
Revisiting the Birth Order–Creativity Connection: The Role of Sibling Constellation

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ABSTRACT: This study examined the possibility that sibling demographic differences (i.e., age and sex differences between the focal individual and his or her siblings) and sibsize (i.e., number of children in the focal individual's family) moderate the relation between an individual's birth order and his or her creativity. A total of 359 undergraduates described their family background and then were assigned to small teams to work on 8 problem-solving tasks. Each individual's contributions to the tasks were evaluated for creativity by his or her teammates. Results showed that firstborns with large sibling groups were more creative when they had relatively more siblings close in age or of the opposite sex. We discuss the implications of the results for future research on birth order and creativity.

Today, the importance of creativity in contributing to individual growth and achievement is well-recognized and continues to inspire researchers to identify the conditions and processes that guide its development (Runco, 1996). Among the many variables suspected to affect the development of creativity, researchers have devoted substantial attention to structural variables such as birth order. Following in the footsteps of Galton who first speculated about the special eminence of firstborns in 1874, many researchers over the past century have focused their attention on the question of whether firstborn status facilitates or inhibits creativity (e.g., Eisenman, 1987; Gaynor & Runco, 1992; Sulloway, 1996).

Unfortunately, despite the considerable effort that has been devoted to answering this question, there is little agreement among scholars about the effects of birth order on creativity. Although some authors suggest that firstborns should be less creative than

laterborns because firstborns tend to be more conservative, conventional, and conforming (e.g., Sulloway, 1996), others argue that the overrepresentation of firstborns among eminent individuals indicates their higher creativity (e.g., Altus, 1966; Schachter, 1963). Previous empirical work supports both positions with some studies showing that firstborns are less creative than laterborns (e.g., Eisenman, 1964; Seay, 1985; Staffieri, 1970) and some providing evidence that firstborns are more creative than laterborns (e.g., Eisenman, 1987; Eisenman & Schussel, 1970; Lichtenwalner & Maxwell, 1969; Schubert, Wagner, & Schubert, 1977). Other studies support neither position obtaining no significant differences in creativity between first- and laterborns (e.g., Albaum, 1977; Cicirelli, 1967; Datta, 1968; Wilks & Thompson, 1979).

The goal of this study was to address these inconsistent findings by examining the possibility that sibling constellation variables such as differences in age and sex between firstborns and their siblings, and the number of siblings in the family, moderate the effects of birth order on creativity. Specifically, we hypothesized that firstborns would exhibit higher creativity as the age differences between them and their siblings decrease or as the sex differences between them and their siblings increase. In other words, we expected that firstborns would be relatively more creative when they grew up with siblings close in age or of the opposite sex. Moreover, we expected that number of siblings

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would further qualify these moderating effects, such that firstborns with larger sibling groups would exhibit the highest creativity when they had more siblings close in age or of the opposite sex.

The idea that age and sex differences between siblings, along with the number of siblings, may play an important role in explaining birth order effects is not new (e.g., Gaynor & Runco, 1992; Runco & Bahleda, 1986; Sulloway, 1996). For example, Sulloway (1996) highlighted that both age and sex differences may qualify the effects of birth order on creativity. And Runco and Bahleda (1986) explored the possibility that sibsize would moderate the relation between birth order and creativity. However, no study has examined all of these potential moderators simultaneously. Moreover, little is known about how these variables combine with one another to jointly shape the effects of birth order on creativity. This study extends previous research by considering sibling age and sex differences, as well as sibsize, in jointly moderating the effects of birth order on creativity. Additionally, in contrast to previous investigations that focused on adjacent siblings only (e.g., Datta, 1968; Gaynor & Runco, 1992), our study is the first to assess age and sex differences between a focal individual and all siblings in his or her sibling group.

In the pages to follow, we first discuss separately the moderating role of sibling age and sex differences and then argue that sibsize combines with both of these variables to jointly affect the birth order–creativity relation. Next, we describe a study that tests these arguments in a work team context. Consistent with previous theory and research, we define creativity as the extent to which teammates judge an individual's contributions to the team product as novel and potentially useful (Amabile, 1996; Taggar, 2002).

Birth Order, Sibling Age Differences, and Creativity

Several earlier studies suggest that sibling age differences may moderate the effects of birth order on creativity (e.g., Datta, 1968; Gaynor & Runco, 1992; Sulloway, 1996). For example, studying potential scientific creativity in a sample 536 young male scientists, Datta found that the creativity ratings of scientists who were distant younger brothers were significantly lower than those of participants who were distant older

brothers, close older brothers, and close younger brothers. More recently, Gaynor and Runco (1992) examined the extent to which age differences between individuals and their adjacent siblings moderate the birth order–creativity relation. Their study of preadolescent children revealed a significant interaction between birth order and age differences with middle children with a large age interval receiving relatively higher parental ratings of creativity.

Why may sibling age differences affect the relation between birth order and creativity? Previous research suggests that firstborn children occupy a special position in the age hierarchy of siblings (Sulloway, 1996). Firstborns are not only frequently expected by their parents to act as a surrogate parent toward their younger siblings but also tend to voluntarily assume such a role to retain parental favor (Rosenberg, 1982; Sulloway, 1996). The pressures associated with serving as a parental surrogate often result in the early adoption of adult behaviors, inhibiting important aspects of the childhood experience and promoting early and accelerated development of conscience, responsibility, and maturity (Rosenberg, 1982). Although this premature resolution of childhood may result in the development of greater intellectual focus, ambition, and achievement often observed in firstborns (e.g., Adams & Phillips, 1972; Belmont & Marolla, 1973; Sulloway, 1996), it may also suppress childhood play, which is frequently associated with the development of cognitive and affective processes essential to creativity (Russ, 1993).

The extent to which oldest children are burdened with the responsibility of disciplining their younger siblings, however, may depend on the age differences between them. The sooner firstborns are joined by younger siblings, the less likely it is that they will be expected to serve as parental surrogates. Thus, when the age intervals separating eldest from younger siblings are relatively small, firstborns' creativity should suffer relatively little from the inhibiting influences associated with the early adoption of adult behaviors. As age differences increase, firstborns may be more likely to be expected to function as sibling caretakers, ultimately resulting in premature resolution of childhood and, consequently, constrained creativity.

On the basis of these arguments, we propose:

H1: Sibling age differences will moderate the relation between birth order and creativity such

that firstborns will exhibit lower creativity as the age differences between them and their siblings increase.

Birth Order, Sibling Sex Differences, and Creativity

Another sibling constellation variable that may help address the question of whether firstborn status facilitates or inhibits creativity is sibling sex differences (Cicirelli, 1967; Sulloway, 1999). Specifically, the extent to which firstborns are creative may depend on whether they grow up with same-sex or opposite-sex siblings. Although few studies have directly tested this idea, previous research has investigated the possibility that this sibling constellation variable influences individuals' gender role development (Wagner, Pfeffer, & O'Reilly, 1993), which, in turn, might influence the relation between birth order and creativity.

Previous research suggests that growing up with opposite-sex siblings seems to promote psychological androgyny—the extent to which individuals exhibit both masculine and feminine attitudes, interests, and abilities (Schubert, Wagner, & Schubert, 1992; Sutton-Smith, 1982; Wagner, Schubert, & Schubert, 1993). For example, Koch (1956) found that children with opposite-sex siblings tended to have preferences resembling those of the opposite sex. Similarly, using Koch's sample, Brim (1958) found that girls with a younger brother displayed more masculine traits than girls with a younger sister. Because holding characteristics of the opposite sex generally represents extra acquisitions, not substitutions for feminine traits for girls or masculine traits for boys (Brim, 1958; Wagner et al., 1993), children displaying increased psychological androgyny due to having opposite-sex siblings should exhibit a more diverse set of attitudes, interests, and abilities likely resulting in enhanced creativity. Supporting this logic, Koch (1956) showed that older boys and girls with an opposite-sex sibling had more interests and were more curious than those with a same-sex sibling. Further, Eisenman and Foxman (1970) found that the number of sisters was positively correlated with creative problem solving for male participants.

Additional support for the notion that individuals exhibiting both masculine and feminine traits tend to

be more creative comes from research studying the link between psychological androgyny and creativity. For example, a study by Norlander, Erixon, and Archer (2000) showed that individuals in an androgynic group (i.e., high masculinity and high femininity) obtained higher creativity scores on a picture completion task and scored higher on creative attitude than individuals in other gender-role groups. Torrance (1963) found that creative boys exhibited more feminine characteristics than their peers and that creative girls were perceived as more masculine than other girls. Finally, Helson (1967) showed that a group of female mathematicians judged to be highly creative displayed both masculine and feminine traits.

In summary, previous research suggests that the presence of opposite-sex siblings is likely to promote psychological androgyny and, thereby, creativity (Schubert et al., 1992). However, the extent to which individuals' benefit from the creativity-stimulating qualities associated with having siblings of the opposite sex may depend on their position in the age hierarchy of siblings in the family. Firstborns tend to be described as more stereotypically masculine or feminine than laterborns (Patterson, 1980; Wagner et al., 1993)—characteristics frequently associated with relatively low levels of creativity (Norlander et al., 2000; Wagner et al., 1993). Thus, the presence of opposite-sex siblings might play an especially important role in boosting the creativity of firstborns by mitigating the stereotypically masculine or feminine gender role development.

On the basis of these arguments, we propose:

- H2: Sibling sex differences will moderate the relation between birth order and creativity such that firstborns will exhibit higher creativity as the sex differences between them and their siblings increase.

Birth Order, Sibling Age Differences, Sibling Sex Differences, Sibsize, and Creativity

Thus far we have argued that the relation between birth order and creativity is affected by both sibling age and sex differences. However, it is probable that these effects are amplified by another sibling constellation variable: sibsize. As noted earlier, increasing sibling age differences are likely to inhibit the cre-

ativity of firstborns because firstborns are often expected to assume the role of parental surrogate. However, parental surrogation may not only be a function of the size of the age intervals separating firstborns from their siblings but also a function of the number of siblings. Specifically, the negative consequences associated with assuming the role of a sibling caretaker may be more pronounced for firstborns with many substantially younger siblings than for firstborns with relatively few considerably younger siblings. When many substantially younger siblings are present, sibling caretaking should consume a greater part of firstborns' daily lives. As a consequence, premature resolution of childhood should be accelerated and intensified, ultimately resulting in reduced creativity.

Similarly, the moderating effect of sibling sex differences on the birth order–creativity relation should also be amplified by sibsize. Central to the hypothesis that sex differences enhance the creativity of firstborns is the argument that eldest children frequently grow up to be stereotypically masculine or feminine and that the androgynous influence of opposite-sex siblings mitigates these creativity-suppressing characteristics. It is likely that the creativity-enhancing effects associated with growing up with opposite-sex siblings are greater for firstborns having many siblings of the opposite sex than for those with few opposite-sex siblings. Under this circumstance, the adoption of attitudes, interests, and abilities of the opposite sex should be more likely. Thus, we expect firstborns with many siblings of the opposite sex to especially benefit from the creativity-enhancing effects associated with having opposite-sex siblings.

On the basis of these arguments, we propose:

- H3: Sibling age differences and sibsize will jointly moderate the relation between birth order and creativity such that firstborns with many siblings will exhibit lower creativity as the age differences between them and their siblings increase.
- H4: Sibling sex differences and sibsize will jointly moderate the relation between birth order and creativity such that firstborns with many siblings will exhibit higher creativity as the sex differences between them and their siblings increase.

Method

Research Setting and Participants

Participants were 359 undergraduate students from an introductory management course at a large mid-western university who were randomly assigned to small teams to work on eight problem-solving tasks across two sessions. Teams were composed of the same members in both sessions. The average age of participants was 20 years and 47% were women. All participants received extra credit toward their final grade in the course. Twenty-three of the participants had no siblings. Because our study explicitly focused on the effects of sibling constellation variables, we eliminated individuals with no siblings from substantive analyses, thus reducing the usable sample size to 336.

Procedure and Tasks

Before working on the tasks, participants completed a web-based survey assessing age, sex, parental education, birth order, sibling ages and sex, and sibsize. Participants then worked on two sets of tasks separated by a two-week interval. The first set of tasks consisted of five human resources-related problems (e.g., addressing employee theft); the second set consisted of three new product development problems (e.g., strategies for generating a failed kitchen product). Teams were asked to generate as many creative solutions as possible for each problem. They were given one hour to complete each set of tasks and were allowed to allocate as much time as needed to each problem, as long as all problems were completed in the designated order. Shortly after completing each set of tasks, participants individually completed a web-based survey in which they rated the creative contributions made by each of their teammates.

Measures

Birth order. This refers to the participant's position in the age hierarchy of siblings in his or her family. Because our interest in birth order was limited to the effects of firstborn status on creativity, we created a dummy variable differentiating between firstborn (1) and laterborn status (0). Out of the 336 participants with siblings, 163 were firstborns and 172 were

laterborns (one participant did not indicate his or her birth order status).

Sibling age differences. Previous studies investigating the effects of sibling spacing on creativity typically operationalized spacing as the age difference between the focal individual and his or her next oldest or youngest sibling (e.g., Datta, 1968; Gaynor & Runco, 1992). However, such measures are incomplete because age differences to nonadjacent siblings are disregarded. To capture age differences between the focal individual and all siblings in the sibling group (adjacent *and* nonadjacent), we used a Euclidean distance measure. Such measures are calculated based on comparisons between a focal individual and all other individuals in the social group and have been widely used to assess demographic differences in organizations (e.g., Flynn, Chatman, & Spataro, 2001; Wagner, Pfeffer, & O'Reilly, 1984). We calculated sibling age differences using the following formula:

$$[1/n\sum(x_i - x_j)^2]^{1/2}.$$

In this formula, x_i refers to the age of the participant (in years), x_j reflects the age of each sibling (in years), and n describes the number of siblings. The score increases in size as the age differences between participants and their siblings become larger. An inspection of the distribution of this variable revealed that it differed noticeably from a normal distribution. Consequently, we performed a loglinear transformation to normalize its distribution.

Sibling sex differences. Similar to investigations examining the consequences of sibling spacing, studies examining the effects of sex differences among siblings on individuals' creativity generally focused on the sex difference involving the next older or younger sibling (e.g., Datta, 1968). Thus, to capture sex differences between a focal individual and all his or her siblings, we again used the Euclidean distance measure described above with x_i now referring to each participant's sex (0 = male, 1 = female), x_j reflecting each participant's siblings' sex (0 = male, 1 = female), and n describing the number of siblings. Because sex is a dummy-coded variable, the difference scores range from zero to one. Similar to the estimates of age differences, the sex difference scores increase as the sex differences between participants and their siblings be-

come larger. For example, a male participant with one brother and one sister would receive a score of .71, whereas a male participant with two sisters would receive a score of 1.

Sibsize. This refers to the number of biological and nonbiological children in the sibling group excluding the self (ranging from one to nine siblings). Following previous research on sibsize and creativity (Gaynor & Runco, 1992), we normalized the distribution of this variable by recoding sibsize to range from one sibling to four or more siblings (only 12 of the 336 participants had more than four siblings).

Creativity. Each individual's contributions to the two sets of problem-solving tasks were evaluated for creativity by his or her teammates (Amabile, 1996; Taggar, 2002). Specifically, participants were instructed to judge both the number of creative solutions and the overall creativity of ideas made by each teammate using the following definition of creativity (Amabile, 1996; Shalley & Oldham, 1997): ideas that are both novel (i.e., different from those generated by others in the team) and potentially practical or useful (i.e., suitable for implementation into practice). After completing each set of tasks, each participant rated the creativity of his or her teammates using two items: "The overall creativity of the contributions made by your teammates to the project. That is, to what extent did each person make novel and practical suggestions to the solutions the team submitted?"; "The number of creative contributions each of your teammates made to the project. That is, how many novel and practical suggestions did each person make to the problem solutions the team submitted?" Scale anchors were 1 (*not at all creative*) to 7 (*extremely creative*) for the first item and 1 (*none*) to 7 (*all*) for the second item.

To derive an overall creativity score for each participant, we first averaged the ratings provided by participants' teammates across both sets of tasks. This was justified because the ratings for each item correlated significantly across the two sets of tasks (r s ranged from .36 to .47, all p s < .01). In a second step, we created scales by averaging the ratings made by participants' teammates across the two creativity items. Thus, for each teammate, we created a creativity score by averaging his or her responses to the two creativity items (all α s > .70). Next, we averaged the creativity indexes across teammates to create an overall creativity score

for each participant. Because aggregation across raters is only justified when there is substantial agreement among raters, we calculated estimates of within-group interrater reliability using the formula suggested by James, Demaree, and Wolf (1984). The average value for r_{WG} across all participants was 0.83 indicating an acceptable level of agreement and justifying aggregation of data across raters (Klein et al., 2000).

Control variables. We controlled for participants' age (years) and sex (0 = male, 1 = female) in all substantive analyses. In addition, previous research has stressed the importance of controlling for interfamilial differences such as parents' education when examining relations between birth order and various outcomes based on cross-sectional data (e.g., Rodgers, 2001). Thus, we also included a measure of parental education as a control variable in our analyses. The highest degree earned by either of the participants' parents or step-parents was measured on a scale that ranged from 1 (*grade school*) to 6 (*master's or higher*).

Results

Descriptive statistics and correlations among the variables are presented in Table 1. Only one of the relations between creativity and the demographic and sibling constellation measures was statistically significant. Sex was negatively related to creativity ($r = -.16$, $p < .01$), indicating that women were rated as less creative than men.

We hypothesized that the relation between birth order and creativity was moderated by sibling age and sex differences, as well as sibsize. Moderators are vari-

ables that affect the direction or strength of the relation between an independent and a dependent variable and are characterized statistically in terms of interactions (Baron & Kenny, 1986; Cohen, Cohen, West, & Aiken, 2003). To test the moderating effects of sibling age and sex differences we conducted moderated hierarchical regression analysis including all first- and second-order terms before adding the relevant two three-way interactions to the model (Cohen et al., 2003). Including all lower order terms in the regression equation is important because only under this circumstance does the regression coefficient associated with each higher order interaction truly reflect the effect of the interaction on the dependent variable (Cohen et al., 2003).

We entered our predictors in five consecutive steps. First, we entered the three control variables (i.e., participants' age and sex, and parental education) followed in the second step by the four sibling constellation variables (i.e., birth order, sibling age differences, sibling sex differences, and sibsize). In the third step, we entered the three nonpredicted two-way interactions (i.e., birth order \times sibsize, sibling age differences \times sibsize, and sibling sex differences \times sibsize). In the fourth step, we entered the two-way interactions predicted to affect creativity (i.e., birth order \times sibling age differences and birth order \times sibling sex differences). Finally, in the fifth step we entered the relevant three-way interactions (i.e., birth order \times sibling age differences \times sibsize and birth order \times sibling sex differences \times sibsize).

H1 and H2 stated that sibling age and sex differences would moderate the relation between birth order and creativity. Initial support for both hypotheses requires that the regression coefficients associated with the birth order \times sibling age differences and

Table 1. Means, Standard Deviations, and Correlations of Study Variables

Variable	M	SD	1	2	3	4	5	6	7
1. Age	20.44	1.52	—						
2. Sex	0.47	0.50	-.03	—					
3. Parental education	4.93	1.21	-.05	-.04	—				
4. Birth order	0.49	0.50	-.01	.06	.00	—			
5. Sibling age differences	1.36	0.60	.05	.00	-.02	-.07	—		
6. Sibling sex differences	0.61	0.41	.06	.02	-.02	.06	.04	—	
7. Sibsize	1.77	0.94	-.04	-.04	-.08	-.35**	.36**	.07	—
8. Creativity	4.46	0.73	.01	-.16**	.08	.10	.01	.03	.06

Note. N ranges between 318 and 336 due to missing data.

* $p < .05$. ** $p < .01$ (two-tailed).

Table 2. Results of Hierarchical Regression Analysis

Independent Variable	β	ΔR^2	ΔF	R^2	F
Step 1		.03	3.11*		
Age	0.01				
Sex	-0.16**				
Parental education	0.06				
Step 2		.02	1.73		
Birth order	0.15**				
Sibling age differences	-0.01				
Sibling sex differences	0.01				
Sibsize	0.08				
Step 3		.01	0.90		
Birth order \times sibsize	0.00				
Sibling age differences \times sibsize	-0.14				
Sibling sex differences \times sibsize	0.18				
Step 4		.00	0.84		
Birth order \times sibling age differences	-0.12				
Birth order \times sibling sex differences	-0.03				
Step 5		.03	4.46**	.09	2.15**
Birth order \times sibling age differences \times sibsize	-0.36*				
Birth order \times sibling sex differences \times sibsize	0.45*				

Note. $N = 317$ after listwise deletion.
 * $p < .05$. ** $p < .01$ (two-tailed).

birth order \times sibling sex differences interaction terms would reach statistical significance. As shown in Table 2, both terms were nonsignificant. Thus, H1 and H2 were rejected.

H3 and H4 predicted that the relation between birth order and creativity would be jointly moderated by sibling demographic differences and sibsize. Support for these hypotheses requires that the regression coefficients associated with the birth order \times sibling age differences \times sibsize and the birth order \times sibling sex differences \times sibsize interaction terms would reach statistical significance. Consistent with these hypotheses, the regression coefficients associated with both terms were significant ($\beta = -.36, p < .05$ and $\beta = .45, p < .05$, respectively) and the entire block of interaction terms explained a significant amount of incremental variance in creativity ($\Delta R^2 = .03, p < .01$). To facilitate the interpretation of these interactions, we plotted them following procedures outlined by Aiken and West (1991). In support of H3 and H4, Figures 1 and 2 show that the creativity of firstborns with many siblings suffered from an increase in age differences but benefited from an increase in sex differences. Simple slope analyses revealed that in the case of firstborns with many siblings, the simple slope of the regression line between sibling age differences and creativity had a sig-

nificant negative value ($b = -.55, t = -2.54, p < .01$), whereas the regression line between sibling sex differences and creativity had a significant positive value ($b = .87, t = 2.51, p < .01$). These results provide support for the argument that firstborns with larger sibling groups are more creative when they have relatively more opposite-sex siblings or relatively more siblings close in age.

Post Hoc Analyses

Although our results support the notion that firstborns with many siblings close in age are highly creative, they tell us little about the size of the age interval that promotes creative behavior in firstborns. To further explore this issue, we created two alternative sibling spacing indicators by counting the number of siblings closely spaced versus widely spaced to the focal individual. Following research on the relation between sibling constellation and educational performance (e.g., Powell & Steelman, 1990), we compared the number of siblings within two years of the focal individual's age (closely spaced) with the number of siblings separated from the focal individual by three or more years (widely spaced). Using these alternative in-

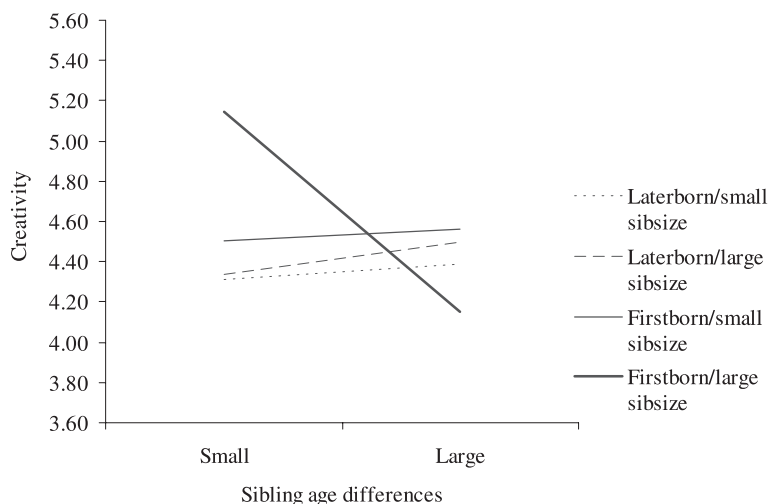


Figure 1. Interaction of birth order, sibling age differences, and sibsize on creativity.

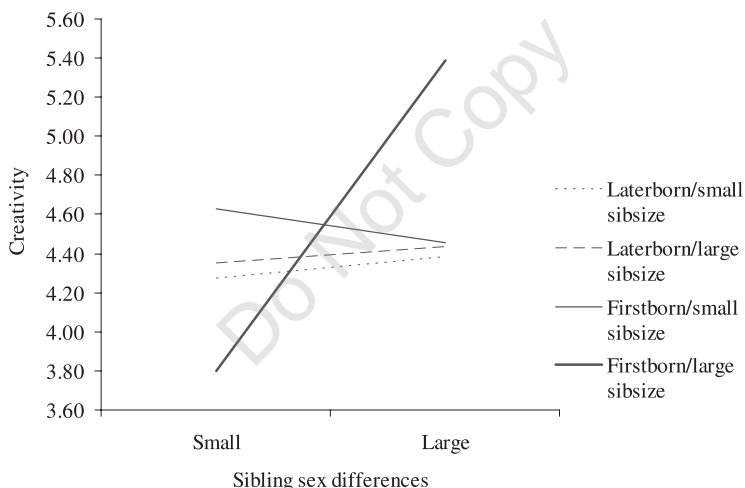


Figure 2. Interaction of birth order, sibling sex differences, and sibsize on creativity.

dicators, we conducted two separate regression analyses following procedures described earlier.

As expected, the regression coefficient associated with the three-way interaction between birth order, sibsize, and number of *closely* spaced siblings entered in the last step was positive ($\beta = .37, p < .10$). By contrast, but also in line with our expectations, the coefficient associated with the interaction between birth order, sibsize, and number of *widely* spaced sib-

lings was negative ($\beta = -.51, p < .05$). Consistent with our arguments, the interaction plots revealed that for firstborns with large sibling groups, creativity increased as the number of closely spaced siblings (i.e., siblings less than three years younger than the focal individual) increased but decreased as the number of widely spaced siblings (i.e., siblings three or more years younger than the focal individual) increased. These results suggest that our finding regarding the

moderating role of sibling age differences is consistent across different measures of age spacing and that a sibling age interval of less than three years is creativity-enhancing for firstborns.

Discussion

This study examined the moderating effects of sibling constellation variables (i.e., sibling age and sex differences, and sibsize) on the relation between an individual's birth order and his or her creativity. Results showed that sibling demographic differences alone had no impact on the birth order–creativity relation. However, when considering sibsize in addition to these demographic differences, results showed that the creativity of firstborns with many siblings suffered as sibling age differences increased but was enhanced by an increase in sibling sex differences. Thus, growing up with a large group of opposite-sex siblings or with a large group of siblings relatively close in age seems to positively affect the creativity of firstborns.

Our results demonstrate that the extent to which firstborn status facilitates or inhibits creativity is a function of the sibling constellation variables investigated in this study. They also suggest that one reason why previous research addressing this question has largely failed to produce consistent and conclusive support regarding the effects of birth order on creativity might be that such research has failed to systematically account for the influences of sibling structure. Hence, rather than focusing on the question of whether different birth order positions are associated with relatively high or low levels of creativity, future research should shift its attention to the sibling constellation variables that likely moderate the effects of birth order position on creativity.

Our finding that the presence of many considerably younger siblings constrains the creativity of firstborns is consistent with our argument that increasing age differences are frequently associated with parental expectations that the eldest should assume the role of a sibling caretaker. Apparently, serving as a parental surrogate results in early adoption of adult behaviors thereby inhibiting important aspects of the childhood experience and ultimately constraining the development of creativity-relevant processes. This finding is also consistent with previous research suggesting that firstborns' intellectual development benefits from the

presence of younger siblings close in age (Zajonc & Markus, 1975).

In line with previous work on sibling spacing and its effects on different outcome variables, we conducted additional analyses to examine the size of the age interval separating firstborns from their younger siblings that likely promotes the development of creativity. Consistent with our arguments, results of these analyses revealed that for firstborns with larger sibling groups, creativity increased as the number of closely spaced siblings (i.e., siblings less than three years younger than the focal individual) increased but decreased as the number of widely spaced siblings (i.e., siblings three or more years younger than the focal individual) increased. These findings are similar to those obtained by Cicirelli (1967) who showed that children separated by less than three years tended to be more creative than those separated by many more years and bolster our confidence in the results obtained in this study. However, we used a three-year age difference as the cutoff value to distinguish between closely and widely spaced siblings and although such a cutoff value has been employed in previous research (e.g., Powell & Steelman, 1990), it is possible that the findings of our exploratory analyses might have differed had we used different cutoff values.

Further supporting the hypotheses proposed in this study and consistent with previous research underscoring the creativity-enhancing qualities of growing up with opposite-sex siblings (Schubert et al., 1992), our results revealed a positive effect of sibling sex differences on the creativity of firstborns with larger sibling groups. Apparently, because eldest children frequently grow up to be more stereotypically masculine or feminine than younger children—characteristics generally believed to constrain creativity—sibling sex differences play an especially important role in enhancing the creativity of firstborns by mitigating the stereotypically masculine or feminine gender role development. However, in contrast to our expectations, increasing sex differences only boosted the creativity of firstborns with larger sibling groups but failed to result in a substantial increase in creativity for firstborns with sibling groups relatively small in size. Apparently, for firstborns to benefit from the creativity-enhancing qualities associated with having opposite-sex siblings, many opposite-sex siblings have to be present.

Although our study has some clear theoretical implications, it also has limitations. First, we examined

the creative contributions made by individuals in a team context. Previous research in the area of brainstorming has shown that interactions that occur naturally between the members of a team often inhibit creativity. Specifically, brainstorming teams have frequently been demonstrated to produce fewer ideas than a comparable number of individual brainstormers due to factors such as social inhibition (e.g., social anxiety, social loafing) and cognitive interference (e.g., production blocking; Larey & Paulus, 1999; Paulus, 2000). Because the inefficiencies that result from multiple people combining their efforts might interfere with individuals' creative contributions, it is possible that the results obtained in this study are not generalizable to situations where participants generate ideas independently. Future research is needed to directly test this issue.

Second, we argued that sibling age and sex differences moderate the birth order–creativity relation via effects on parental surrogation and psychological androgyny. Although our results are consistent with predictions, we did not assess androgyny or parental surrogation directly and, consequently, it is not clear whether the proposed effects of birth order, demographic differences, and sibsize are actually mediated by these variables. More research is needed that directly assesses the procedural variables that translate sibling structure into creativity.

Third, although we controlled for differences between the families of our participants by including parental education in our models, it is possible that other interfamilial differences might partially account for some of the effects observed in this research. To address this concern, future research should more extensively control for potential confounding variables associated with differences between families.

Finally, like previous investigations (e.g., Gaynor & Runco, 1992), our study relied on between-family patterns—measured in cross-sectional data obtained from many individuals, each from a different family—rather than on within-family patterns. However, research examining birth order effects on intelligence suggests that results obtained from between-family analyses might be systematically different from those based on analyses within families (Rodgers, 2001). Future work is needed to explore whether such differences also emerge in the study of creativity.

In conclusion, the most impressive result of this study is that sibling demographic differences and the

size of the sibling group jointly moderate the relation between an individual's birth order and his or her creative contributions in a team context. This finding lends support to the idea that sibling constellation variables play a critical role in affecting the creativity of individuals in different birth order positions. In addition, the findings also underscore the usefulness of capturing age and sex differences between focal individuals and all their siblings, as our measures of sibling age and sex differences significantly combined with sibsize to jointly moderate the birth order–creativity relation.

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