Explaining the Relation Between Birth Order and Intelligence

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The interest in the relation between birth order and intelligence dates back to Sir Francis Galton's *English Men of Science* (*1*). Galton found more firstborn sons in prominent positions than what he attributed to chance. This was the start of numerous studies; one of the most influential was a *Science* publication in 1973 showing a negative association between birth order and intelligence in young Dutch men (*2*). Since then, sociologists, psychologists, and demographers have proposed several explanatory models (*3*). The most influential models have emphasized explanations relating to interactions within the family and favorable conditions for intellectual stimulation for low-birth-order children.

Several researchers have claimed that the relation between birth order and intelligence is false, confounded by factors relating to family size: Families with low-intelligence children tend to be large, and the relation with birth order is an artifact when comparisons between families are made (*3*). This explanation would not produce birth order effects between siblings. Thus, the demonstration of small but notable birth order effects on intelligence quotient (IQ) in large studies examining relations within families (*4*, *5*) contradicts the idea that artifact is the full explanation.

A third model claims that the relation is explained by prenatal or gestational factors. One hypothesis suggests an effect of maternal antibody attack on the fetal brain: Maternal antibody levels tend to increase by higher birth orders in a suggested mechanism parallel to rhesus incompatibility and erythroblastosis (*6*). It has been shown that children of mothers with autoimmune disease have an increased risk of learning disabilities [for example, (*7*)], but there are no empirical data to support immunoreactivity in explaining the birth order effect.

Some children have different social and biological ranks in the family. One example is children who grow up in families with deceased elder siblings. A social interaction effect within the family would result in higher scores for a secondborn who had lost an elder sibling than for subjects ranked second both socially and biologically. On the other hand, if the birth order effect was gestational, secondborn children who are raised as the eldest would have IQ scores equal to those of other secondborn children.

We have data on birth order, vital status of elder siblings, and IQ scores among male Norwegian conscripts (*8*). This gave us an opportunity to test the family interaction and the gestational explanations. We anticipated that men who had a biological rank different from the social rank would score better than males of similar birth order who had not experienced the early loss of elder siblings if the social interaction hypothesis was right, whereas similar scores would support the gestational hypothesis. Because children from families with an adverse reproductive history had a less-advantageous distribution on a number of factors associated with low IQ (*8*), we considered it important to adjust for those factors.

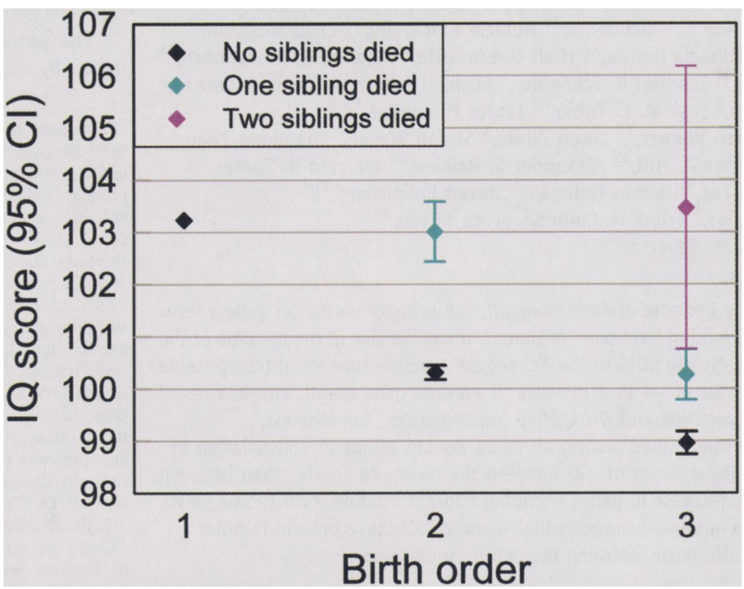

Fig. 1. Relation between birth order and IQ score. Mean IQ scores for male conscripts, first-, second-, and thirdborn in Norway to mothers with single births only and first birth from 1967 through 1976, according to birth order and number of elder siblings who died in infancy (age < 1 year). Scores are adjusted for parental education level, maternal age at birth, sibship size, birth weight, and year of conscription. Error bars show 95% confidence intervals (CIs). Reference: birth order one.

IQ scores were negatively associated with both birth order and social order (table S1). Linear regression showed that these associations were stronger in adjusted models and that the effect of birth order no longer was significant ($P = 0.76$) after accounting for social order (table S1).

The adjusted IQ scores in association with all combined categories of birth order and social order are given in Fig. 1. Conscripts of first rank in social terms, no matter their biological rank, scored equal to firstborn men, albeit the confidence interval for the birth order three result was wide. Men of birth order three who grew up as the second eldest child had IQ scores close to those of secondborns with no elder sibling loss.

This study provides evidence that the relation between birth order and IQ score is dependent on the social rank in the family and not birth order as such. Furthermore, conscripts with loss of siblings are disadvantaged compared with conscripts with no such loss regarding several factors associated with intelligence. Therefore, higher scores in the former group are hardly compatible with the artifact hypothesis.

References and Notes

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8. Materials and methods are available as supporting material on *Science* Online.
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Supporting Online Material

www.sciencemag.org/cgi/content/full/316/5832/1717/DC1
Materials and Methods
SOM Text
Table S1
References

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