

Multidimensional Assessment of Sexual Orientation and the Fraternal Birth Order Effect

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Previous research demonstrates that for every older male sibling a male child has, the odds are increased by 33% over the naturally occurring odds that he will be nonheterosexual. This concept is known as the Fraternal Birth Order Effect (FBOE). Although this finding has been duplicated in multiple studies, researchers have not used other dimensions of sexual orientation when measuring the presence of the FBOE. The present study measures the FBOE in a racially diverse sample of right-handed men using a multidimensional assessment of sexual orientation that measures self-identified sexual orientation, sexual behaviors, sexual attractions, and sexual fantasies. The current study did not find the presence of the FBOE using Slater's Index, Berglin's Index, or Blanchard's Proportion in right-handed men regardless of being grouped by self-identified sexual orientation, sexual behaviors, sexual attractions, or sexual fantasies. Reasons for not observing a FBOE in the current data set are discussed and implications for future research are proposed.

Keywords: assessment of sexual orientation, birth order, fraternal birth order effect, older brothers, sexual orientation

Most research on biological etiologies of sexual orientation focuses on nonheterosexual orientations and differences in neurological structures and prenatal hormonal environments. Findings emerging from this research include differences in size of various brain structures based on sexual orientation (e.g., Allen & Gorski, 1992; Berglund, Lindström, & Savic, 2006; Byne et al., 2001; LeVay, 1991; McCormick & Witelson, 1994; Swaab, 2007; Swaab & Hofman, 1990), prenatal hormonal interactions with stress (Ellis, Peckham, Ames, & Burke, 1988), and prenatal hormonal interactions with nicotine (Ellis & Cole-Harding, 2001) that influence the sexual orientation of the unborn child. Additionally, research attempts to understand the importance of biological contributions to human sexual orientation by examining correlates related to a person's sexual orientation, looking for biodemographic markers such as fraternal birth order effect (FBOE; e.g., Blanchard, 2001; Bogaert, 1997), digit length (e.g., Grimbos, Dawood, Burriss, Zucker, & Puts, 2010), and recalled childhood gender nonconformity (CGN; e.g., Bailey & Zucker, 1995; Lippa, 2008). Biodemographic markers of sexual orientation provide cor-

relates to help understand the influence of the prenatal environment on the etiology of sexual orientation (Rahman, Clarke, & Morera, 2009).

Blanchard (2001) states that a valid biodemographic marker of male sexual orientation is the presence of the fraternal birth order effect (FBOE). The FBOE states for every older male sibling a male child has, the naturally occurring odds of a male child developing a nonheterosexual orientation increases (Blanchard & Bogaert, 1996; Cantor, Blanchard, Paterson, & Bogaert, 2002). The naturally occurring odds of a male child developing a nonheterosexual orientation are estimated at 2% (Blanchard, 2001). The FBOE is only observed in nonheterosexual right-handed men (Bogaert, 2002, 2003a, 2003b). Although the specific biological explanation for the FBOE only being observed in right-handed nonheterosexual men is not known, a study of 3,146 men found a significant positive correlation between nonheterosexual orientation, right-handedness, and the number of older brothers (Blanchard, Cantor, Bogaert, Breedlove, & Ellis, 2006).

The hypothesized etiology of the FBOE is explained by the maternal immune hypothesis (MIH). Male cells contain a histocompatibility antigen (commonly referred to as an H-Y antigen) not present in female cells (Blanchard, 2001). The foundational aspects of MIH are when the mother is pregnant with a male fetus, the male fetus' H-Y antigens cross over the placenta to the mother's blood stream (Ellis & Ames, 1987; MacCulloch & Waddington, 1981). The mother's body does not recognize the H-Y antigens, and her immune system, in response, produces H-Y antibodies. The H-Y antibodies cross the placenta and enter the blood stream of the male fetus, and the antibodies potentially could alter brain structures in the male fetus (Blanchard, 2001; Ellis &

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Ames, 1987). The mother's immune system response to the male fetus supports biological differences in brain structures for adult men who identify as homosexual and lower birth weight for male children who identify as homosexual as adults (Bogaert, 2003a).

Self-identification of sexual orientation is not the only dimension of a person's sexual orientation. The American Psychological Association acknowledges the breadth of dimensionality in defining sexual orientation by stating the following:

Sexual orientation refers to an enduring pattern of emotional, romantic, and/or sexual attractions to men, women, or both sexes. Sexual orientation also refers to a person's sense of identity based on those attractions, related behaviors, and membership in a community of others who share those attractions. Research over several decades has demonstrated that sexual orientation ranges along a continuum, from exclusive attraction to the other sex to exclusive attraction to the same sex. (APA, 2013)

Current research demonstrates the multivariate aspects and complexities of assessing sexual orientation (Diamond, 1998, 2005; Sell, 2007; Vrangalova & Savin-Williams, 2010, 2012; Weinrich & Klein, 2002). The current APA definition also underscores research demonstrating the most reliable constructs of sexual orientation are self-identity, attractions, fantasies, and behaviors.

The level to which one construct is congruent with all other constructs of sexual orientation behaviors is not known. Research demonstrates some participants self-selecting a nonheterosexual identity label (e.g., gay, lesbian) endorse participating in sexual behavior with the opposite sex; and conversely, some individuals self-selecting a heterosexual identity label endorse participating in sexual behavior with the same sex (Diamond, 1998, 2005; Glover, Galliher, & Lamere, 2009). By exploring the presence of within group differences in self-identified sexual orientation (e.g., a woman who self-selects a heterosexual label but participates in same sex behavior), researchers have begun to identify a population who identify as heterosexual yet exhibit one or more inconsistencies with that label on other dimensions of sexuality (e.g., same sex behavior, same sex attraction, same sex fantasy; Vrangalova & Savin-Williams, 2010). Furthermore, sexual behaviors, attractions, and even identities can change over time, and may not be congruent with a traditional label of sexual orientation (i.e., heterosexual, bisexual, homosexual; Dodge, Reece, & Gebhard, 2008; Klein, Sepekoff, & Wolf, 1985; Sell, 2007).

With the focus of sexual orientation research mainly centered on nonheterosexual individuals, comparatively little is known about how the multiple dimensions of sexual orientation vary among heterosexual individuals. However, researchers have begun to report and explore the variations in heterosexual identities. Bailey, Dunne, and Martin (2000) in an Australian twin study reported the same number of men endorsed "heterosexual identity with slight homosexual feelings" as reported "completely homosexual" identity. The similar size of a well-researched group (completely homosexual) with a relatively unresearched group (heterosexual with slight homosexual feelings) supports the idea of studying variations in the traditional labels of sexual orientation. Bogaert (2003b) reported similar findings in a British sample where 5% to 6% reported a heterosexual identity yet expressed being attracted to the same sex at least once. Vrangalova and Savin-Williams (2010) found that 51% of men and 84% of women identified at least one component of his or her respective sexual orientation that

was incongruent with the self-identified heterosexual label. Individuals with slight nonheterosexual feelings, attractions, and behaviors, when given a choice of the three traditional labels of sexual orientation, are apt to select a heterosexual identity (Vrangalova & Savin-Williams, 2010). In light of this emerging research into the incongruency of self-identified sexual orientation with other dimensions of sexual orientation, researchers assessing participants in studies would find it pertinent to not only assess self-identified sexual orientation, but also assess sexual behavior, sexual attractions, and sexual fantasies.

The majority of researchers analyzing FBOE in men, however, use self-identification of sexual orientation as the sole measure of sexual orientation for an individual (e.g., Bogaert, 2003a, 2003b, 2007; Ellis & Blanchard, 2001; Gomez-Gil et al., 2011; Rahman, 2005). In circumstances when multiple dimensions of sexual orientation were assessed (e.g., behaviors, attractions, etc.), the participants' data were omitted from analysis if the subsequent dimensions assessed did not match the self-identified sexual orientation (e.g., participant indicates 'gay' as sexual orientation but indicates having some fantasies and behaviors that are heterosexual in nature; Schwartz, Kim, Kolundzija, Rieger, & Sanders, 2010). Eliminating participants based on inconsistencies in sexual orientation dimensions reduces the sample's diversity and thus reduces the external validity of the findings to the general population. Other FBOE studies used individuals presenting for treatment of gender dysphoria (e.g., Blanchard & Sheridan, 1992; Blanchard, Zucker, Bradley, & Hume, 1995). The individuals with gender dysphoria were subsequently classified into the nonheterosexual group. Gender dysphoria is not a component of sexual orientation development, but rather a component of transgender identity development and not predictive of sexual orientation (see Drescher & Byne, 2012). Bogaert (2003b) acknowledges that no current study exists using overt sexual behavior and attraction measures in assessing the sexual orientation of participants and how using sexual behavior and attractions impacts FBOE.

The current study addresses the lack of multidimensional assessment of sexual orientation within the FBOE literature by using Vrangalova and Savin-Williams' (2010, 2012) model of assessing not just self-selected sexual orientation, but also overt sexual behaviors, sexual fantasies, and sexual attractions. Based on other previous research, we hypothesized the following:

- Individuals who self-select a nonheterosexual sexual orientation identity will have a greater birth order number than individuals who self-select a heterosexual sexual orientation identity, as seen in previous studies researching the FBOE (e.g., Bogaert, 2003a, 2002, 2007; Ellis & Blanchard, 2001; Gomez-Gil et al., 2011; Rahman, 2005).
- Individuals who acknowledge the presence of same-sex sexual attraction will have a higher birth order than individuals who do not acknowledge the presence of same-sex sexual attraction.
- Those who acknowledge experiencing same-sex sexual fantasies will have a higher birth order than individuals who do not acknowledge experiencing same-sex sexual fantasies.
- Individuals who endorse same-sex sexual behavior (i.e., having a same-sex sexual partner) will have a higher birth order than individuals who do not endorse same-sex sexual behavior.

Method

Participant Recruitment and Data Collection Procedures

From October of 2013 until March of 2014, 2,372 participants (1,399 women, 973 men) responded to an invitation advertised for participants to answer questions about different sexual attractions, sexual orientations, and sexual behaviors. SurveyMonkey hosted both the informed consent and questionnaire. Individuals who provided consent continued to the questionnaire SurveyMonkey recorded 3,068 digital impressions, of which 2,988 provided consent, and 2,372 completed the questionnaire in its entirety. In an effort to protect confidentiality and anonymity, no identifiable information was collected.

Only right-handed men were used in the current study based on previous research evaluating FBOE and right-handed men (e.g., Bogaert, 2002, 2003a, 2003b). The total number of participants with data meeting the selection criteria (must be male and right-handed) in the current study was 742. However, 20 individuals did not complete all questionnaire items, therefore analysis was conducted on $N = 722$ men. Participants were recruited from introductory psychology courses, abnormal psychology courses, social media sites, various listservs, and Mechanical Turk. Participants taking an introductory or abnormal psychology class received course credit for participation in the experiment. Participants recruited from the Mechanical Turk site received 15 cents on completion of the survey. No other compensation was given for completion of the survey.

Procedures

Each participant accessed the link provided by the advertisements or online postings. The online questionnaire contained an informed consent describing for the participant the study was going to collect demographic information and information about his or her particular sexual orientation, sexual attractions, sexual fantasies, and sexual behaviors. If the participant consented, the participant completed the demographic information and multidimensional assessment of sexual orientation. Once the participant completed the online questionnaire, the participant was routed to a separate online questionnaire where the participant provided his own name and course instructor if receiving course credit. If a participant is not receiving course credit, the participant was finished with the survey, debriefed, and offered results of the research if they e-mailed the request to the researcher.

Measures

Birth order. Participants informed researchers of birth order by providing the number of siblings. Participants were asked four questions to identify the number of older brothers, older sisters, younger brothers, and younger sisters. The questionnaire stated to only include the number of siblings that had the same biological mother as the participant. Adoptive and step-siblings were not considered for this study. An example of the questions asked was, "How many older brothers (from the same biological mother as you) do you have? (enter a whole number)."

Handedness. Participants answered the question, "Do you consider yourself primarily right-handed, primarily left-handed, or ambidextrous?"

Self-identification of sexual orientation, attraction, and behavior. Research suggests when assessing multiple dimensions of sexual orientation, a researcher should assess sexual identification, sexual behavior, and sexual attraction (Badgett & Goldberg, 2009; Kinsey, 1941; Kinsey, Pomeroy, & Martin, 1948; Vrangalova & Savin-Williams, 2012). Vrangalova and Savin-Williams (2010, 2012) recommend assessing self-identified sexual orientation by asking one question about sexual orientation, two questions about sexual attraction, two questions about sexual behaviors, and two questions about sexual fantasy.

Sexual orientation identity label. Participants were asked, "How would you classify your sexual orientation?" and selected from one of five options (heterosexual, mostly heterosexual, bisexual, mostly gay/lesbian, gay/lesbian).

Sexual attraction. Participants were asked, "How sexually attracted are you to men?" and selected from a 7 point Likert scale ranging from 1 (*not at all*) to 7 (*very much*). Additionally, participants were asked "How sexually attracted are you to women?" and were presented with the same Likert scale.

Sexual behavior. Participants were asked, "What is the total number of male sexual partners you have had?" and "What is the total number of female sexual partners you have had?" A participant classified a sexual partner as someone whom the participant had penile-vaginal penetration, oral sex, anal sex, and/or mutual masturbation (Vrangalova & Savin-Williams, 2012).

Sexual fantasy. Consistent with Vrangalova and Savin-Williams (2010), participants answered the following question "What percent of your sexual fantasies during masturbation involve men?" and rated the question from 0% to 100%. Each participant also answered the following question "What percent of your sexual fantasies during masturbation involve women?" and rated the question from 0% to 100%.

Data Analysis

Determining birth order. Initially, Slater's Index (Slater, 1962) was used to determine the birth order of a proband using the number of older and younger biological siblings. Slater's Index requires taking the total number of older siblings and dividing by the total number of siblings. In this ratio, the proband is not included. Although this ratio helps adjust for family size of the proband, if the proband has no biological siblings then the ratio is undefined, therefore leaving analysis of an only child impossible using Slater's Index (Blanchard, 2014).

Berglin's Index (Berglin, 1982) is able to include probands that have no siblings because of a mathematical adjustment. Furthermore, Berglin's formula uses the proband when calculating the ratio of birth order. The formula takes the proband's birth order, subtracts .5, and then divides that by the total number of children. Blanchard (2014) suggests that this ratio might not be sensitive enough to larger families. Furthermore, when using Berglin's Index or Slater's Index, it might be important to match family size within the sample.

Blanchard (2014) proposes a third method that adjusts for family size, that is similar to Berglin's Index but allows for modified proportions based on the four types of siblings (older brothers,

older sisters, younger brothers, younger sisters) a proband can have. Of interest in this study is the modified proportion of older brothers, which the formula for the ratio is (the number of older brothers + .25), divided by (the number of total siblings + 1). Because of the diversity of the sample, all three methods of calculating birth order were used, and are referred to as Slater's Index (SI), Berglin's Index (BI), or Blanchard's Proportion (BP).

Data preparation. For the purpose of data analysis, respondents were split into two groups, a nonheterosexual and heterosexual group. For self-identified sexual orientation, individuals that selected 'heterosexual' were placed in the heterosexual group, whereas individuals selecting 'gay/lesbian' were placed in the nonheterosexual group. The 57 individuals who selected mostly heterosexual, 23 who selected bisexual, and 20 who selected mostly gay were not included in the grouping for self-identified sexual orientation. The majority of the research used for fraternal birth order (as well as other research on sexual orientation) relies on self-identification. Not including individuals who fall within the two extremes of sexual orientation (between heterosexual and homosexual) are not used in analysis (e.g., Bogaert, 2003a, 2002, 2007; Ellis & Blanchard, 2001; Gomez-Gil et al., 2011; Rahman, 2005), and the logic is followed in this study as it pertains to self-identification of sexual orientation.

For sexual behavior, participants that identified having any same-sex sexual partner (i.e., 1 or more) were placed in the

nonheterosexual group and individuals who did not identify having a same-sex sexual partner were placed in the heterosexual group. For sexual attraction, if a person selected 1 – *not at all* when answering the same sex sexual attraction question, the person was placed in the heterosexual group. If the person selected 2 or greater, they were placed in the nonheterosexual group. Finally, for sexual fantasies, if a person endorsed having same-sex sexual fantasies (i.e., 1% or greater) they were placed in the nonheterosexual group, otherwise they were placed in the heterosexual group. Given that Slater's Index requires the presence of a sibling, participants reporting no sibling ($n = 73$) were excluded from analysis of Slater's Index for all four dimensions (sexual orientation, attraction, behavior, and fantasies).

To evaluate whether differences between the study groups were present, we conducted independent t tests to determine whether the means between the heterosexual and nonheterosexual groups were significantly different on number of older brothers or sisters, younger brothers or sisters, and age (see Table 1). When grouping by self-identified sexual orientation, significant differences were found in age specifically in regards to sexual behavior (i.e., number of same-sex partners); however, this was not consistently demonstrated across dimensions. Age can confound observed relationships due to demographic shifts in fertility trends over time (Adsera, 2004). The significant difference in age between groups based on the presence of sexual behavior is better explained by

Table 1

Means and Comparisons of Age and Number of Siblings When Grouped by Multiple Sexual Orientation Dimensions

Variable	t	df	p	Heterosexual group		Nonheterosexual group	
				M	SD	M	SD
Age							
Self ID	.42	616	.67	33.44	13.11	32.87	13.25
Behavior	2.99	720	.003*	32.26	12.66	35.47	13.87
Attraction	-.64	720	.52	33.45	12.98	32.81	13.28
Fantasy	.70	720	.49	32.94	12.89	33.65	13.47
Number of older brothers							
Self ID	.55	616	.58	.57	.88	.52	.80
Behavior	-.39	720	.70	.55	.87	.53	.85
Attraction	-.72	720	.47	.56	.88	.52	.83
Fantasy	-.33	720	.74	.55	.88	.53	.83
Number of older sisters							
Self ID	.04	616	.97	.49	.79	.82	.76
Behavior	.02	720	.98	.47	.80	.47	.78
Attraction	-.66	720	.51	.48	.79	.44	.77
Fantasy	-1.38	720	.17	.50	.80	.41	.74
Number of younger brothers							
Self ID	.39	616	.70	.60	.92	.57	.84
Behavior	-.70	720	.99	.61	.92	.56	.81
Attraction	-.54	720	.59	.61	.94	.57	.82
Fantasy	-.21	720	.83	.60	.93	.58	.82
Number of younger sisters							
Self ID	-1.50	616	.13	.50	.89	.64	.97
Behavior	.82	720	.41	.51	.89	.57	.87
Attraction	.76	720	.45	.51	.91	.56	.85
Fantasy	1.22	720	.22	.50	.90	.59	.86
Total siblings							
Self ID	-.30	616	.77	2.16	1.72	2.21	1.62
Behavior	-.13	720	.90	2.14	1.70	2.12	1.59
Attraction	-.57	720	.57	2.17	1.74	2.09	1.57
Fantasy	-.28	720	.77	2.15	1.74	2.11	1.54

* $p < .05$.

individuals who endorse a nonheterosexual orientation, same-sex fantasy, or same-sex attraction, but have not engaged in sexual activity with a same-sex individual. Specifically, in the current data set, 46 of the 218 individuals who endorsed a nonheterosexual sexual orientation also reported having zero same-sex sexual partners.

Results

Participant Sociodemographics

The mean age of participants was 33.19 years ($SD = 13.09$) with a minimum age of 18 and maximum age of 79. The racial makeup of the participants was 77.3% Caucasian, 8.7% Latino, 5.1% African American, 4.4% Asian American, 2.5% Biracial or Multiracial, and 2.0% Other. The majority of participants identified as Heterosexual (69.3%), having at least a 2-year college degree (57.3%), and single/never married or in a long-term committed relationship (46.1%).

Multidimensional Assessment of Sexual Orientation

To demonstrate valid multidimensional assessment of sexual orientation, independent t tests were conducted to ensure the presence of significant differences in sexual behavior, fantasy, and attraction for each sexual orientation identification along the continuum (Vrangalova & Savin-Williams, 2012). Because significant differences in sexual behaviors, fantasies, and attractions were found in individuals who identified as mostly heterosexual from those that identified as heterosexual or bisexual, and significant differences were found in individuals who identified as mostly gay from individuals who identified as bisexual or gay, the multidimensional assessment was valid (See Tables 2, 3, and 4). The results replicated previous research (Vrangalova & Savin-Williams, 2012), as well as found significant differences between sexual orientation groups of bisexual, mostly gay/lesbian, and gay/lesbian. An independent samples t test was calculated comparing the mean percentages of same-sex sexual fantasies among bisexual men ($M = 52.48$, $SD = 29.48$) and mostly gay/lesbian men ($M = 96.65$, $SD = 4.15$). Significant differences in percentages were found, $t(23) = -7.11$, $p < .001$. No significant differ-

ences existed between mostly gay/lesbian men and gay/lesbian men. An independent samples t test was calculated comparing the mean percentages of opposite sex sexual fantasies among bisexual men ($M = 49.48$, $SD = 30.70$) and mostly gay/lesbian men ($M = 5.05$, $SD = 6.49$), and mostly gay/lesbian men and gay/lesbian men ($M = 1.20$, $SD = 3.01$). Significant differences in percentages were found for bisexual men and mostly gay/lesbian men, $t(24) = 6.77$, $p < .001$ and mostly gay/lesbian men and gay/lesbian men, $t(20) = 2.60$, $p < .05$.

Fraternal Birth Order Effect

Congruent with previous studies, t tests were conducted to compare birth order ratios between groups (e.g., Blanchard & Sheridan, 1992; Blanchard, 2014; Blanchard et al., 1995; Bogaert, 2003a, 2003b). An independent samples t test was calculated comparing the mean ratios of individuals who identified as heterosexual with individuals who identified as gay. In all three ratios, no significant differences were found. An independent samples t test was calculated comparing the mean ratios of individuals who identified having no same-sex attraction with individuals who identified as having at least some same-sex attraction. In all three ratios, no significant differences were found. An independent samples t test was calculated comparing the mean ratios of individuals who identified as having no same-sex sexual partners with individuals who identified as having had at least 1 same-sex sexual partner. In all three ratios, no significant differences were found. An independent samples t test was calculated comparing the mean ratios of individuals who identified as having no same-sex sexual fantasies with individuals who identified as having some presence of same-sex sexual fantasies. In all three ratios, no significant differences were found (See Table 5).

Discussion

The purpose of the present study was to assess the FBOE using a multidimensional assessment of sexual orientation. Most previous studies of FBOE classified individuals based on one dimension of sexual orientation, self-identification. When assessing for sexual orientation, it is not uncommon for individuals to self-select a heterosexual sexual identity label and later endorse nonhetero-

Table 2
Same Sex and Opposite Sex Sexual Attractions in Men by Sexual Orientation Groupings

Grouping	<i>n</i>	Same sex sexual attraction				Opposite sex sexual attraction			
		Strength of attraction		Difference in groups		Strength of attraction		Difference in groups	
		<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>
Heterosexual	500	1.22	.68	-8.13***	59.3	6.78	.73	3.04**	59.9
Mostly heterosexual	57	2.68	1.33	-6.07***	78	6.23	1.34	1.20	78
Bisexual	23	4.74	1.45	-3.28**	41	5.83	1.40	8.31***	41
Mostly gay	20	6.15	1.35	-2.48*	19.36	2.95	.83	8.44***	140
Gay	122	6.90	.33			1.52	.68		

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3

Same Sex and Opposite Sex Sexual Behaviors in Men for the Five Sexual Orientation Groupings

Grouping	<i>n</i>	Same sex sexual behavior				Opposite sex sexual behavior			
		Number of partners		Difference in groups		Number of partners		Difference in groups	
		<i>M</i>	<i>SD</i>	<i>t</i> test	<i>df</i>	<i>M</i>	<i>SD</i>	<i>t</i> test	<i>df</i>
Heterosexual	500	.61	5.59	−2.23*	56.8	13.52	21.26	.57	555
Mostly heterosexual	57	7.02	21.60	−2.13*	30.2	11.84	18.13	−.85	78
Bisexual	23	22.57	32.30	−.86	41	15.26	15.38	3.71**	24.63
Mostly gay	20	31.80	38.39	−.40	140	3.00	3.52	.91	140
Gay	122	35.29	35.82			1.80	5.71		

* $p < .05$. ** $p < .01$.

sexual behaviors and attractions, and the converse is true for some who endorse a nonheterosexual identity label (Baldwin et al., 2014; Diamond, 1998, 2005; Glover, Galliher, & Lamere, 2009). By using a multidimensional assessment of sexual orientation, the procedure provides a more representative sample of a population's sexual orientations (Vrangalova & Savin-Williams, 2012).

Within the current study, we sought to replicate the finding of Vrangalova and Savin-Williams' (2010, 2012) research on assessment of sexual orientation on a continuum. Looking at the five sexual orientation groupings 'heterosexual,' 'mostly heterosexual,' 'bisexual,' 'mostly gay,' and 'gay/lesbian,' significant differences in sexual behaviors and sexual attractions were observed between each adjacent grouping. Furthermore, expanding on Vrangalova and Savin-Williams' (2010, 2012) research, we observed significant differences in sexual fantasies between each grouping. The replication of the previous model and the addition of the significant findings in relation to sexual fantasies supports the idea first described by Kinsey et al. (1948) that sexual orientation exists on a continuum.

We sought to better understand whether individuals who select a nonheterosexual identity would have a higher birth order than those who select a heterosexual identity and individuals who endorse same-sex sexual attraction would have a higher birth order

than those who do not endorse a same-sex sexual attraction. Additionally, individuals who endorse same-sex sexual behaviors would have a higher birth order than those who do not endorse having same-sex sexual attractions and individuals who acknowledge having same-sex sexual fantasies would have a higher birth order than those who do not acknowledge having a same-sex sexual fantasy. Unlike previous earlier studies (e.g., Blanchard et al., 2006; Bogaert, 2002, 2003a; Cantor et al., 2002) but in line with Kishida and Rahman's (2015) study, a FBOE was not observed in the present sample, regardless of which dimension of sexual orientation was used to group individuals into 'heterosexual' and 'nonheterosexual' categories.

It is plausible that FBOE was not demonstrated within our current results because of obtaining more heterogeneous samples than previous studies for the heterosexual and nonheterosexual groupings. In the seminal studies on birth order (e.g., Slater, 1962) as well as more recent studies (e.g., Blanchard & Sheridan, 1992, 1992; Blanchard & Bogaert, 1996; Gomez-Gil et al., 2011; Slater, 1962; VanderLaan & Vasey, 2011) the researchers obtained more homogenous groupings for the heterosexual and homosexual groupings using convenience sampling and/or data matching techniques. Researchers use data matching to ensure equal group size in the differing between group conditions in an experiment. How-

Table 4

Same Sex and Opposite Sex Sexual Fantasies in Men for the Five Sexual Orientation Groupings

Grouping	<i>n</i>	Same sex sexual fantasies				Opposite sex sexual fantasies			
		Number of fantasies		Difference in groups		Number of fantasies		Difference in groups	
		<i>M</i>	<i>SD</i>	<i>t</i> test	<i>df</i>	<i>M</i>	<i>SD</i>	<i>t</i> test	<i>df</i>
Heterosexual	500	3.21	14.53	−4.59***	59.3	92.22	23.23	3.70***	63.7
Mostly heterosexual	57	21.09	28.98	−4.36***	78	76.79	30.49	3.62**	78
Bisexual	23	52.48	29.48	−7.11***	23	49.48	30.70	6.77***	24.25
Mostly gay	20	96.65	4.15	−1.73	136	5.05	6.49	2.60*	20.41
Gay	118	98.75	5.14			1.20	3.01		

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 5
Independent t Tests Results for Slater's Index (SI), Berglin's Index (BI), and Blanchard's Proportion (BP) and Self-Identification of Sexual Orientation, Behaviors, Attractions, and Fantasies

Variable	<i>t</i>	<i>df</i>	<i>p</i>	Heterosexual group		Nonheterosexual group	
				<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Identification							
SI	0.704	556	.48	.49	.43	.46	.44
BI	0.818	616	.41	.49	.26	.47	.27
BP	0.851	616	.40	.27	.20	.24	.19
Behavior							
SI	-1.290	647	.20	.49	.43	.44	.44
BI	-0.971	720	.23	.49	.26	.47	.27
BP	-0.831	720	.41	.26	.20	.24	.20
Attraction							
SI	-1.118	647	.26	.49	.43	.44	.44
BI	-1.076	720	.28	.49	.25	.47	.26
BP	-0.720	720	.47	.26	.20	.24	.20
Fantasies							
SI	-1.400	647	.16	.49	.43	.44	.43
BI	-1.404	720	.16	.49	.26	.47	.26
BP	-0.134	720	.89	.25	.20	.25	.20

Note. All results nonsignificant.

ever, with the absence of an established observable benchmark to gauge the external validity of the data matched information, unintended biases could be introduced (Arceneaux, Gerber, & Green, 2010).

We also purposefully did not use data matching technique in an effort to obtain a more racially diverse sample. Although most previous studies' participants were predominately white (e.g., Blanchard & Sheridan, 1992; Blanchard et al., 1995; Bogaert, 2003a; Cantor et al., 2002; Kinsey, Pomeroy, & Martin, 1948; Slater, 1962), we were able to obtain a more racially diverse sample as noted above. In the 2010 census, 72% of the U.S. population identified as white (U. S. Census Bureau, 2010), and in the current Study 77.3% of the participants identified as white. Thus the current sample is more reflective of the general population of the U.S. than other FBOE studies. The main concern for only using white participants in the past is attributable to family size differences between white and nonwhite individuals. Blanchard's (2014) proportion addresses the concern with family size and therefore all participants' data regardless of race or ethnicity were analyzed.

Additionally, the hypotheses were not supported potentially as a result of FBOE not being observed in a diverse population assessed for sexual orientation along a continuum. The previous studies looking at FBOE compare only two sexual orientation identifications found at the extreme ends of the sexual orientation spectrum (homosexual and heterosexual). Several studies compared the birth order of self-identified 'heterosexual' individuals with clients presenting for treatment at a clinic specializing in individuals with gender dysphoria, identifying as 'homosexual' (e.g., Blanchard & Sheridan, 1992; Blanchard et al., 1995).

Of note in the literature of the fraternal birth order effect is the tendency to pathologize development of a nonheterosexual orientation. Initial FBOE research using individuals who identify with gender dysphoria as representative of all nonheterosexual men

demonstrates a misunderstanding of the development of a nonheterosexual orientation and how an individual experiencing gender dysphoria is perceived both by the medical community and society. Although an entire discussion on gender dysphoria and gender identity development is not the focus of this discussion, it is pertinent to acknowledge that gender dysphoria is not a stage in nonheterosexual orientation development (Bilodeau & Renn, 2005; Cass, 1979; Diamond, 1998; Savin-Williams & Diamond, 2000), nor is it predictive that a child or adolescent that presents with gender dysphoria will necessarily become an adult who endorses a nonheterosexual orientation (for further discussion, see Drescher & Byne, 2012; Toscano & Maynard, 2014). To tie homosexual orientation to gender dysphoria alludes to a potential medical intervention (for gender dysphoria) to a recognized non-medical condition (one's sexual orientation). Therefore, a homogeneous homosexual male grouping using only men who identify as having gender dysphoria is potentially not representative of all nonheterosexual men. Researchers who use men who present with gender dysphoria or are transgender should exercise extreme caution when attempting to generalize results to nonrepresentative populations.

Furthermore, the literature presents the MIH as an aggressive explanation to the nonheterosexual orientation of a subsequent male child. The expectant mother's immune system is presented as recognizing the presence of a male fetus and 'attacking' the fetus. The immune system is not an aggressive, attack defense mechanism, but rather a complex cell memory system (e.g., Barbano, Spivak, Feng, Antoniotti, & Mishra, 2005). If the immune system is a memory system, then the mother's immune system is not attacking the male fetus and should not be presented as such. Future researchers are encouraged to ensure that discussion of sexual orientation and gender identity development is not presented as containing a pathological origin, but rather explored as naturally occurring differences in the spectrum of human sexuality.

Despite these potential limitations, the relevance of the current findings helps potentially clarify the impact of the FBOE. Blanchard (2014) states the FBOE has a relatively small effect size with the current definition of using effect sizes. The relatively small effect sizes of FBOE found in previous literature on more homogenous samples speaks to the sensitivity of the actual effect. Not finding the FBOE in a diverse sample alters the applicability of the effect to all populations. Our data suggest the FBOE might not be generalizable to the spectrum of sexual orientation. The FBOE might be present in more dichotomous populations such as sex offenders (e.g., Lalumière, Harris, Quinsey, & Rice, 1998), clients with gender dysphoria (e.g., Blanchard & Sheridan, 1992; Blanchard & Bogaert, 1996), and individuals who are transgendered (e.g., Gomez-Gil et al., 2011). Thus the FBOE may not be generalizable to the entire spectrum of sexual orientation, but rather to extreme points on the sexual orientation spectrum.

Future research into FBOE needs to address an important variable not discussed in the FBOE literature, fraternal sibling spacing. Fraternal sibling spacing is defined as the number of years in age between a male and his next oldest biological brother from the same mother. The MIH is hypothesized as a lifelong response of a mother to her unborn male child. However, many common immunities do not last a lifetime, and therefore the mother's hypothesized immune system response to male H-Y antigens could be time limited. Antibody levels peak usually within a few weeks post vaccination for common vaccines like influenza (Castilla et al., 2013) and gradually begin to decline (e.g., tetanus vaccinations fall below minimum level after 10 years; Centers for Disease Control, 2014). If the MIH is not a lifelong immunization, then the shorter the sibling spacing is between two brothers, the higher probability that the MIH impacts the younger brother in the dyad and therefore the FBOE could be moderated or mediated by fraternal sibling spacing.

We sought to use a multidimensional assessment of sexual orientation to help strengthen the literature on FBOE; however, current results failed to support the FBOE. Thus FBOE may not be observed across the sexual orientation spectrum. Together, our findings illustrate the importance of using a multidimensional assessment of sexual orientation when conducting research on the etiologies and biodemographic markers of sexual orientation. Future research on multidimensional assessment of sexual orientation and FBOE should evaluate whether fraternal sibling spacing is a potential mediator or moderator of the FBOE. In the meantime, researchers should begin to use multidimensional assessment of sexual orientation to recruit and analyze participants who are normally underrepresented or undersampled in current literature on nonheterosexual individuals. These results inform practitioners about the unique dimensions that shape a person's unique experience regarding his or her own sexual orientation.

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