.13 (108)	.20 (107)	.12 (120)
Balance	-.12 (108)	-.13 (107)	-.06 (120)

Continued...

Intercorrelations Between Cognitive Measures and Personality Measures (Continued)

Cognitive Measures	Personality Measures		
	Affection	Inclusion	Dependence Proneness
	Females		
IQ	-.21 (75)	.05 (75)	-.12 (79)
Familiar Scores	.17 (75)	.29 (75)	.02 (80)
Unfamiliar Scores	.10 (75)	.11 (75)	-.04 (80)
Specialization	.09 (75)	.24 (75)	.07 (80)
Total Scores	.14 (75)	.21 (75)	-.01 (80)
Balance	.23 (75)	.25 (75)	.02 (80)

Note. Numbers in brackets are Ns.