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Number of Older Brothers and Sexual Orientation: New Tests and the Attraction/Behavior Distinction in Two National Probability Samples

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The extent to which number of older brothers or "fraternal birth order" predicted the 2 main components that researchers have traditionally used to conceptualize sexual orientation—that is, psychological attraction and sexual behavior—was examined in 2 recent national probability samples. In both studies, fraternal birth order predicted same-sex attraction in men, with each additional older brother increasing the odds of homosexual attraction by an average of 38%. Results also indicated that the fraternal birth order/same-sex attraction relationship in men was independent of sexual behavior, including early same-sex behavior. No sibling characteristics predicted sexual orientation in women. Results suggest experience-based theories (e.g., early same-sex play) of the fraternal birth order effect in men are unlikely to be correct.

A substantial amount of research has been conducted on sexual orientation in recent years (e.g., Bem, 1996; Ellis & Ames, 1987; Gangestad, Bailey, & Martin, 2000, LeVay, 1996; D. Singh, Vidaurri, Zambarano, & Dabbs, 1999; Williams et al., 2000). Interest in this issue occurs in part because sexual orientation is a fundamental aspect of human variability, and thus researching this issue is an important pursuit for scientists interested in personality and individual differences. In addition, sexual orientation is related to gender roles (e.g., Bailey & Zucker, 1995; Lippa, 2000), and thus, as noted by Bailey, Dunne, and Martin (2000), research on sexual orientation may reveal the causes of sex differences. Furthermore, research on sexual orientation can lead to a better understanding of the mechanisms of sexual attraction in general, including pathological sexual variation (e.g., Bogaert, Bezeau, Kuban, & Blanchard, 1997).

Along with a resurgence of interest in birth order as a variable affecting personality (e.g., Sulloway, 1996; cf. Beer & Horn, 2000), there has been increasing interest in the role that this variable plays in sexual orientation development. Research indicates that a later birth order is related to homosexuality in men (Blanchard, 1997). A birth order/sexual orientation relationship has yet to be demonstrated in women (e.g., Bogaert, 1997). It has also been established that the birth order effect in men occurs because homosexual men have a greater number of older brothers than heterosexual men (see Blanchard, 1997). The first study establishing the "older brother" or "fraternal birth order" effect used a Canadian sample of 604 gay and heterosexual men (Blanchard & Bogaert, 1996). Homosexuality correlated with number of older brothers but not with older sisters, younger brothers, or younger sisters. Each additional older brother increased the odds of homosexuality by 33%. Cantor, Blanchard, Paterson, and Bogaert (2002) determined the strength of the fraternal birth order effect: Of all gay men, 1 in 7 acquired their sexual orientation from this effect, and, for men with a mean of 2.5 older brothers, the effect of older brothers equals all other causes of homosexuality combined. It has also been established that this effect is largely independent of a familial (genetic) effect on sexual orientation (Blanchard & Bogaert, 1997). Finally, some research (e.g., Blanchard & Ellis, 2001; Bogaert, 2000, in press) suggests that environmental factors may not underlie this effect, but research is limited and direct tests are required.

An important area that our research has not addressed—and one that has implications for the etiology of the fraternal birth order effect—concerns the conceptualization of sexual orientation. In particular, our studies have not examined the extent to which fraternal birth order primarily relates to one or both of the two main components traditionally used to conceptualize sexual orientation. These components are *behavior/experience* and *psychological attraction* (Sell, 1997). Early research often emphasized the behavioral component of sexual orientation. Ford and Beach (1951), for example, used overt behavior in conceptualizing sexual orientation. Researchers in the Kinsey tradition also emphasized overt behavior, although Kinsey himself incorporated "psychic responses" in his evaluation of sexual orientation (Kinsey, Pomeroy, & Martin, 1948). Finally, overt behavior has been widely used when assessing the prevalence of homosexuality in different populations (Diamond, 1993).

Recently, researchers have emphasized the psychological component, attraction, over overt behavior in conceptualizing sexual orientation (e.g., Bailey et al., 2000; Money, 1988; Zucker & Bradley, 1995). In this view, at the core of sexual orientation there is a depth and stability of psychosexual processing that overt behavior, at least by itself, cannot capture. Overt sexual behavior would be correlated with psychological attraction, but, for a variety of reasons, one's attraction to men or women and overt sexual behavior can have a less than perfect correspondence. For example, designating a closeted "gay" man (e.g., is married and has only

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had sex with his wife) with no attraction for women as "heterosexual" solely or even partly on the basis of his overt behavior is quite misleading.

Whether fraternal birth order primarily relates to same-sex attraction or behavior has implications for understanding this effect and, ultimately, sexual orientation development. If fraternal birth order relates primarily to same-sex attraction and not to behavior per se, then the effect can be said to relate to the "psychological core" of sexual orientation: deep and presumably stable psychosexual processes related to mate orientation. As such, a mechanism would have to explain why fraternal birth order affects these stable and deeply rooted attraction processes, which may result from prenatal hormonal effects (e.g., Ellis & Ames, 1987), and/or early identification or disidentification with opposite or same-sex peers (e.g., Bem, 1996), and/or the organization of lower brain structures (e.g., anterior hypothalamus; cf. LeVay, 1991).

Such a pattern of results would also have implications for the most plausible causal sequence among fraternal birth order, attraction, and behavior, and this sequence would likely run as follows: fraternal birth order → same-sex attraction/orientation → same-sex behavior. It should be noted that in this model there is a direct relationship between fraternal birth order and same-sex attraction, which mediates an indirect and weaker relationship between fraternal birth order and behavior. This relationship between fraternal birth order and behavior would be weaker because not every man with a strong sexual attraction for a particular sex/gender will necessarily engage in exclusive sexual behavior with his preferred sex/gender. As an example, a young man who has a strong attraction to other men because of etiological factors related to having three older brothers has, in turn, because of this attraction, sexual relations primarily with men. However, another young man who also has a strong sexual attraction to other men because of etiological factors related to having three older brothers may not, despite his attraction, engage in same-sex behavior because of social and other factors (e.g., lack of opportunity, fear of social sanctions).

If, however, fraternal birth order primarily relates to behavior and less to attraction per se, then this effect can be said to relate less to the psychological core of sexual orientation and more to overt behavior/experience. As such, a plausible mechanism in this case would need to be one that primarily affects one's behavior but has less or only an indirect impact on basic attraction processes. Such a pattern too would have implications for the most plausible causal sequence among these variables, and would likely be as follows: fraternal birth order → same-sex activity → same-sex attraction. It should be noted that in this model there is a direct relationship between fraternal birth order and same-sex behavior, which mediates an indirect and weaker relationship between birth order and same-sex attraction. This relationship between fraternal birth order and attraction would be weaker because not every man who engages in same- or opposite-sex activity will necessarily develop a strong sexual attraction for the sex/gender with which he has had sexual activity. As an example, an adolescent boy who has sex with other males because of etiological factors related to having three older brothers may develop, in turn, because of this activity (through, e.g., conditioning of arousal), a strong sexual attraction to men. However, another adolescent boy who has experimented with same-sex activity because of three older brothers may still develop a strong attraction to women because, relative to the boy above, he has less of a predisposition to homosexuality or encounters complicating circumstances (e.g., less enjoyable experiences).

There are a number of theories that would explain why being later born primarily elevates or affects same-sex behavior. One is related to opportunity (as an example, see Jones & Jones's, 1995, contagion model), where, for example, a larger number of older brothers increases the likelihood of same-sex activity with an older brother (but see Bogaert, 2000). Another is related to Openness to Experience, a personality dimension that may characterize later borns more than early borns (Sulloway, 1996). In this view, later borns tend to act on unconventional inclinations, including *sexual* inclinations, which, in turn, lead to permanent differences among siblings, such as, presumably, a birth order difference in sexual orientation. Thus, according to Sulloway (1996), "One important psychological reason why later borns might tend to be homosexuals is that they are more open to experience and hence willing to act on their unconventional sexual inclinations" (p. 488). Thus, these experience-based theories of the fraternal birth order effect would be consistent with the latter model (fraternal birth order → same-sex activity → same-sex attraction), and, if correct, the data should exhibit a strong relationship between fraternal birth order and sexual behavior, not attraction per se.

In this article, fraternal birth order's relationship to both sexual attraction and behavior was examined in two recent national probability samples, one from Britain and the other from the United States (Wellings, Field, Johnson, & Wadsworth, 1994; Laumann, Gagnon, Michael, & Michaels, 1994). These two studies were stimulated by the need for sexual information in the general population in the wake of HIV/AIDS, and they are among the best sexuality surveys of recent years (see Hyde & DeLamater, 2000). The fraternal birth order effect has never been studied in representative national probability samples of adults (cf. Bearman & Brueckner, 2002). If effects are found in such samples, then strong evidence exists that the fraternal birth order effect generalizes to larger national probability populations.

Study 1 (Wellings et al., 1994)

Method

Sample. Wellings et al. (1994) used a probability sample of households in Britain (England, Wales, and Scotland). In households where an eligible respondent—that is, people between the ages of 16 and 59—could be identified and interviewed, participation rate was 71.5%. The final sample contained 18,876 participants. Participants were interviewed and given one of two versions of a questionnaire, a long form to which a representative quarter of the sample responded (N = 4,548), or a short form to which the remainder responded. For the present study, the subsample using the long form (men = 1,973; women = 2,575) was used because only these participants responded to birth order questions.

Birth order and other relevant demographics. Three categories—first born, last born, and in-between—assessed birth order. Participants were also asked whether they had only sisters, only brothers, or both brothers and sisters (or none). Finally, they were asked for their total number of siblings. It should be noted that both biological and nonbiological (e.g., adopted) siblings were included in the totals, and there was no way to separate biological from nonbiological siblings. From these variables, number of older brothers, older sisters, younger brothers, and younger sisters were constructed. For example, the following decision rules were used to construct a participant's number of older brothers: (a) if he or she

reported having no siblings, no brothers, or was the oldest, then a score of zero was given; (b), if he or she had only brothers and was last born, then the score for older brothers equaled total siblings; (c), if he or she had only brothers, was "in-between," and had two siblings, then a score for older brothers was 1; (d), if he or she had both brothers and sisters, was last born, and had two siblings, then a score for older brothers was also 1; (e), if he or she had only brothers, was "in-between," and total siblings was greater than two, then the score for older brothers equaled total siblings/2; (f), if he/she had both brothers and sisters, was last born, and total siblings was greater than two, then older brothers also equaled total siblings/2; and finally (g), if he/she had both brothers and sisters and was "in-between," then older brothers equaled total siblings/4. It should be noted that the first four rules give exact quantities for older brothers and the last three give expected quantities for older brothers (male $M = 0.61$, $SD = 0.87$; female $M = 0.66$, $SD = 0.89$). One should also note that similar rules were used to construct older sisters (male $M = 0.60$, $SD = 0.86$; female $M = 0.65$, $SD = 0.88$), younger brothers (male $M = 0.60$, $SD = 0.79$; female $M = 0.65$, $SD = 0.83$), and younger sisters (male $M = 0.57$, $SD = 0.77$; female $M = 0.62$, $SD = 0.80$).

Age, education (ranging from 1 = *no education* to 4 = *degree*), social/occupational class (ranging from 1= *professional* to 7 = *unskilled*), and ethnicity/race (1 = *White*, 2 = *Black*, 3 = *Asian*, and 4 = *other*) were also assessed. Men's mean age was 36.0 years ($SD = 11.5$); their mean education was 2.3 ($SD = 1.7$), where 2 = *zero level or equivalent*; their mean social/occupational class was 3.1, where 3 = *nonskilled/nonmanual*; and 94% were White, 2% Black, and the remainder were another race/ethnicity. Woman's mean age was 36.6 years ($SD = 11.8$); their mean education was 2.1 ($SD = 2.4$); their mean social/occupational class was 3.1; and 95% were White, 2% Black, and the remainder were another race/ethnicity.

Sexual attraction and sexual experience/behavior. Sexual attraction was assessed using a 5-point scale: "I have felt sexually attracted to . . . "; where 1 = *only females, never to males* (male $n = 1{,}795$; female $n = 9$), 2 = *more often to females, and at least once to a male* (male $n = 111$; female $n = 6$), 3 = *about equally often to males and females* (male $n = 16$; female $n = 7$), 4 = *more often to males, and at least once to a female* (male $n = 14$; female $n = 128$), and 5 = *only males, never to females* (male $n = 15$; female $n = 2{,}367$). The following 5-point behavioral measure was used: "I have had some sexual experience . . . "; where 1 = *only with females (or a female), never with a male* (male $n = 1{,}791$; female $n = 6$), 2 = *more often with females, and at least once with a male* (male $n = 106$; female $n = 4$), 3 = *about equally often with females and with males* (male $n = 9$; female $n = 4$), 4 = *more often with males, and at least once with a female* (male $n = 14$; female $n = 71$), and 5 = *only with males (or a male), never with a female* (male $n = 10$; female $n = 2{,}440$). The measures of attraction (male $M = 1.12$, $SD = 0.49$; female $M = 4.92$, $SD = 3.67$) and behavior (male $M = 1.11$, SD = 0.46; female $M = 4.95$, $SD = 0.29$) were significantly correlated in men ($r_s = .654$, $p < .001$) and women ($r_s = .560$, $p < .001$), using Spearman's Rank correlation.

Participants were also asked for their age of first same-sex experience ("Have you ever had *any* kind of sexual experience or sexual contact with a male?" [or a "female," if the respondent was a woman] and "How old were you the first time that ever happened?"). Men's mean age of same-sex experience was 14.7 years ($SD = 5.59$); for women, it was 18.41 years ($SD = 7.81$). If a man reported having a same-sex experience at 14 years or younger, then he was given a value of 1; if he reported having a first same-sex experience after 14 or did not have any same-sex experience, he was given a value of zero.[1] If a woman reported having a same-sex experience at 18 years or younger, then she was given a value of 1; if she reported having a first same-sex experience after 18 or did not have any same-sex experience, she was given a value of zero. Whether participants had an early first same-sex experience was included because if sexual experience can cause later attraction, then the timing of same-sex behaviors is likely important, with an earlier onset more likely to cause a permanent inclination. Thus, including this measure tests whether fraternal birth order is primarily related to not only same-sex experience but also *early* same-sex experience.

Results

In men, education and attraction were significantly correlated, $r_s(1890) = .13$, $p < .001$, as were social/occupational class and attraction, $r_s(1796) = -.08$, $p < .001$, using Spearman's Rank correlation. Education and sexual behavior were also significantly correlated in men, $r_s(1871) = .14$, $p < .001$, as were social/occupational class and sexual behavior, $r_s(1787) = -.10$, $p < .001$, using Spearman's Rank correlation. No other demographics related to sexual attraction or behavior in men. In women, attraction and education were correlated, $r_s(2479) = .11$, $p < .001$, as were attraction and age $r_s(2517) = -.05$, $p < .01$, using Spearman's Rank correlation. Sexual behavior and education also correlated in women, $r_s(2485) = .08$, $p < .001$, using Spearman's Rank correlation. No other demographics related to sexual attraction or behavior in women.

To examine a possible birth order (e.g., older brother) effect in men, linear regressions were undertaken, with sexual attraction or sexual experience/behavior as the criterion, sibship size (total number of siblings), education, social class, and number of older siblings (older brothers + older sisters) or number of older brothers as simultaneously entered predictors. Social/occupational class and education were controlled because, as mentioned above, they were related to both criteria, and sibship size was controlled because it is a potential confounding factor in birth order research (e.g., Ernst & Angst, 1983). Birth order did not relate to either sexual attraction or behavior (both ps $> .30$, two-tailed), but, as shown in Table 1, number of older brothers predicted same-sex attraction ($p < .03$, two-tailed); no significant older brother effect was observed for sexual experience/behavior ($p > .30$, two-tailed).

To test whether number of older brothers predicted sexual attraction independent of same-sex experience and early same-sex behavior, gender of partner (i.e., the sexual behavior measure) and whether the participant had a same-sex experience at 14 years or younger was controlled. In this analysis, as in the previous analyses, education, social class, and sibship size were controlled. Number of older brothers was still significant ($p = .04$, two-tailed; see Table 2). Thus, an older brother relationship to sexual attraction was independent of same-sex experience and early same-sex behavior.

These linear regressions were reconducted using sibship size as a weighted variable in a weighted least squares model. Thus, instead of controlling for sibship size, I "weighted" by sibship size. A weighted least squares model ensures that large sibships have more of an impact on the analysis, a relevant issue because birth order effects are seen more clearly in large families. In larger families, any given participant can occupy a much larger range of ordinal positions (e.g., 1st through 7th) relative to smaller families; thus, weighting by sibship size reduces the range restriction in

[1] I dichotomized this measure to allow heterosexual participants to have a score (zero), thus allowing more power by using the entire sample ($n = 1{,}930$) rather than just participants who reported same-sex experience ($n = 139$).

ordinal positions occurring in small families. Weighted least squares analyses have been used before for research on birth order and sexual orientation (e.g., Blanchard, Zucker, Bradley, & Hume, 1995; Bogaert, 2000), in particular for nonlinearly transformed and/or truncated birth order data, such as in the present study. The older brother effects for attraction were now stronger (with no significant older brother effects for sexual behavior). For example, as in the latter analysis, number of older brothers significantly predicted attraction ($p < .001$, two-tailed), independent of social class, education, same-sex experience, and early same-sex behavior.[2]

In women, linear regressions were also undertaken, with sexual attraction or sexual behavior as the criterion; and birth order or specific sibling characteristics (i.e., older brothers, older sisters, younger brothers, younger sisters) and the other relevant demographic variables (i.e., age, education, sibship size) as simultaneously entered predictors. Age and education were controlled in the attraction analysis because, as mentioned, these demographics were related to this variable in women. Education was controlled in the sexual-behavior analysis because, as mentioned, this variable was related to sexual behavior. It should be noted that all sibling characteristics (older brothers, older sisters, younger brothers, younger sisters) were included in these analyses because no specific sibling characteristic has been found to predict sexual orientation in women. One should also note that I controlled sibship size when examining general birth order, but not in the analyses with all sibling characteristics because these four variables together essentially control for this variable. No birth order characteristic significantly predicted sexual attraction or behavior (all ps $> .05$; see Table 3). Weighting by sibship size did not alter the results (all ps $> .05$).

In summary, number of older brothers predicted same-sex attraction in men. The older brother/attraction relationship in men was also independent of same-sex behavior. More specifically, an older brother/attraction relationship remained significant controlling for sexual behavior (partner gender), including early same-sex behavior, and no evidence of an older brother/sexual behavior relationship was found. Finally, no birth order characteristic predicted sexual orientation in women.

Table 1
Older Brothers Predicting Attraction and Behavior Using Linear Regressions in Men, Study 1

	Sexual attraction (n = 1,710)			Sexual behavior (n = 1,707)		
Predictor	β	t	p	β	t	p
Older brothers	.07	2.13	.033	.03	1.02	.307
Sibship size	−.04	1.25	.212	−.03	−0.85	.394
Social/occupational class	−.03	−0.91	.362	−.02	−0.70	.482
Education	.09	3.15	.002	.11	3.87	.000

Note. Sexual attraction is rated from 1 = *women only* to 5 = *men only*; Sexual behavior is rated from 1 = *women only* to 5 = *men only*; Education is rated from 1 = *no education* to 4 = *degree*; Social/occupational class is rated from 1 = *professional* to 7 = *unskilled*.

Table 2
Sibling Characteristics (e.g., Older Brothers) Predicting Attraction Using a Linear Regression and Controlling for Same-Sex Experience in Men, Study 1

	Sexual attraction (n = 1,694)		
Predictor	β	t	p
Older brothers	.04	2.11	.035
Sibship size	−.01	−0.70	.486
Social/occupational class	−.01	−0.41	.682
Education	.01	0.57	.569
Sexual behavior	.84	53.42	.000
Same-sex behavior 14 and younger	−.03	−1.89	.059

Note. Sexual attraction is rated from 1 = *women only* to 5 = *men only*; Sexual behavior is rated from 1 = *women only* to 5 = *men only*; Education is rated from 1 = *no education* to 4 = *degree*; Social/occupational class is rated from 1 = *professional* to 7 = *unskilled*; Same-sex behavior 14 and younger is rated as 0 = no and 1 = yes.

Study 2 (Laumann et al., 1994)

Study 2 addressed the same two questions as Study 1: (a) Was there evidence of a fraternal birth order effect in a national probability sample, this time in the United States, and (b) is number of older brothers associated with same-sex attraction as well as with same-sex behavior in men? The data are from the National Health and Social Life Survey (Laumann et al., 1994), which I analyzed previously (Bogaert, 2000). A birth order effect in men was found in these data, but the more specific effect of older brothers was not tested because the decision rules used to reconstruct sibling characteristics in Study 1 did not become apparent until after Bogaert (2000) was published; nor did Bogaert (2000) test whether birth order was primarily related to sexual attraction or sexual behavior in men, again because the importance of such an issue did not become apparent until after Bogaert (2000) was published.

Method

Sample. In this probability sample of U.S. households (adults aged 18 to 59), less than 3% of Americans were ineligible (e.g., prisoners and students in college dormitories). In total, 1,921 women and 1,511 men were surveyed, comprising a 79% cooperation rate. Participants were interviewed for about 90 min, after which they privately completed a small questionnaire on certain sensitive topics (e.g., masturbation).

Birth order and other relevant demographics. As in Study 1, birth order was limited to three categories—first born, last born, and in-between—and there was no information on specific sibling characteristics (e.g., older brothers). Participants did indicate, however, their total number of sisters and their total number of brothers. For these totals, Laumann et al. (1994) collapsed data across 6 through 10 siblings into 6, and 11 or more siblings were collapsed into 11. For example, if a participant happened to have 8 brothers and 12 sisters, his or her scores on these variables would be 6 and 11, respectively. Thus, possible values for these sibling variables were 0, 1, 2, 3, 4, 5, 6, and 11. One should also note that both biological and nonbiological (e.g., adopted)

[2] Although sibship size is an important confounding variable in birth order research, it did not relate to attraction in Studies 1 and 2, and thus there is justification to weight for (and not control for) sibship size in these analyses.

Table 3
Linear Regressions With Attraction and Behavior as the Criteria in Women, Study 1

	Sexual attraction (n = 2,442)			Sexual behavior (n = 2,449)		
Predictor	β	t	p	β	t	p
Older brothers	−.04	−1.64	.104	−.05	−1.80	.071
Older sisters	.00	0.04	.966	.02	0.60	.550
Younger brothers	.03	1.14	.256	.02	0.62	.539
Younger sisters	−.02	−0.60	.549	.01	0.33	.742
Age	−.04	−2.00	.045	—	—	—
Education	.07	3.45	.002	.05	2.60	.009

Note. Sexual attraction is rated from 1 = *men only* to 5 = *women only*; Sexual behavior is rated from 1 = *men only* to 5 = *women only*; Education is rated from 1 = *no education* to 4 = *degree*.

siblings were included in the totals, and there was no way to separate biological siblings from nonbiological siblings.

As in Study 1, number of older brothers, older sisters, younger brothers, and younger sisters were constructed from this sibling information. For example, the following decision rules were used to construct a participant's number of older brothers: (a) if he or she was the oldest or reported no brothers, then a score of zero was given; (b) if he or she reported being last born, then the score for older brothers equaled the number of brothers; and (c) if he/she was "in-between," then the score for older brothers equaled number of brothers/2. It should be noted that the first two decision rules give exact quantities for older brothers, and that the last one gives both exact quantities (for two older brothers and no sisters) and expected quantities (for the remaining cases) for older brothers (male M = 0.93, SD = 1.17; female M = 0.94, SD = 1.12). One should also note that similar decision rules were used to construct older sisters (male M = 0.84, SD = 1.08; female M = 0.89, SD = 1.12), younger brothers (male M = 0.95, SD = 1.16; female M = 0.92, SD = 1.13), and younger sisters (male M = .82, SD = 1.00; female M = 0.88, SD = 1.08).

Other demographics were age, education (ranging from 1 = *8th grade or less* to 8 = *advanced degree*), social/occupational class (ranging from 168 [low] to 861 [high]), and race/ethnicity (1 = *White*, 2 = *Black*, 3 = *Native American*, 4 = *Asian/Pacific Islander*, 6 = *Hispanic*). Men's mean age was 36.0 years (SD = 10.8); their mean education was 4.3 (SD = 1.7), where 4 = *vocational/trade school*; their mean social/occupational class was 426.0 (SD = 133.6); and 78% were White, 14% Black, and approximately 8% were another race/ethnicity. Women's mean age was 36.7 (SD = 11.0); their mean education was 4.2 (SD = 1.6); their mean social/occupational class was 426.7 (SD = 131.8); and 74% were White, 18% Black, and approximately 8% were another race/ethnicity.

Sexual attraction and sexual behavior. Sexual attraction was assessed using the following 5-point scale: "In general, are you sexually attracted to only men, mostly men, both men and women, mostly women, or only women?"; where 1 = *only men* (male n = 39; female n = 1,824), 2 = *mostly men* (male n = 11; female n = 51), 3 = *both men and women* (male n = 9; female n = 15), 4 = *mostly women* (male n = 43; female n = 11), and 5 = *only women* (male n = 1,402; female n = 10). The following behavioral measure was used: "Have your sex partners in the last 5 years been . . . "; where 1 = *exclusively male* (male n = 33; female n = 1,649), 2 = *both male and female* (male n = 24; female n = 13), and 3 = *exclusively female* (male n = 1,280; female n = 27). The measures of attraction (male M = 4.83, SD = 0.71; female M = 1.08, SD = 0.43) and behavior (male M = 2.93, SD = 0.33; female M = 1.04, SD = 0.26) were significantly correlated in both men, $r_s(1336) = .627$, $p < .001$, and women, $r_s(1673) = .459$, $p < .001$, using Spearman's Rank correlation.

Participants were asked about their age of first same-sex experience ("Now I would like to ask you some questions about sexual experience with males [or "females," if the respondent was a woman] after you were 12 or 13, that is, after puberty"; "How old were you the first time you had sex with a male?" [or a "female," if the respondent was a woman]). Men's mean age of same-sex experience was 16.11 years (SD = 3.64); for women, it was 21.65 years (SD = 7.69). If a man reported having same-sex experience at 16 years or younger, then he was given a value of 1; if he reported having a first same-sex experience after 16 or did not have any same-sex experience, he was given a value of zero. If a woman reported having same-sex experience at 21 years or younger, then she was given a value of 1; if she reported having a first same-sex experience older than 21 or did not have any same-sex experience, she was given a value of zero. Finally, given that the main measure of opposite and same-sex behavior mentioned above was limited to the last 5 years, I included whether the participant had *ever* had a same-sex experience. For this measure, if the participant reported having same-sex experience at any age, he or she was given a score of 1; if the participant did not report a same-sex experience at any age, he or she was given a score of zero.

Results

In men, age and sexual attraction were significantly correlated, $r_s(1503) = .06$, $p < .05$, as were education and attraction, $r_s(1497) = -.06$, $p < .05$, using Spearman's Rank correlation. Age and sexual behavior were significantly correlated in men, $r_s(1338) = .07$, $p < .05$, as were education and sexual behavior, $r_s(1331) = -.08$, $p < .01$, using Spearman's Rank correlation. No other demographics related to sexual attraction or behavior in men. In women, attraction and education were significantly correlated, $r_s(1885) = .13$, $p < .001$, as were attraction and social/occupational class, $r_s(1757) = .08$, $p < .001$, using Spearman's Rank correlation. No other demographics related to sexual attraction or behavior in women.

In men, linear regressions were undertaken, with sexual attraction or sexual experience as the criterion, and age, education, and number of older siblings (older brothers + older sisters) or number of older brothers as simultaneously entered predictors. Age and education were controlled because they were, as mentioned, related to the criteria. In addition, sibship size was controlled because of its role as a potentially confounding factor in birth order research. No significant birth order effect or older brother effect was observed for sexual behavior (both ps > .15, two-tailed), but birth order and older brother effects were found (p = .03 and p = .01, two-tailed, respectively) for sexual attraction, with number of older siblings and number of older brothers predicting same-sex attraction (see Table 4).

As in Study 1, to test whether number of older brothers predicted attraction independent of same-sex experience and early same-sex behavior, gender of partner(s) in the last 5 years (i.e., the sexual behavior measure), whether the participant had a same-sex experience 16 years or younger, and whether he ever reported any same-sex experience were controlled. As in the previous analyses, age, education, and sibship size were also controlled. Number of older brothers still predicted same-sex attraction (p = .01, two-tailed; see Table 5).[3]

As in Study 1, I reconducted these linear regressions using sibship size as a weighted variable in a weighted least squares model. The

[3] To make this analysis comparable with Study 1, I examined an earlier age of first same-sex experience (i.e., aged 14 or under), but it did not alter the results.

Table 4
Older Brothers Predicting Attraction and Behavior Using Linear Regressions in Men, Study 2

	Sexual attraction (n = 1,487)			Sexual behavior in last 5 years (n = 1,324)		
Predictor	β	t	p	β	t	p
Older brothers	−.08	−2.49	.013	−.05	−1.43	.152
Age	.04	1.62	.105	.06	2.08	.037
Education	−.04	1.49	.136	−.08	−2.70	.007
Sibship size	.06	1.90	.057	.04	1.20	.229

Note. Sexual attraction is rated from 1 = *men only* to 5 = *women only*; Sexual behavior in last 5 years is rated from 1 = *men only* to 3 = *women only*; Education is rated from 1 = *8th grade or less* to 8 = *advanced degree*.

older brother effects for sexual attraction were generally stronger and there were still no significant effects for sexual behavior. For example, as in the latter analysis, number of older brothers significantly predicted sexual attraction (p = .001, two-tailed), independent of age, education, same-sex experience in the past 5 years, whether the participant had a same-sex experience at 16 years or younger, and whether he ever reported any same-sex experience.

In women, similar linear regressions were undertaken, with sexual attraction or behavior as the criterion; and birth order or the specific sibling characteristics (i.e., older brothers, older sisters, younger brothers, younger sisters) and the other relevant demographic variables (education, social/occupational class, sibship size) as simultaneously entered predictors. Education and social/occupational class were controlled in the sexual attraction analysis because these demographics were, as mentioned, related to this criterion. It should be noted that I included all sibling characteristics (older brothers, older sisters, younger brothers, younger sisters) in these analyses because no specific sibling characteristic has predicted sexual orientation in women. In addition, I controlled sibship size when examining general birth order, but not in the analyses with all sibling characteristics because these four variables together essentially control for this variable. No birth order variable, including number of older brothers, significantly predicted the criteria in women (all ps > .15, two-tailed; see Table 6). Weighting by sibship size did not appreciably alter the results (all ps > .15).

In summary, the fraternal birth order effect in men was replicated in Study 2. In addition, as in Study 1, an older brother/sexual attraction relationship was found to be independent of sexual behavior, including early same-sex behavior. Finally, no birth order effects were observed in women.

Table 5
Sibling Characteristics (e.g., Older Brothers) Predicting Attraction Using a Linear Regression and Controlling for Same-Sex Experience in Men, Study 2

	Sexual attraction (n = 1,320)		
Predictor	β	t	p
Older brothers	−.06	−2.55	.011
Sibship size	.04	1.55	.123
Age	.01	0.57	.565
Education	.02	1.04	.301
Sexual behavior in last 5 years	.59	24.44	.000
Same-sex behavior 16 and younger	−.03	−1.10	.272
Ever same-sex behavior	−.14	−4.09	.000

Note. Sexual attraction is rated from 1 = *men only* to 5 = *women only*; Sexual behavior in last 5 years is rated from 1 = *men only* to 3 = *women only*; Education is rated from 1 = *8th grade or less* to 8 = *advanced degree*; Same-sex behavior 16 and younger is rated as 0 = no and 1 = yes; Ever same-sex behavior is rated as 0 = no and 1 = yes.

General Discussion

In two large national probability samples, number of older brothers predicted sexual orientation (i.e., attraction) in men. These findings support prior research (see Blanchard, 1997), although the present studies advance this research program because, prior to the present studies, the fraternal birth order effect was never examined in national probability samples of adults. Sampling problems have raised questions about the reliability of some findings on the etiology of sexual orientation (e.g., Bailey et al., 2000; Kendler, Thorton, Gilman, & Kessler, 2000), but such concerns do not seem to apply to our research. It is interesting to compare the size of the older brother effect in the present samples with prior research. To do this, I calculated an odds ratio from a logistic regression using a dichotomized measure of the 5-point attraction scales (1 = *exclusively* or *almost exclusively heterosexual*; 2 = *homosexual/bisexual*) used in these two samples. For this analysis, I combined the two samples. Number of older brothers (p = .005, two-tailed), controlling for sibship size, increased the odds of homosexual attraction by 38%. Thus, this value is comparable with the value on which recent size calculations are based (33%; Cantor et al., 2002).

Birth order did not predict sexual orientation in women. Of the 16 studies examining this issue, 2 found that lesbians (or prehomosexual girls) were early born (Wolff, 1971; Zucker, Lightbody, Pecore, Bradley, & Blanchard, 1998), 2 found that lesbians were later born or probably later born (Liddicoat, 1961; Slater, 1962), and the rest, including four very large recent samples

Table 6
Linear Regressions With Attraction and Behavior as the Criteria in Women, Study 2

	Sexual attraction (n = 1,740)			Sexual behavior (n = 1,683)		
Predictor	β	t	p	β	t	p
Older brothers	.00	0.26	.877	−.01	−0.41	.679
Older sisters	−.02	−0.71	.476	.01	0.39	.692
Younger brothers	−.01	−0.31	.755	.01	0.26	.795
Younger sisters	.03	0.88	.380	.02	0.53	.595
Education	.10	3.54	.000			
Social class	.04	0.15	.877	—	—	—

Note. Sexual attraction is rated from 1 = *men only* to 5 = *women only*; Sexual behavior in last 5 years is rated from 1 = *men only* to 3 = *women only*; Education is rated from 1 = *8th grade or less* to 8 = *advanced degree*; Social class ranges from 186 (*low*) to 861 (*high*).

(Bogaert, 1997, 2000; Ellis & Blanchard, 2001; see also Studies 1 and 2), were inconclusive or found no difference. Thus, in light of the consistent birth order effects in men, the null results in women reinforce the notion that women's sexual orientation probably develops in different ways from men's (e.g., Pattatucci, 1998).

In men, number of older brothers primarily related to sexual attraction and not sexual behavior, including early same-sex experience. In other words, fraternal birth order primarily related to what might be termed the psychological core of sexual orientation—attraction—and not to a correlate of and likely outcome of sexual orientation—partner choice. As such, whether a person has or has not had same-sex experience, including early same-sex experience, did not affect the older brother/sexual attraction relationship. Not only do these findings help to conceptualize the older brother/sexual orientation relationship, but they also have implications for explanations underlying such a relationship. In particular, they suggest that the older brother mechanism primarily affects basic psychosexual attraction processes, which, as mentioned, may result from one or all of the following mechanisms: prenatal hormones (e.g., Ellis & Ames, 1987); early identification/deidentification with opposite or same-sex peers (e.g., Bem, 1996); and the organization of lower brain structures (e.g., anterior hypothalamus; cf. LeVay, 1991). As a consequence, these findings also suggest that experienced-based theories of the fraternal birth order effect are unlikely to be correct. One such explanation is related to Openness to Experience (Sulloway, 1996). Sulloway's (1996) explanation of the older brother effect emphasizes greater exploratory sexual activity among later born boys and young men, relative to early born boys and young men, leading to a relatively stable homosexual sexual orientation in some men. Thus, his theory would predict that birth order (e.g., older brothers) would more strongly relate to (early) same-sex behavior than to same-sex attraction, which may in some cases be a plausible outcome of (early) same-sex behavior. However, the data do not support this view: Same-sex experience was not related to number of older brothers, and the fraternal birth order effect was completely independent of same-sex behavior, including early same-sex behavior. The present results join other recent evidence that learning/environmental mechanisms probably do not underlie the fraternal birth order effect (e.g., Blanchard & Ellis, 2001; Bogaert, 2000). For example, Bogaert (2000) specifically tested whether a learning mechanism—sex-activity among brothers—underlies this effect. Such activity among brothers, which is a special case of behavioral contagion (e.g., Jones & Jones 1995), would presumably have a stronger effect on the younger of the boys involved, resulting in a tendency for gay males to occupy later sibship positions. No evidence was found for such a mechanism. The results of the present two studies confirm this result, but also extend it by demonstrating that *any* kind of sexual activity, early or otherwise, among males (i.e., not just between brothers), along with related personality dimensions (e.g., Openness to Experience), probably does not underlie the fraternal birth order effect. Consequently, other theories should be pursued more fully.

Bem's (1996) "exotic-to-erotic" theory of sexual orientation incorporates evidence that gay people, on average, were atypical with regard to childhood sex-typed behavior; for example, boys had less sports involvement (see Bailey & Zucker, 1995). Bem argued that nonmasculine boys feel they are different from other, more masculine boys; these feelings of "differentness" or deidentification lead to eroticization of other males. He also argued that the more older brothers a feminine or nonmasculine boy has, the more likely he is to develop a sense of being different from and thus being attracted to other males. Bem essentially posited, then, that an Older Brother $\times$ Sex-Typing interaction should occur to predict sexual orientation, such that when boys are low in masculinity, number of older brothers will predict homosexuality; and when boys are high in masculinity, number of older brothers may not or only weakly predict homosexuality. New research with a sample containing information on sexual orientation, childhood sex-typing, and birth order could test Bem's interaction model (but see Bogaert, 2003).

The most well-articulated biological theory of the fraternal birth order effect concerns a maternal immune response to succeeding male pregnancies (e.g., Blanchard & Bogaert, 1996; MacCulloch & Waddington, 1981). In the same way that a mother who is Rh negative (Rh-), after carrying and giving birth to an Rh positive (Rh+) fetus, may develop an immune response that affects subsequent Rh+ fetuses, we have speculated that some mothers may eventually become "immunized" to a factor or substance important in male fetal development and that this immune response eventually affects later male pregnancies. This explanation is partly based on evidence that a mother's immune system is more capable of recognizing and responding to—in immunological terminology, "remembering"—male rather than female fetuses (Gaultieri & Hicks, 1985). Presumably, female fetuses are less likely to be remembered and induce an immune response because the mothers themselves are female. In other words, a mother's immune system is more likely to interpret factors or substances in male development, as opposed to factors in female development, as foreign or "antigenic" because her own body and development is female. Moreover, the possibility of such a response should increase with each male fetus, because, with each male pregnancy, a mother's body has an additional opportunity to remember and respond to the foreign/antigenic substance(s) produced by males. Hence, an older brother and not an older sister effect should occur, that is, each male pregnancy prior to a male's birth should increase his likelihood of being gay.

If this theory is correct, then the link between the mother's immune reaction and the child's future sexual orientation would likely be some effect of maternal antibodies on the sexual differentiation of the brain. These antibodies would cross the placental barrier during pregnancy and enter and then affect the fetal brain (e.g., anterior hypothalamus; see LeVay, 1991). When this happens, the brain would not develop in a male-typical pattern, and the individual would be attracted to men as opposed to women. Early formulations of a maternal immune response theory concentrated on testosterone as the relevant antigen, but recent formulations have focused on male-specific, Y-linked H-Y antigen as the relevant antigen (Blanchard & Bogaert, 1996; see also male-specific, cell-surface proteins or protocadherins, Blanchard et al., 2002). H-Y antigens are substances found only in males, play a role in sexual differentiation (Wachtel, 1983), are well represented on the brain cell surfaces of males, and can induce an immune response in females (see Blanchard & Klassen, 1997); indeed they are labeled "antigens" because of their capacity to induce an immune reaction in females (Wachtel, 1983). As yet, there is no direct support for the role of H-Y (or, for that matter, a maternal immune response) in sexual orientation development. However, one study

gives indirect support for such a mechanism (J. Singh & Verma, 1987): After female mice were immunized to H-Y antigen, their male offspring were, at maturity, less likely than male offspring sired from control females to engage in typical reproductive behavior with estrous females.

These studies investigated a distinction between sexual attraction and behavior, and the results have implications for sexual orientation research. With regard to birth order, no recent studies used only or isolated (overt) behavioral measures of sexual orientation, so it is difficult to compare the behavioral results in these two studies, which were very weak, with past research. However, an implication is that past research probably demonstrated significant effects because the studies had sufficient power and/or had sexual orientation measures that correlated well enough with attraction. Another implication is that future birth order research should define sexual orientation using attraction measures. Finally, it may be important to consider whether a similar distinction between attraction and behavior is observable in other sexual orientation research. For example, with regard to heritability, genetics may strongly affect basic attraction processes, and environmental influences may relate more to overt sexual behavior (but compare Bailey et al., 2000 and Kendler et al., 2000). Moreover, a possible link between homosexuality and psychological disturbance (e.g., Fergusson, Horwood, & Beautrais, 1999) may derive more from overt homosexual behavior, which is not socially sanctioned, than homosexual attraction per se.

Despite the consistency of the results and the importance of the samples, limitations should be noted. First, sibling characteristics (e.g., older brothers) were partly based on estimated or expected values, increasing the error/inaccuracy of the results. However, this inaccuracy is most likely to operate *against* finding significant results and should not increase the chances of spurious findings. Thus, these studies should be considered conservative tests of the fraternal birth order effect and its relation to the attraction/behavior distinction. Second, although most participants in these samples are likely to have come from biologically intact families, there was no way to separate participants from biological versus nonbiological families (cf. Beer & Horn, 2000). Thus, speculations about a biological mechanism (e.g., Blanchard & Bogaert, 1996) are not directly testable in these samples and require gathering new data.

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