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ORIGINAL PAPER

On the Relationship Between Domain-Specific Creative Achievement and Sexual Orientation in Swedish Twins

Miriam A. Mosing[1,2] · Karin J. H. Verweij[1] · Christoph Abé[3] · Örjan de Manzano[1] · Fredrik Ullén[1]

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Abstract Despite the commonly held belief that homosexual males and females are more creative compared to heterosexuals, empirical studies on homosexuality and its relationship to creativity have been sparse, often with questionable methodology and very small sample sizes, reporting mixed findings. No study till date has explored the associations described above in a large population-based and genetically informative sample. Here, we examined such potential associations between sexual orientation and creative achievement in several different domains (music, writing, dance, visual arts, science, invention, and theater) using a large cohort of 4494 Swedish twins (of which 7.5 % were not exclusively heterosexual). Data were analyzed for the sexes separately as well as pooled. Results showed significant associations between sexual orientation and two of the creative domains—theater and writing—with non-heterosexuals being more creative in these domains. In all other domains, no significant differences were found between the non-heterosexual and heterosexual groups. Findings from co-twin control analyses suggested that the significant associations may not be causal in nature (i.e., homosexual orientation leads to higher creativity) but due to shared liability. However, we lacked power to differentiate between shared genetic and shared environmental influences. Results and potential implications are discussed critically.

Keywords Sexual orientation · Twins · Behavior genetics · Creativity

✉ Miriam A. Mosing
miriam.mosing@ki.se

[1] Department of Neuroscience, Karolinska Institute, Retzius v 8, 171 77 Stockholm, Sweden

[2] Department of Medical Epidemiology and Biostatistics, Karolinska Institute, Stockholm, Sweden

[3] Department of Clinical Neuroscience, Karolinska Institute, Stockholm, Sweden

Introduction

"Creativity is the ability to produce work that is both novel (i.e., original, unexpected) and appropriate (i.e., useful, adaptive concerning task constraints)" (Sternberg & Lubart, 1999, p. 3). A commonly held belief is that homosexuals (here defined as individuals who are sexually attracted to members of the same sex), especially homosexual men, are more creative and more likely to work in a creative domain compared to heterosexuals (Charyton, 2008; Gautam, 2001). For example, it has been suggested that individuals among various professions, such as poets and fiction writers, are more likely to be homosexual, and musical entertainers, poets, artists, fiction writers, architects, and members of the theater are more likely to be bisexual (Ludwig, 1995). In line with that, gay men are alleged to have better fashion sense and taste compared to straight men and are therefore thought to make better fashion designers and interior decorators (e.g., Demb, 1992). Others list various eminent artists who were reportedly homosexual or bisexual such as Michelangelo, Sappho, Leonardo da Vinci, Adrienne Rich, Andy Warhol, and Gertrude Stein, implicating that homosexuality may contribute to creativity, especially in men (e.g., Rothenberg, 1994).

The earliest empirical study on this subject explored differences in creativity between 66 homosexuals and 150 heterosexual psychotherapy patients and reported heterosexuals to be more creative (Ellis, 1959). The study has been criticized for its use of a clinical sample and the measure of creativity—the therapist and author himself rated creativity (highly, moderately, or not creative) in each of his patients without the bases on which these ratings being clearly defined. However, another study (Domino, 1977), comparing four groups of homosexuals

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(28 homosexual social activists, 39 clients of a college counseling center indicating homosexual concerns, 26 homosexuals with an artistic occupation, and 32 "social homosexuals" recruited from gay bars) and four groups of control heterosexuals on nine domains of creativity, reported either no significant differences between groups or higher scores for heterosexuals.

These studies were conducted while homosexuality was still included in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM), i.e., before 1973. A more recent population-based study (Lewis & Seaman, 2004) reported that gay, lesbian, and bisexual individuals (about 180 of a sample of about 2000) were more likely to attend the arts (visits to museums, classical music concerts, and dance performances) than demographically similar heterosexuals; however, there was no convincing evidence for differences in active engagement in the arts between the groups. Further, Konik and Crawford (2004) reported that only bisexuals ($N = 39$) scored significantly higher on a measure of cognitive flexibility compared to homosexuals ($N = 95$) and heterosexuals ($N = 192$), and Bailey and Oberschneider (1997) reported that in a sample of 136 professional dancers, gay men comprised the majority of male dancers, while there was a much smaller prevalence of gay females. The most recent study asked 28 homosexual and 34 heterosexual males to participate in an online survey of self-rated creativity and found no significant differences between the groups (Noor, Chee, & Ahmad, 2013). In summary, despite the existence of strong stereotypes and speculations of greater creativity in homosexuals, empirical studies published in peer-reviewed journals have been sparse, often used inadequate methodology, very small and not population-based samples, focused mostly on males, and have reported mixed findings (for a comprehensive review, see Charyton, 2008).

Reasons for a potentially higher prevalence of homosexual individuals in some creative or artistic work environments are unclear. It often has been argued that environmental influences in reaction to an individual's homosexuality would best explain gay affinity for the arts (Lewis & Seaman, 2004), i.e., the fact that someone is homosexual causally (directly or indirectly) leads to a higher creative engagement later. For example, art venues may be more open-minded and welcoming toward homosexuals compared to other cultural events (e.g., soccer games, car races, etc.) which hold stronger prejudices against minorities and are more discriminating (Herek & Capitanio, 1996). Furthermore, an arty environment may allow homosexual individuals to express themselves in an accepting environment while in daily life they may feel more restricted (Harris, 1997). Finally, it has been suggested that demographically homosexuals are more likely to be educated, urban, and childless, and have a higher level of disposable income, which could make them more likely to consume and invest in the arts (e.g., Black, Gates, Sanders, & Taylor, 2000; Lewis & Seaman, 2004).

However, genetic influences have been shown to play a role in sexual orientation (Bailey, Dunne, & Martin, 2000; Bailey & Pillard, 1991; Bailey, Pillard, Neale, & Agyei, 1993; Kallmann, 1952; Kendler, Thornton, Gilman, & Kessler, 2000; Långstrom, Rahman, Carlstrom, & Lichtenstein, 2010), and it has been proposed that such genetic influences predisposing to homosexuality may also lead to increased creativity, i.e., that the link between homosexuality and creativity is of biological origin (Lewis & Seaman, 2004; Whitam & Mathy, 1986). For example, there has been some support for underlying hormonal and neurological (structural and functional) differences between homosexual and heterosexual individuals (Hu et al., 2014; Mustanski et al., 2005; Rahman, 2005; Savic, Garcia-Falgueras, & Swaab, 2010; Swaab, 2008; Swaab & Garcia-Falgueras, 2009). Further, despite some inconsistencies in the literature, the majority of studies on the familial transmission of creativity have shown a significant genetic component. The bulk of this literature consists of studies on "creative potential" in young age cohorts, using proxy measures such as divergent thinking and creative personality (e.g., Bouchard, Lykken, Tellegen, Blacker, & Waller, 1993; Nichols, 1978), while relatively few studies have used adult, genetically informative samples (i.e., twins and families) on creative interests and real-life creative achievement. However, moderate heritability has been reported for the following: artistic occupational themes and creative basic interests (Moloney, Bouchard, & Segal, 1991), interests in arts and crafts (Lykken, Bouchard, McGue, & Tellegen, 1993), creative writing (Tan & Grigorenko, 2013), working within a creative profession, and self-reported creative achievement (Kyaga, 2014; Piffer & Hur, 2014). Together, these findings suggest that shared genes could explain at least some of the association between creativity and sexual orientation.

In summary, the current literature suggests that although there may potentially be an association between sexual orientation and creativity, their mutual relationships and possible causes (i.e., shared genetic or environmental liability versus causal relationship) are still unclear. To our knowledge, no study till date has explored this association using a genetically informative sample. Here, we aimed to explore (1) potential associations between sexual orientation and creative achievement in several different domains using a very large population-based twin sample, and (2) whether such associations were truly causal or were mediated by underlying shared liability (i.e., genetic or shared environmental influences).

Method

Participants

The data were collected with two web-based surveys from a large Swedish twin cohort with approximately 32,000 twins

born between 1959 and 1985—the STAGE cohort (Lichtenstein et al., 2006). The first survey was conducted between 2005 and 2006 and included the questions about sexuality (number of same- and opposite-sex partners) and had a total of 11,229 male and 14,096 female participants ($M = 33.7$ years, $SD = 7.7$) (Långstrom et al., 2010). The second survey was conducted between 2012 and 2013 (for further detail on this survey, see Mosing, Madison, Pedersen, Kuja-Halkola, & Ullén, 2014; Ullén, Mosing, Holm, Eriksson, & Madison, 2014) and contained the creative achievement questionnaire (see below). In total, 11,543 individuals were willing to participate in the second survey. Data from the first survey were matched to the participants of the second survey, i.e., participation in both surveys determined inclusion in the present study. Means for the different CAQ sum-scales did not differ significantly between the subsample (with sexuality information) and the full sample. The final sample consisted of 4494 participants aged 27–54 years ($M = 41.0$, $SD = 7.7$) at time of the second survey. Single twins were included as they contributed to the estimation of means and variances.

Zygosity was determined based on questions about intra-pair resemblance. In the Swedish Twin Registry, this method has been shown to be more than 98 % accurate when zygosity status was confirmed using genotyping (Lichtenstein et al., 2002). The present study received approval from the Regional Ethics Review Board in Stockholm.

Measures

Sexual Orientation

Individuals were asked how many same-sex and opposite-sex partners they had had during their lifetime using two questions: "How many individuals of the opposite sex have you been together with sexually?" and "How many people of the same sex have you been together with sexually?" Individuals were scored as heterosexual (individuals who only reported opposite-sex partners and no same-sex partners) or as nonexclusively heterosexual (individuals who reported same-sex partners). Individuals who reported having had no sex partners were coded as missing for that variable. Of the total sample 7.5 % (N = 337) indicated not to be exclusively heterosexual (referred to as non-heterosexual here). See Table 1 for further details.

Creative Achievement

We used an adapted version of the Creative Achievement Questionnaire (CAQ; Carson, Peterson, & Higgins, 2005), a self-report inventory addressing involvement in seven different arts and science domains (music, writing, dance, theater, visual arts, science, and invention). The CAQ has been shown to possess high test–retest reliability ($r = .81$) and internal consistency ($\alpha = .96$), as

Table 1 Means and *SD*s for heterosexual and non-heterosexual participants for number of same- and opposite-sex partners and the creative achievement scales

		Females				Males				Combined			
		Non-heterosexual ($N = 234$)		Heterosexual ($N = 2547$)		Non-heterosexual ($N = 103$)		Heterosexual ($N = 1610$)		Non-heterosexual ($N = 337$)		Heterosexual ($N = 4157$)	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Opposite-sex partners[a]		7.95	10.45	6.02	6.50	6.52	11.80	7.94	10.10	7.49	10.92	6.76	8.14
Same-sex partners[a]		2.56	2.38	na	na	3.98	2.98	na	na	3.01	2.67	na	na
Subscales	Visual	1.64	1.12	1.60	1.10	1.39	0.90	1.33	0.95	1.56	1.06	1.50	1.05
	Music	2.18	1.44	2.15	1.41	2.05	1.47	2.02	1.50	2.14	1.45	2.10	1.44
	Dance	1.76	1.05	1.83	1.14	1.50	0.93	1.43	0.86	1.68	1.02	1.67	1.06
	Writing	1.68	1.18	1.43	0.98	1.48	0.95	1.33	0.94	1.62	1.12	1.39	0.97
	Invention	1.32	0.86	1.29	0.76	1.87	1.45	2.11	1.54	1.49	1.12	1.61	1.20
	Science	1.69	1.19	1.66	1.15	1.82	1.14	1.94	1.26	1.73	1.18	1.77	1.20
	Theater	1.58	1.14	1.41	0.96	1.64	1.18	1.31	0.86	1.60	1.15	1.37	0.93
Sum-scales	Artistic	8.84	3.71	8.43	3.41	8.06	3.36	7.42	3.02	8.60	3.62	8.04	3.30
	Scientific	3.02	1.58	2.95	1.53	3.69	2.00	4.05	2.34	3.22	1.74	3.37	1.96
	Total	11.86	4.30	11.37	4.04	11.75	4.08	11.47	4.10	11.82	4.23	11.41	4.06
	Versatility	2.40	1.90	2.18	1.76	2.30	1.75	2.16	1.63	2.37	1.86	2.18	1.71

Means could be equated between the sexes for all creative achievement variables without significant reduction of model fit

[a] About 50 individuals were winsorized at 3*SD* above the mean as they indicated a very high number of sex partners

well as reasonable predictive validity ($r = .59$) and convergent validity with other measures of creative potential ($r = .33$–$.51$) (for further details, see Carson et al., 2005). Each subscale consisted of a forced choice question with seven response alternatives, i.e., statements about achievement in a given domain, such as "I am not interested in music at all" to "I am professionally active as a musician and have been reviewed/featured in the national or international media and/or have received an award for my musical activities." The subscales were analyzed as continuous variables with scores ranging between 1 and 7. As an additional control, all phenotypic analyses of the creativity subscales were repeated with dichotomized scores comparing individuals who perform in public (scores 4–7) versus those who do not (scores 1–3). Further, four summary scales were derived: scientific (sum of invention and science), with scores ranging between 2 and 14, artistic (sum of visual, dance, music, writing, and theater) ranging between 5 and 35, versatility (number of domains where participant scored higher than one) ranging between 0 and 7, and CAQ total (sum of all items) ranging between 7 and 49, which were analyzed as continuous variables.

Phenotypic Analyses

To test for significant group differences, we compared means between the heterosexual and non-heterosexual groups, first separately for males and females and subsequently with both sexes combined. For this, maximum-likelihood procedures in the statistical package Mx were used, which accounts for relatedness of the sample (Neale, Boker, Xie, & Maes, 2006). In all analyses, age and sex were taken into account. In maximum-likelihood modeling, the goodness-of-fit of a model to the observed data is distributed as chi square, and the number of parameters to be estimated is reflected by the degrees of freedom. First, a saturated model is fitted, allowing for different means between the non-heterosexual and heterosexual groups. Subsequently, the model is more constrained by equating model parameters (e.g., means of non-heterosexuals and heterosexuals in a given creativity domain). Then the constrained model is compared to the saturated model, by testing the change in chi square ($\Delta\chi^2$) against the change in degrees of freedom (Δdf). This allows for testing whether constraining model parameters to be equal significantly worsened the model fit, i.e., whether the means between the groups are indeed significantly different. To correct for multiple testing (i.e., five creativity scales and the four sum-scales), a conservative p value of $\alpha = .01$ was considered significant.

Co-twin Control Analyses

A discordant co-twin control design was used to explore potential genetic and shared environmental mediation of existing associations between sexual orientation and any of the creative achievement domains. This design utilizes the fact that identical twins (MZ) share all their genes while nonidentical twins (DZ) on average only share 50 % of their segregating genes. Further, the two members of a twin pair (regardless of MZ or DZ) share aspects of their environment, such as experiences shared due to their common rearing—these shared influences make the twins more similar to each other. Therefore, analyses within twin pairs (MZ and DZ) control for such shared environmental influences and also for part of (within DZ) or even all (within MZ) genetic influences. Hence, if an association was truly causal and not mediated by genetic or familial effects, it would be assumed that this association is seen not only on the population level, but also within MZ and DZ twins discordant for their sexuality, i.e., a MZ/DZ homosexual twin would be more creative than his/her heterosexual co-twin.

However, if the association was due to shared genetic influences, we would expect that the effect would not be evident in discordant MZ twins (i.e., the heterosexual co-twin would be as creative as his/her non-heterosexual co-twin, and both would be more creative than the general heterosexual population) as they share all their genes. The effect would also be present in discordant DZ twins, even though to a lesser extent, as they share half their genetic make-up (i.e., the heterosexual co-twin would be less creative than his/her non-heterosexual co-twin, but still more creative than the general heterosexual population). Finally, if the association between sexual orientation and creativity was due to shared environment (i.e., the same environment which predisposes individuals to homosexuality also makes them more creative), we would expect to see the same pattern in MZ and DZ pairs (as both types of twins share their rearing environment), with no difference between the non-heterosexual and the heterosexual twin of discordant pairs in their creativity level. Hence, in this study, in addition to comparing non-heterosexual and heterosexual individuals on the population level, we compared the mean differences in creativity between individuals discordant for sexual orientation (non-heterosexual twin compared to heterosexual co-twin) within identical twin pairs (MZ) and nonidentical twin pairs (DZ), and we compared the heterosexual co-twin (of a discordant pair) to heterosexual unrelated individuals (without a non-heterosexual co-twin).

Results

Phenotypic Analyses

Means and *SD*s of the number of same- and opposite-sex partners and the creativity scales for the heterosexual and non-heterosexual groups are shown in Table 1. Mean analyses were first conducted separately for males and females; however, the means could be equated over sexes for all creative achievement variables without significant reduction of model fit. There were no significant differences between non-heterosexual and heterosexuals in the different creativity domains (single and summary scales), with the exception of non-heterosexual females scoring

Table 2 Results of mean analyses testing whether the estimates of the different creative achievement scales can be equated between non-heterosexuals and heterosexuals ($\Delta df = 1$) without a significant deterioration of model fit

		Females		Males		Combined	
		Δ-2LL	*p* value	Δ-2LL	*p* value	Δ-2LL	*p* value
Subscales	Visual	0.06	ns	0.77	ns	0.37	ns
(continuous)	Music	0.00	ns	0.01	ns	0.00	ns
	Dance	1.54	ns	0.48	ns	0.25	ns
	Writing	8.02	.005	2.48	ns	10.32	.001
	Invention	0.29	ns	1.40	ns	0.03	ns
	Science	0.07	ns	0.12	ns	0.00	ns
	Theater	3.04	ns	6.72	.009	8.31	.004
Sum-scales	Artistic	1.36	ns	2.88	ns	3.71	ns
(continuous)	Scientific	0.28	ns	0.82	ns	0.00	ns
	Total	1.45	ns	0.73	ns	1.97	ns
	Versatility	1.78	ns	0.83	ns	2.30	ns

Means could be equated between the sexes for all variables without significant reduction of model fit

significantly higher on the writing subscale and non-heterosexual males on the theater subscale. The effect was even more significant for both domains when males and females were combined, as the trends in the opposite sex were in the same direction. Results of the mean analyses for males and females combined for each of the variables are shown in Table 2. There was a trend for non-heterosexuals scoring slightly higher than heterosexuals in the artistic summary scale ($p = .05$). Results of the dichotomized creative achievement scales (not shown) comparing public performers versus those who did not perform in public resembled the continuous scale results. Finally, we tested whether the associations between sexual orientation and the writing and theater subscales were due to an IQ advantage of the non-heterosexual group (results not shown); however, we did not find a non-heterosexual IQ advantage in our data.

Co-twin Control Analyses

Co-twin control analyses were applied to writing and theater—the two domains which showed significant differences between non-heterosexuals and heterosexuals. Results are shown in Table 3. The left half of the tables shows the means for non-heterosexuals and heterosexual twins of discordant pairs (MZ and DZ) and results of univariate analysis of variance corrected for sex and age effects comparing the means of the two groups. The right half of the table shows the means for heterosexual individuals (not part of a discordant pair) and test results comparing the two heterosexual groups (discordant versus other). Although there were significant differences between non-heterosexuals and heterosexuals on the population level for the writing and theater domain, contrary to the causal hypothesis, the association was not evident within twin pairs, i.e., there was no significant difference within discordant MZ or DZ twins (left part of Table 3). Further, heterosexual twins of a discordant pair scored significantly higher than other heterosexual twins (not part of a discordant pair) in the theater domain, but not in writing (right half of Table 3). These findings suggest that, in the theater domain, regardless of zygosity, heterosexual co-twins of a non-heterosexual twin were similarly successful as their non-heterosexual co-twin and significantly more successful than other heterosexuals.

Discussion

The present study was the first to examine the potential associations between sexual orientation and creative achievement in several different domains using a large population-based genetically informative sample. Results showed that there were only significant differences in the domains of theater and writing with non-heterosexuals being more successful in these areas than heterosexuals. Our findings confirmed the hypothesis of higher creative engagement in non-heterosexuals only in specific domains (theater and writing) and not in others. While these findings partly confirm Ludwig's (1995) hypothesis of writers and individuals active in the theater being more likely to be homosexual or bisexual, we did not find the same for some other domains, such as dance (Bailey & Oberschneider, 1997), music (Ludwig, 1995), and the visual arts (Rothenberg, 1994). These discrepancies between our findings and these previous studies could be due to differences in the investigated measures and samples; however, we would like to emphasize that the present study was population based and much larger than any previous study, supporting the validity of our findings. The absence of a difference between non-heterosexuals and heterosexuals in the science and invention domain is in line with the fact that the common belief of a higher creativity of homosexuals mostly is confined to cultural- and art-related domains.

Table 3 Comparing means in Writing and Theater of identical (MZ) and nonidentical (DZ) pairs discordant for sexuality as well as means of heterosexual twins from a concordant pair for sexuality

		Discordant pairs							Other twins (not discordant)			
		Non-heterosexual			Heterosexual			Non-heterosexual vs. heterosexual	Heterosexual			Heterosexual discordant vs. heterosexual other
		M	SE	*N*	*M*	SE	*N*	*p* value	*M*	SE	*N*	*p* value
Writing	MZ	1.48	0.19	58	1.51	0.17	56	ns	1.38	0.05	543	ns
	DZ	1.72	0.19	48	1.62	0.20	51	ns	1.37	0.02	2135	ns
Theater	MZ	1.71	0.16	58	1.72	0.14	56	ns	1.31	0.04	543	.01
	DZ	1.34	0.18	48	1.81	0.19	51	ns	1.37	0.02	2135	<.01

All analyses are corrected for age and sex

Co-twin control analyses showed that, for writing, there was no significant association with sexuality in twins discordant for sexuality, i.e., when controlling for shared environmental and genetic influences. This finding could point to a noncausal association between the two traits. However, the fact that we did not find a significant difference between the heterosexual co-twin and other heterosexual twins (without a non-heterosexual co-twin) suggests a lack of power to detect differences between non-heterosexual and heterosexual individuals in these subgroups. Given the limited number of discordant twin pairs, we only have smaller subgroups to compare in these analyses. However, in the theater domain, although there was no significant difference within the discordant MZ and DZ groups, in both groups, the heterosexual co-twin of a non-heterosexual twin scored significantly higher than other heterosexual twins. The pattern suggests a noncausal explanation for the association, such as underlying shared liability. Shared environmental and genetic influences may affect both creativity as well as sexuality. This would mean that the same genes/environment increase an individual's predisposition to seek out same-sex experiences as well as to engage in creative activity (in theater); hence, there was no significant difference within discordant pairs (who share part or all of their genes and their entire family environment). Unfortunately, we lacked power to detect differences between MZ and DZ patterns and therefore could not distinguish between shared environmental and genetic influences.

In line with this finding, some research suggests partly shared neurobiological correlates of creativity and sexual orientation. For example, differences in certain cerebral features associated with sexual orientation as well as creativity have been observed, which might be partly explained by genetic and/or hormonal factors (Abraham et al., 2012; Arden, Chavez, Grazioplene, & Jung, 2010; Rahman, 2005; Savic et al., 2010; Swaab, 2008; Swaab & Garcia-Falgueras, 2009). If there is an overlap between cerebral features related to sexual orientation and creativity, it is reasonable to assume that the development of both might be related to concurrent neurobiological mechanisms. Although this speculation could partly explain our results, more research is needed to explore the potential neurobiological basis for the relationship between sexual orientation and creativity.

Further, the possibility that correlations between sexuality and creative achievement reflect shared genetic influences and common neurobiological mechanisms would also be in line with findings showing that homosexual and bisexual individuals display personality traits and occupational interests that are (partly) similar to traits and interests typical for the opposite gender (Lippa, 2005a, 2005b, 2008). A large body of research has shown that variation in personality traits is partly accounted for by genetic influences (for a comprehensive review, see Johnson, Vernon, & Feiler, 2008). Thus, sexual orientation-related differences in personality traits may partly mediate the associations seen between sexuality and creative achievement. Similarly, some sex differences in cognitive abilities have been reported (Kimura, 1999), with females usually obtaining lower scores than males on tasks which require spatial skills like mental rotation tests, and males scoring lower than females on tests of language skills, such as verbal fluency tasks (e.g., Halpern et al., 2007). Strikingly, it has been suggested that homosexual males may outperform heterosexual males on verbal fluency tasks (Rahman, Abrahams, & Wilson, 2003), and heterosexual males may perform better than homosexual males on a mental rotation test (Peters, Manning, & Reimers, 2007). Again, ample research shows that cognitive abilities are largely heritable (Plomin & Spinath, 2004), suggesting that differences in specific cognitive abilities between the groups may partly explain the finding of shared underlying liability between sexual orientation and creative achievement. However, sex- and sexual orientation-related differences in cognitive abilities remain a controversial topic (e.g., Ardila, Rosselli, Matute, & Inozemtseva, 2011; Heister, 1982; Tuttle & Pillard, 1991).

Although the present study is, to our knowledge, by far the largest and also the first one using a population-based genetically informative sample, there were several limitations which need mentioning. First, as a measure of sexual orientation (heterosexual vs. homosexual/bisexual), we used number of sex partners (same- and opposite sex), rather than whether individuals identified themselves as homosexual, bisexual, or heterosexual, as asses-

sed with the Kinsey scale (Kinsey, Pomeroy, & Martin, 1948). It has been shown that individuals can self-identify differently from their behavior (Stein, 1999). Therefore, another possible explanation of our findings could be that individuals who are active in theater and writing may be more open to same-sex experiences, but may not actually be more likely to be homosexual, i.e., they may be misclassified based on our measure. However, it has been shown that individuals are more likely to acknowledge homosexual attraction or behavior than to identify as lesbian or gay (Laumann, Gagnon, Michael, & Michaels, 1994; Lewis & Seaman, 2004). Next, given that sexuality is a sensitive topic and the questionnaire was not anonymous, participants may not have answered the questions honestly. However, participants were ensured that they could not be identified from the data published and that their names would be removed from the data before further analyses. Furthermore, sexuality is an open topic in Sweden and lesbian, gay, bisexual, and transgender rights in Sweden have been regarded as some of the most progressive in the world, suggesting that compared to data collected in other countries the present study may be relatively accurate. Finally, a large sample was used here to detect difference between the sexuality groups on the phenotypic level which provides ample power to detect even small effects. Considering this, it is important to mention that, albeit significant, the differences between the groups were small and not evident in many previously proposed domains. Thus, the observed higher CAQ scores in some domains might not be noticeable in daily life and should not be over-interpreted.

In summary, although in most domains there were no significant differences in creative achievement between heterosexuals and non-heterosexuals, the data suggested that non-heterosexuals or individuals who had same-sex sexual experiences may be slightly more active and successful in the domains of writing and theater. Further, these effects may be due to shared liability, rather than being causally associated, suggesting that the association is mediated by overlapping genetic or shared environmental factors which influence the predisposition to same-sex sexual behavior as well as creativity.

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