Educational Encouragement by Parents: Its Relationship to Precocity and Gender

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Abstract

Family involvement and encouragement have significant impact on the eventual display of talent. In the display of mathematical talent, there are large gender differences (Benbow, 1988). Can differences in family encouragement given to gifted females and males help explain this gender gap? The present study addressed that question. It was an investigation into: (1) parental support and encouragement of quantitative and verbal pursuits for extremely mathematically or verbally talented students; (2) the relation of such behaviors to talent development and gender differences, and (3) possible differences in the process for modestly versus extremely gifted students. No major differences were found between parents of extremely precocious children and of modestly gifted children, except a greater paternal involvement for the extremely precocious. Our results did indicate that parents differentiate support as a function of child's talent domain but *not* as a function of gender. Parents' behaviors were somewhat stereotypical; fathers were more involved in quantitative areas, and mothers tended to be viewed as the primary source of encouragement in verbal areas. It was concluded that the stereotyped behaviors of parents may negatively influence subsequent achievement of gifted females in math/science.

Albert and Runco (1986), Bloom (1985), Feldman (1986), Fowler (1981), and many other investigators have found that the family environment is an important influence on the eventual display of talent by a child. Specifically, the family focuses and mobilizes the individual and the surrounding environment. Moreover, Bloom (1985), investigating the development of extraordinary achievement, found that parents often recognized a child's talent early and then nurtured and encouraged that child's subsequent hard work. This study was designed to investigate if parental encouragement also relates to development of extreme precocity in two domains, verbal and mathematical, and if differences in such encouragement can help explain the gender gap in mathematical precocity.

Although gender differences in mathematical ability and achievement were reported consistently for several decades, they now appear to be diminishing among the average-ability population at a rate "faster than the gene can travel" (Rosenthal and Rubin, 1982, p. 711; see also Feingold, 1988). Gender differences have remained unchanged, however, among intellectually talented students (Benbow, 1988; Feingold, 1988). These differences are still considered large and increase with degree of precocity (Benbow, 1988; Benbow & Stanley, 1980, 1981, 1983). Specifically, gender differences in mathematical reasoning ability are the largest among the most precocious.

Most individuals would prefer an environmental explanation for this difference, and, as reviewed by Meece et al. (1982) and reported in a volume edited by Chipman, Brush, and Wilson (1985), the following classes of environmental hypotheses have been proposed: (1) females have lower liking for mathematics than do males; (2) females feel that mathematics is less useful to future career goals than do males; (3)females have less confidence in their mathematical ability than do males; (4) females and males sex-type mathematics as a masculine discipline, thereby making females less motivated to achieve in mathematics; and (5) significant others, such as parents and teachers, have different expectations for males' and females' mathematical achievement, and they encourage males more than females to achieve in mathematics. Although these explanations have been tested primarily with average-ability samples, Eccles (1985) used such findings to further our understanding of gender differences among the gifted. In addition, they partially form the basis of the insightful work on the special needs of gifted females by Callahan

Putting the Research to Use

Parents of intellectually talented, young adolescents do not report providing differential encouragement to male versus female children. Moreover, the children themselves did not report differences in encouragement on the basis of sex. Rather, parents appeared to respond to and nurture their child's domain of talent. Thus, sex stereotyping was not overt. Yet it was implied by the parents' behaviors. Fathers were more involved in quantitative areas, while mothers tended to be viewed as the primary source of encouragement in verbal areas. These findings have important implications for parents and professionals since "actions speak louder than words." Behaviors may communicate messages to gifted females in ways not intended. Sex stereotyped messages may hinder the development of exceptional mathematical ability into adult achievement in mathematics or science.

(1980), Hollinger and Fleming (1988), Kerr (1985), and Reis (1987).

This study focused on the hypothesis that differential encouragement given to girls and boys may contribute to the formation of gender differences in mathematical precocity. Previous investigations have found indications that both parents differentially encourage their sons and daughters in mathematics and that fathers tend to emphasize or to be more involved in their children's mathematical activities than mothers (e.g., Fox, 1977; Parsons, 1983). Either or both of these patterns could result in a greater emphasis on mathematics for boys than for girls and hence gender differences in aptitude.

It is unknown if these results obtained for average-ability students can be extrapolated to help explain gender differences in mathematical precocity. Indeed, the attempts since 1972 by the Study of Mathematically Precocious Youth (SMPY) to identify environmental explanations of this gender difference generally have been disappointing (Benbow, 1988). The present study, which investigates aspects of parental support and encouragement given to precocious students, represents another attempt to explain (at least in part) the gender difference in mathematical precocity using only environmental factors. We also were interested to discover if support provided by parents differed as a function of child's talent domain and degree of precocity.

Methods[1]

Subjects

Using the College Board's Scholastic Aptitude Test (SAT) as a screening device, two groups at Johns Hopkins have tested, in their annual talent searches, several hundred thousand students. Students under the age of 13 and in the top 3% nationally on achievement measures were screened: from 1972 through 1979 by SMPY and from 1980 onward by the Center for the Advancement of Academically Talented Youth (CTY).[2] The SAT is designed to measure the mathematical and verbal reasoning abilities of high school students (Donlon 1984). For junior-high school students, however, the test functions more as a measure of reasoning ability than it does for 11th and 12th graders (Stanley & Benbow, 1986).

Among these talented youth was a subgroup of exceptionally talented students (identified from November 1980 through October 1983): 268 boys and 23 girls who before age 13 scored at least 700 on the SAT Mathematics section (700M group) and 98 boys and 67 girls those ages whose scores were no lower than 630 on the SAT Verbal section (630V group). Students meeting either of the above criteria are estimated to represent the top 1 in 10,000 of their age group. At the time of the study, the average age for this group was 13.7 years and did not differ by sex. These students have been described in detail by Stanley (1988).

For this study, students were classified into four groups: those, by sex, who qualified on the mathematics criterion (700M's) and those, by sex, who met the verbal criterion (630V's). Within this study, there were 35 700M females[3], 173 700M males, 48 630V females, and 44 630V males. Those 48 who had scored at least 700M and also at least 630V were excluded from all analyses due to the fact that they met criteria for both groups. This study was designed to assess differences between mathematical and verbal precocity.

To see if results differed by degree of precocity, a group of modestly gifted students was also studied. Selected from participants in CTY's 1983 talent search, these students, 87 males and 118 females, combined SAT scores (SAT-M + SAT-V) were no greater than 540, approximately a chance score. Because the lowest combined SAT score for a 700M/630V student was 950, the ability level of these students is substantially lower. Since only the top 3% can participate in talent searches, they can be described as modestly gifted. They participated in this study when they were 14 to 15 years old.

Procedure

Each student meeting the criteria for one of these groups was sent two questionnaires, one to be completed by the student and one by the parents. For this study only the parent questionnaire was utilized.

Of the 440 700M/630V parent questionnaires mailed, 340 were returned, a response rate of 78%. Results from discriminant function analyses indicated no response bias on the basis of child's talent domain, gender, or SAT scores. Of the 205 questionnaires mailed to parents of the modestly gifted, 96 (47%) were returned. The response rate was somewhat lower for modestly gifted parents than for the 700M/630V parents, presumably because they had not interacted much with SMPY's staff and the response time given was shorter. Once again, a linear discriminant function analysis between respondents and nonrespondents, using SAT scores and sex of the modestly gifted as variables, was not significant.

A set of questions in the lengthy questionnaire investigated which parent was the primary source of encouragement of enjoyment, study, and acceleration of learning in various subjects (see appendix). To obtain a more reliable indicator of attitudes and behaviors than any one question alone, these questions were combined into scales: those measuring encouragement in quantitative (math and science) and verbal areas. The values for these scales were divided by the number of subject areas combined to create them. The result was that all scales ranged from 0 (primary source of encouragement was not once associated with that parent in that area)

[1]The methodology of this study is an adaptation of Raymond and Benbow (1986).

[2]Three other universities also conduct talent searches: Duke, Northwestern, and University of Denver.

[3]Because there are so few 700M females, we continued to add them to our group after October 1983. Thus, although there were only 23 700M females in the original group, there were 35 when analyses were performed; this number will continue to increase.

to 1 (that parent was always reported to be the primary source of encouragement in that area). The scales could thus be used to compare the relative involvement of mothers and fathers in quantitative and verbal areas. The questions, however, do not address the amount of encouragement given by any parent, except when no encouragement was reported to be given by either parent. This is a limitation.

The scales are identical for the modestly gifted and for the 700M's/630V's, with only one variation. Due to the lower ability level of the modestly gifted students, acceleration would not be as appropriate an educational option for them as it would be for 700M's/630V's. The acceleration questions were thus omitted from the calculatons for the modestly gifted's scales.

For 700M's/630V's the correlations between relative involvement in their children's verbal and quantitative pursuits were .32 for mothers and .48 for fathers. For the modestly gifted, the correlations were .59 for mothers and .67 for fathers. The differences between the 700M/630V and the modestly gifted's *r*'s were significant ($p < .01$). These results seem to indicate that the modestly gifted's parents were less likely than 700M/630V parents to differentiate support by subject area. Instead, they were more likely to be the primary source of encouragment to their child in all areas or not at all.

Internal consistency reliabilities were also computed for all the maternal and paternal quantitative and verbal support scales computed in this study. The Cronbach's alphas were all greater than .80. Thus, the scales do appear to measure two somewhat different aspects of support or encouragement and are quite reliable.

We investigated differences between mothers' and fathers' encouragement behaviors and differences between the verbally and mathematically talented by sex. Thus, several comparisons were performed on each encouragement variable: (1) mathematically talented child versus verbally talented child, by sex, (2) mothers versus fathers, (3) verbal versus quantitative encouragement of mothers, (4) verbal versus quantitative encouragement of fathers, (5) verbal versus quantitative encouragement for mathematically talented students, and (6) verbal versus quantitative encouragement for verbally talented students. For the modestly gifted only contrasts 2, 3, and 4 and between sex were computed.

Analysis of variance (ANOVA) was the major mode of data analysis. Because of the unequal N's in the subgroups, the ANOVAs were nonorthogonal. It was decided to retain a nonorthogonal design (because the larger the N the greater the statistical power) and handle its complications with the four-step procedure outlined by Applebaum and Cramer (1974). Effect sizes (Cohen, 1977) were also computed to evaluate the magnitude of a significant difference. These effect sizes (*d*) were classified by Cohen as being small if $d \geq .2$, medium if $d \geq .5$, and large if $d \geq .8$. In addition, due to unequal N's in the four subgroups of 700M/630V's, Pearson correlation coefficients and effect sizes for the total group were computed in such a manner as to avoid disproportionate impact of any one subgroup (see Raymond & Benbow, 1986).

Results

Parental Encouragement by Talent Domain and Gender

Descriptive data for the encouragement variables are in Table 1. ANOVA's were performed, separately, on each of the nine variables for the extremely precocious, with gender and talent domain (i.e., 630V *vs* 700M) as factors. For the relative involvement of mothers and fathers and the total parental encouragement in quantitative subjects, there were no significant effects for gender, talent domain, or their interaction.

Within the modestly gifted group, *t*-tests showed no significant differences between males and females for paternal and total parental quantitative involvement. Comparison group mothers were, however, more frequently reported as the primary source of quantitative encouragement if their child was male rather than female ($t = 2.40$, $p < .05$; $d = .55$).

For maternal, paternal, and overall involvement in the verbal subjects, ANOVA's on 700M/630V parental responses showed statistically significant differences for talent domain ($F = 17.10$, $p < .001$; $F = 17.10$, $p < .001$; $F = 22.80$, $p < .001$) but not for gender or the interaction between talent domain and gender. Both parents were more often reported as a primary source of involvement in the verbal subject areas if the child was verbally rather than mathematically talented. Within the modestly gifted group, *t*-tests showed no statistically significant differences between parents of males and females on any of these variables.

For total paternal and total parental involvement, ANOVA's revealed statistically significant talent domain effects for the extremely precocious ($F = 4.36$, $p < .05$; $F = 3.96$, $p < .05$). Fathers and both parents combined were more frequently involved in their child's education if the child was verbally talented rather than mathematically talented (see Table 1). There were no significant differences, however, for total maternal involvement. Similarly, *t*-tests showed no significant differences on any of these variables between modestly gifted males' and females' parents.

In summary, parents did not report more frequently being a primary source of encouragement in quantitative areas if their child was mathematically talented rather than verbally talented. In contrast, support for verbal activities was more frequently given if the child was verbally rather than mathematically talented. Greater parental involvement with verbally than with mathematically talented youth was also found. Except in one instance responses did not differ as a function of gender.

Maternal vs. Paternal Support

In separate analyses, we contrasted maternal and paternal involvement in the two subject areas and overall (see Table 2). For the modestly gifted, mothers were more often cited

Table 1

Mean Values by Group and Sex for Measures of Parental Self-Reports of Involvement in Quantitative and Verbal Areas

Involvement	700M		630V		Modestly Gifted		
	Male	Female	Male	Female	Male	Female	*t*
Mother's Quant.							
Mean	.74	.77	.70	.68	.85	.70	2.40[a]
s.d.	.30	.28	.33	.34	.17	.37	
Father's Quant.							
Mean	.87	.79	.82	.78	.75	.75	n.s.
s.d.	.21	.31	.26	.25	.32	.31	
Mother's Verbal							
Mean	.62	.63	.75	.79	.72	.71	n.s.
s.d.	.24	.23	.20	.24	.24	.27	
Father's Verbal							
Mean	.51	.51	.66	.70	.55	.53	n.s.
s.d.	.28	.31	.24	.30	.32	.33	
Total for Mothers							
Mean	.68	.70	.72	.73	.79	.71	n.s.
s.d.	.23	.20	.21	.24	.17	.30	
Total for Fathers							
Mean	.69	.65	.74	.74	.65	.64	n.s.
s.d.	.20	.26	.22	.24	.30	.29	
Total Quant.							
Mean	.80	.78	.76	.73	.80	.73	n.s.
s.d	.20	.20	.23	.25	.21	.26	
Total Verbal							
Mean	.57	.57	.70	.74	.63	.62	n.s.
s.d.	.22	.24	.19	.25	.24	23	
Total for Parents							
Mean	.60	.68	.73	.74	.72	.67	n.s.
s.d.	.18	.18	.19	.22	.20	.23	

[a] $p \leq .05$

as the primary source of support for their child's education than were fathers ($t = 2.76$, $p < .01$; $d = .37$). For the parents of the extremely talented, however, there were no statistically significant differences between mother's and father's overall involvement for any of the four groups.

In the quantitative area, there was no difference between mother's and father's involvement within the modestly gifted group. Within the 700M/630V group, however, fathers were more often cited as a primary source of support for quantitative pursuits than were mothers ($p < .05$; $d = .33$).

In the verbal subjects, there was an apparently greater maternal than paternal involvement for both 700M/630V's and the modestly gifted ($p < .05$, $d = .40$—for the extremely precocious; $p < .001$, $d = .62$—for the comparison group).

Although no overall differences between parents of the extremely precocious were found, the trend is that mothers were more often cited as the primary source of support for verbal activities than were fathers, while fathers were more often supportive of their children's mathematical pursuits. This indicates simply a differential emphasis for mothers and fathers. In contrast, mothers of modestly gifted were cited as being more involved than their fathers. Again no statistically significant gender differences were found.

Quantitative vs. Verbal Support

Finally, we contrasted quantitative versus verbal involvement of each parent and that given to each group of students (see Table 2). First, we tested the frequency of each parent's quantitative versus verbal involvement. For the 630V's, mothers were more often cited as a primary source of sup-

port in verbal than in quantitative areas, but this difference was significant only for 630V females ($t = 2.01$, $p < .05$; $d = .35$). For the 700M's and the modestly gifted, however, mothers were significantly more often the primary source of support for quantitative than verbal pursuits ($p < .05$ for the 700M's and the modestly gifted; $d = .49$ and $d = .21$, respectively). In contrast, fathers of both the extremely precocious students and the modestly gifted were significantly more supportive of quantitative than verbal pursuits ($p < .05$, $d = .82$—for extremely precocious; $p < .001$, $d = .67$—for modestly gifted).

In summary, it appears that fathers gave their children more support in quantitative than in verbal areas, especially if the child demonstrated mathematical talent. Mothers also were more involved quantitatively unless the child was primarily verbally talented.

Relationship with Student SAT Scores

The nine parental support variables were correlated, separately for the extremely precocious and for the modestly gifted, with student SAT scores. None of these correlations were significantly different from zero at the .05 level, using the Bonferroni procedure (Larzelere & Mulaik, 1977).

Discussion

Family involvement and encouragement have significant impact on the eventual display of talent (e.g., Bloom, 1985). There are, however, gender differences in mathematical talent (Benbow, 1988). Are these differences related to differential family encouragement given to gifted females and males? Do differences in family encouragment explain, at least in part, the gender gap in mathematical precocity? The present study addressed those questions.

Table 2

Mean Values for Mother's and Father's Involvement in Quantitative and Verbal Areas

Involvement	Extremely Precocious			Modestly Gifted		
	Mean	SD	*t*-value-range[1]	Mean	SD	*t*-value
Mother's Quant.	.73	.31		.77	.30	
vs.			.32 to 4.84[c]			.49
Father's Quant.	.84	.24		.75	.32	
Mother's Verbal	.67	.24		.72	.25	
vs.			2.54[b] to 4.90[c]			4.71[c]
Father's Verbal	.56	.29		.54	.32	
Mother's Quant.	.73	.31		.77	.30	
vs.			-2.01[a] to 4.85[c]			2.06[a]
Mother's Verbal	.67	.24		.72	.25	
Father's Quant.	.84	.24		.75	.32	
vs.			2.07[a] to 15.24[c]			7.55[c]
Father's Verbal	.56	.29		.54	.32	
Total[2] Quant.	.78	.21		.76	.24	
vs.			-.22 to 12.85[c]			6.31[c]
Total[2] Verbal	.62	.24		.63	.23	
Total[3] for Mothers	.70	.23		.74	.25	
vs.			-.50 to .91			2.76[b]
Total[3] for Fathers	.70	.22		.64	.29	

[a] $p \leq .05$ [b] $p \leq .01$ [c] $p \leq .001$

[1] Comparisons were made within each of the four groups of extremely precocious students, resulting in four *t*-values.

[2] Total, in this case, refers to Mother's + Father's

[3] Total, in this case, refers to Quantitative + Verbal

First, we investigated encouragement parents gave to their children in quantitative and in verbal areas. Parents of the extremely precocious appeared to differentiate their support as a function of child's talent domain, and parents of modestly gifted students appeared either to give support in all areas or not to give support at all.[4] Interestingly, no significant gender differences were found for either the extremely precocious or the modestly gifted.

We also studied whether there were differences in the support or encouragement behaviors of mothers and fathers. Overall, there were no differences between mothers and fathers of extremely precocious students. The majority of parents reported that they both were the primary source of support. For the modestly gifted, however, mothers tended to be more involved than were fathers. Yet within subject areas differences appeared between parents of both groups (i.e., extemely and modestly gifted). Fathers were somewhat more likely to be cited as the primary sources of quantitative support or encouragement than were mothers. The reverse was found in the verbal areas, where differences were larger. Moreover, when comparing mothers' verbal versus quantitative encouragement and fathers' verbal versus quantitative encouragement, a new dimension was revealed. Mothers were more frequently involved in quantitative compared to verbal areas unless the child was verbally talented. Fathers consistently were more involved in quantitative areas, an effect that was enhanced if the child was extremely mathematically talented. Findings for the modestly gifted were consistent with those of the extremely precocious. Thus, degree of precocity does not relate differentially to family encouragment behaviors. Yet it appears that fathers were more involved in their child's education if the child was extremely precocious rather than modestly gifted.

When parental self-reports of encouragment behaviors were correlated with their child's SAT scores, the *r*'s did not differ significantly from zero. Therefore, it does not appear that parents' educational encouragement, as measured in this study, is related to child's ability nor, therefore, to gender differences in mathematical aptitude found among 13-year-olds.

Throughout this study we failed to find significant gender differences on socialization variables for either the extremely or modestly gifted. Parents did not report that they acted differently if their child was male rather than female,[5] findings which are inconsistent with those of Fox (1977), Fox and Richmond (1979), and Parsons, Adler and Kaczala (1982). Instead it appeared in this study that parents were responsive to their child's greater talent area.

Although it did not appear that the socialization behaviors studied here were related to gender differences in mathematical talent at age 13, the parents, but especially fathers, themselves acted in a stereotypical manner. Fathers were more involved in quantitative areas, and mothers in verbal areas. Through role modeling or establishing an association of mathematics and science with fathers and verbal areas with mothers, talented males and females may develop a conception of quantitative pursuits as more appropriate for males than females. Such a schema may influence later achievement in mathematics and science by females. For females, perception of mathematics as a male domain is linked to lower confidence in mathematical ability, mathematical performance, and achievement motivation in quantitative areas (e.g., Fennema & Sherman, 1977). This may help explain why many mathematically talented females abandon math/science careers in college (Benbow & Arjmand, in press). This interpretation of our findings is also consistent with Eccles' (1985) model for explaining the lesser achievements of gifted women. Eccles proposed that an individual's gender role beliefs and schema affect achievement related behaviors through their impact on expectations and subjective valuing of certain educational, occupational, and family activities. We shall continue to study this possibility as we follow the progress of these students throughout their adult lives.

Encouragement aspects of socialization were studied previously (Raymond & Benbow, 1986), using the talented youths' perceptions of their parents' behaviors. The pattern of results in that study indicated that parental encouragement behaviors and sex-typing did not relate to gender differences in mathematical reasoning ability in seventh grade (Raymond & Benbow, 1986). In the present investigation, parental ratings of their own behavior were analyzed. Did findings differ? No. Both sets of data lead to similar conclusions.

A limitation with this study is that the numbers in some of the groups were small. This is an unavoidable problem with research on such a highly gifted population, which is by definition small. In addition, use of standardized and more comprehensive scales would have been preferable. Due to the length and comprehensive nature of the entire questionnaire, use of scales would have decreased substantially the probability of response. Moreover, the questions used in this study assessed only support versus nonsupport, not degree of support. This may have affected the findings by "washing" out differences that existed. Finally, the data are self-report. We do not know if our data reflect what actually happens in these families. The fact that results from this study with parent responses and from Raymond and Benbow (1986) with children's responses were consistent lends validity and credibility to our findings. Yet observing actual parental behaviors and/or assessing degree of encouragement are needed directions for future research.

We conclude that for intellectually talented students in their early teens, parents did not report providing differential encouragement to males and females. Rather, parents appeared to repond to and nurture their child's domain of talent, as Bloom (1985) and others have found. Fathers were more involved in quantitative areas, while mothers tended to be viewed as the primary source of encouragement in verbal

[4]This trend of differential encouragement was not statistically significant for mathematically talented students, however.

[5]One of the multiple gender differences tested was significant, probably due to chance.

areas. Such behaviors could result in their children viewing mathematics and the sciences as male domains. Thus, we hypothesize that the parental socialization patterns unraveled by this study may influence later gender differences in achievement in mathematics and science, but probably cannot account to a significant extent for the current gender gap in mathematical precocity. These findings may have important implications for parents and professionals: behaviors can communicate messages to gifted females in subtle ways and in ways not intended. Such messages may affect gifted females' achievement motivation. It is important to remember, however, that in a study of this nature, cause and effect cannot be clearly separated.

Appendix

For each of the items below, please indicate your feelings and behaviors relative to your spouse. Please darken the oval in the most appropriate column.

Parent completing question 38: _____ Father _____ Mother

	I more than spouse	Spouse more than I	Both I & spouse	Neither I nor spouse
Encourages child's enjoyment of:				
mathematics[1]	0	0	0	0
science[1]	0	0	0	0
literature[2]	0	0	0	0
history & social science[2]	0	0	0	0
writing[2]	0	0	0	0
foreign languages[2]	0	0	0	0
Encourages child's study of:				
mathematics[1]	0	0	0	0
science[1]	0	0	0	0
literature[2]	0	0	0	0
history & social science[2]	0	0	0	0
writing[2]	0	0	0	0
foreign languages[2]	0	0	0	0
Encourages child's interest in a career in:				
mathematics[1]	0	0	0	0
science[1]	0	0	0	0
literature[2]	0	0	0	0
history & social science[2]	0	0	0	0
writing[2]	0	0	0	0
foreign languages[2]	0	0	0	0
Favors child's acceleration in the study of:				
mathematics[1]	0	0	0	0
science[1]	0	0	0	0
literature[2]	0	0	0	0
history & social science[2]	0	0	0	0
writing[2]	0	0	0	0
foreign languages[2]	0	0	0	0

[1]Quantitative subjects—responses from these items were used to compile scores for quantitative encouragement.

[2]Verbal subjects—responses from these items were used to compile scores for verbal encouragement.

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