

Evidence for Heritability of Adult Men's Sexual Interest in Youth under Age 16 from a Population-Based Extended Twin Design

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ABSTRACT

Introduction. Sexual interest in children resembles sexual gender orientation in terms of early onset and stability across the life span. Although a genetic component to sexual interest in children seems possible, no research has addressed this question to date. Prior research showing familial transmission of pedophilia remains inconclusive about shared environmental or genetic factors. Studies from the domains of sexual orientation and sexually problematic behavior among children pointed toward genetic components. Adult men's sexual interest in youthfulness-related cues may be genetically influenced.

Aim. The aim of the present study was to test whether male sexual interest in children and youth under age 16 involves a heritable component.

Main Outcome Measures. The main outcome measure was responses in a confidential survey concerning sexual interest, fantasies, or activity pertaining to children under the age of 16 years during the previous 12 months.

Methods. The present study used an extended family design within behavioral genetic modeling to estimate the contributions of genetic and environmental factors in the occurrence of adult men's sexual interest in children and youth under age 16. Participants were male twins and their male siblings from a population-based Finnish cohort sample aged 21–43 years ($N = 3,967$).

Results. The incidence of sexual interest in children under age was 3%. Twin correlations were higher for monozygotic than for dizygotic twins. Behavioral genetic model fitting indicated that a model including genetic effects as well as nonshared environmental influences (including measurement error), but not common environmental influences, fits the data best. The amount of variance attributable to nonadditive genetic influences (heritability) was estimated at 14.6%.

Conclusions. The present study provides the first indication that genetic influences may play a role in shaping sexual interest toward children and adolescents among adult men. Compared with the variance attributable to nonshared environmental effects (plus measurement error), the contribution of any genetic factors seems comparatively weak. Future research should address the possible interplay of genetic with environmental risk factors, such as own sexual victimization in childhood. **Alanko K, Salo B, Mokros A, and Santtila P. Evidence for heritability of adult men's sexual interest in youth under age 16 from a population-based extended twin design. J Sex Med** **,*:**-**.

Key Words. Behavior Genetic; Twins; Pedophilia; Hebephilia; Sexual Interest

Introduction

There is a growing body of research concerning sexual interest in both prepubescent (i.e., pedophilia) and pubescent (i.e., hebephilia) children (for a review, see Seto [1]). Men are more prone to sexual interest in children than women

[2]. The prevalence of sexual interest in children is difficult to estimate due to the risk of underreporting given the sensitivity of the topic. Santtila et al. [3] reported 12-month incidence rates of adult men's sexual interest in prepubescent (less than 12 years of age) and pubescent girls and boys (12–15 years of age) for a population-based sample of male

twins. Of the 33- to 43-year-old participants, 0.2% reported sexual interest in children aged 12 or younger and 3.3% in children under age 16. In a community sample of 367 men aged 40–79 years from a metropolitan area in Germany, 3.8% ($N=14$) admitted to ever having had sexual contact with a child [4]. In the same sample, 9.5% of the respondents reported ever having masturbated to sexual fantasies involving children. Likewise, in a convenience sample of 193 male university students, 9% admitted to ever having experienced sexual fantasies concerning children [5]. Seto [1] concluded that pedophilia was rare, occurring with a frequency of less than 5% in the male population. Furthermore, the extant data, albeit scarce, seem to indicate that sexual fantasies involving children are more common than overt sexual abuse of children. It should be noted, however, that sexual abuse of children is not necessarily indicative of pedophilia. Some men may become sexually interested in or sexually abuse children due to situational factors or antisociality, for instance.

The etiology of sexual interest in children remains largely unknown. Despite speculation to this effect [6,7], no study to date has directly addressed the possibility of sexual interest in children being heritable. A small scale study by Gaffney et al. [8] found sexual paraphilias to be familial, also suggesting specificity for pedophilia in the familial transmission. The researchers compared the inpatient records of 21 nonpedophilic paraphiliacs, 33 pedophilic patients, and 33 depressed controls, studying whether other members of the families of the participants were also diagnosed with a paraphilia. The researchers used the family history research method (i.e., study of patient charts) to identify paraphiliacs among the relatives of the participants, a method that probably was sensitive to underreporting. Among male first-degree relatives, the morbidity risk for pedophilia was 10.3% within the families of pedophilic patients compared with 3.7% within the families of patients suffering from another paraphilia. The morbidity risk differed significantly (at $P < 0.01$) between the relatives of pedophilic and nonpedophilic patients. Recently, a pilot study involving five families in several generations reported familial aggregation for paraphilias [9]. The results support heterogeneity of paraphilias; in this case, the documented paraphilias were homosexual and heterosexual pedophilia and sexual sadism. However, the reported familial transmission could be due to either shared envi-

ronmental or genetic influences. Therefore, a genetically sensitive design, either a twin or an adoption study, would be required to resolve whether familial transmission was due to genetic or environmental effects.

The heritability of pedophilia has most likely not been studied because of sampling problems: a comparatively low prevalence in the population as well as likely resistance or denial on behalf of participants due to the possible legal consequences and social stigma related to the phenotype. It is also not clear why heritability should be expected. Heritable sexual interest in prepubescent children presents a Darwinian paradox considering that alleles contributing to such interest should be detrimental to biological fitness and should, therefore, be selected against. However, sexual interest in individuals of the same sex also shows heritability [10–13], presenting an equal paradox. It has been suggested that alleles contributing to sexual interest in individuals of the same sex could simultaneously convey other advantages that outweigh the negative consequences of homosexual interest with regard to producing offspring. For instance, there is some empirical evidence that genes coding for homosexuality could increase fecundity in female carriers of the alleles [14,15]. Sexual orientation in terms of gender can, to some extent, be compared with pedophilia (as a sexual preference in terms of age). Seto [16] concluded that in many ways, such as age of onset and stability over time, pedophilia and sexual orientation appear similar. Another aspect in which similarities between sexual gender orientation and paraphilias have been found is concerning neurodevelopmental factors. Rahman and Symeonides [17] found some support for neurodevelopmental influences on paraphilias, as has been found previously for sexual orientation (for a review, see Rahman [18]). The researchers found that scoring high on the paraphilic measure was related to a significantly greater number of older brothers, higher right-hand 2D:4D (ratio between the second and the fourth digit), and non-right-handedness compared with low-paraphilic scorers.

In any case, it could be that sexual interest in children could be a by-product of beneficial effects on another phenotype. A large body of research indicates that men are sexually attracted to indicators of youthfulness in potential sexual partners (e.g., Silverthorne and Quinsey [19]). Evolutionary theory researchers have proposed that men prefer youthfulness of the sexual object, as

youthfulness can be seen as a sign of fertility (literature reviewed by Seto [1]). Pedophilia might represent an extreme form of this youthfulness attraction, in combination with a failure to regulate the mechanisms controlling for behavior in cases when offending occurs [20]. A sizable proportion of men from community samples reacted with sexual arousal toward visual or auditive erotic stimuli displaying or describing prepubescent children [21–25].

Assuming that attraction to indicators of youthfulness is affected by multiple alleles and environmental factors, a rare combination of all alleles and environmental factors moving the person toward extreme interest in youthfulness indicators could result in sexual interest in children showing heritability.

Alternatively, heritable personality or cognitive characteristics could be the phenotypes that predispose individuals to sexual interest in children. Pedophilic child molesters seem to differ from nonpedophilic child molesters, sexual offenders against adults, and normal controls in several respects. There are indications of lower intelligence [26] and altered hormone levels [27] and hormonal responsivity [28] among pedophilic sexual offenders, for instance. Furthermore, both brain structure [29–32] and functioning [33–37] seem to differ based on magnetic resonance imaging studies. Pedophilic sexual offenders tend to perform worse in executive function tasks involving response inhibition and verbal fluency [30,38,39], as well as processing speed [40], although these findings are not unequivocal [41,42]. In addition, pedophilic individuals seem to differ in their electrophysiological brain responses as two studies indicated [43,44]. Finally, child molesters had somewhat higher average scores on scales measuring introversion compared with rapists with adult victims according to a meta-analysis based on 26 studies [45] (see also Becerra-García et al. [46]). More specifically, higher introversion was noted for 77 noninstitutionalized pedophiles from the community [47].

Both the peculiarities in neurocognitive abilities and in the personality traits of pedophilic men could be partially influenced by genetic effects. As most of the research on pedophilia relies on samples of incarcerated child molesters, however, it could also be the case that the observed peculiarities reflect the situation of pedophilic *offenders* rather than of pedophilic individuals in general [48]. In other words, deficits in response inhibition, brain abnormality, or particular personality

traits may not be representative of all pedophilic men but only reflect the problems of those who commit sexual offenses against children and get institutionalized subsequently.

Alternatively, heritability could be due to differences in susceptibility to environmental factors during development. Blanchard et al. [49] noted a cumulation of head injuries during childhood involving unconsciousness in the biographies of pedophilic men, for instance. Environmental theories about sexual offending etiology stress the role of adverse family environments (reviewed by Hanson and Morton-Bourgon [50]). For example, childhood sexual abuse has been found to be more frequently reported by child sexual offenders than non-offenders and nonsexual offenders. These robust findings were reported in meta-analyses both among adolescents [51] and adults [52]. However, experiencing childhood sexual abuse cannot be seen as a causal factor to later child sexual offending, and generally speaking, childhood sexual abuse has been associated with an array of detrimental consequences. Santtila et al. [53] reported that childhood sexual interactions with other children increased the likelihood of adult sexual interest in children aged 15 or younger, especially in interaction with own experiences of childhood physical and sexual abuse. It may be that the likelihood of such experiences resulting in sexual interest in children might vary according to genetically determined susceptibility of the person to environmental influences. In a sample of hospitalized pedophilic child molesters, Mokros et al. [54] compared the correlative links of adverse childhood experiences (such as parental neglect), signs of cerebral perturbation (e.g., low intelligence), and own experiences of sexual abuse with the expression of pedophilic inclination as evident in the offense history. The factors of own sexual victimization and adverse childhood experiences were statistically significant predictors for the expression of pedophilia.

A possible way to conceptualize the potential interplay of a genetic liability with detrimental experiences is to consider a gene–environment interaction model. This means some individuals would be genetically more vulnerable to respond to adverse environmental circumstances, such as childhood sexual abuse, by developing sexual interest in children. In fact, a gene–environment interaction model could integrate findings of different kinds, such as early neurodevelopmental deviances, and adverse childhood experiences,

such as childhood peer rejection, or other experiences, such as childhood sexual interaction with other children. However, even if such an interaction-based theory could help us understand how a sexual interest in children could develop, it does not explain why some men would go on to offend children whereas other men do not offend. For other phenotypes, such as genetically determined susceptibility effects have been found. For instance, Kohen et al. [55] reported the results from a meta-analysis: a functional polymorphism of the enzyme monoamine oxidase A moderated the association between childhood maltreatment on the risk of developing antisocial behavior, constituting a genetic vulnerability factor.

The aim of the present study was to test whether male sexual interest in children involves a heritable component. We used twin model fitting to estimate the likely contributions from genetic and environmental sources. As sexual interest in children is more common in men than in women [2], the analyses were limited to male twins and their male siblings. Still, the low occurrence of the phenotype in the sample did not permit looking specifically at pedophilic sexual interest (i.e., sexual interest in prepubescent children). Instead, the study refers to sexual interest in prepubescent and pubescent children (measured as sexual interest in children under the age of 16). Adolescents aged 15 may be considered past the age of pedohebephilic interest (the age range for hebephilia is usually considered 11–14); the results from our research may concern a possible genetic component in sexual interest directed toward youthfulness more generally. We expected a component of heritability to be present as earlier studies indicated a genetic influence for the related domains of sexual orientation [10–13], as well as for problematic sexual behavior [56] and sexual dysfunction [57].

Methods

Sample

The sample size was 3,967 men. For the genetic analyses, 962 monozygotic (MZ) and 2,124 dizygotic (DZ) twins, as well as 881 male siblings, were available. Out of the pairs of twins whose zygosity could not be determined, one twin per family was chosen for further analyses, in which his zygosity was set to DZ. Male twins from opposite-sex twin pairs were also grouped together with same-sex DZ twins. Zygosity was determined using questionnaire items completed by the twins [58]. Pre-

vious studies have shown that this method of zygosity determination is 95% accurate when compared with blood typing analyses [59].

All participants were 21 years of age or above. The legal age of consent in Finland is 16 (or 18 in case the offender holds a trusted position), with the perpetrator being at least 5 years older than the child/youth. Thus, participants at least 5 years older than the object maximum age were chosen. Some participants younger than 21 reported sexual interest and activity with children below age 16; however, these participants were excluded.

The sample came from the “Genetics of Sexuality and Aggression Study” (GSA), a large project conducted at the Center of Excellence in Behavior Genetics at Abo Akademi University. The main GSA sample consists of two separate data collections. The first data collection was carried out in 2005 and targeted 33- to 43-year-old twins. The second data collection was carried out in 2006 and targeted 18- to 33-year-old twins and their siblings over 18 years of age. The participants were identified from the Central Population Registry of Finland and were native Finnish speakers, born and currently residing in Finland. There was no overlap between the samples. In the first data collection, questionnaires, followed by a reminder letter and later a new questionnaire, were sent to 5,000 twin pairs (2,000 male same-sex pairs, 2,000 female same-sex pairs, and 1,000 opposite-sex pairs) and finally returned by 3,604 participants, resulting in an overall response rate of 36%. The response rate was 27% for male participants. In the second data collection, 23,577 twins and their over 18-year-old siblings were contacted. Those who consented to participate could do so via a secure web page or through posted questionnaires. A total of 10,524 participants responded to the survey, yielding an overall response rate of 45%. The response rate was 34% for male participants. The sample consisted of 4,445 male participants altogether. Out of these, a subsample was selected, as described above. The questionnaires in both data collections were extensive and covered a wide range of sexual behaviors and attitudes, childhood experiences, aggression, and alcohol use. The purpose of the study was clearly described and the voluntary and anonymous nature of the participation emphasized.

The research plan was approved by the Ethics Committee of the Department of Psychology at Abo Akademi University.

Measures

A measure consisting of three dimensions, especially designed for the GSA data collection, was used to measure sexual interest, masturbatory fantasies, and actual sexual behavior with children and adolescents. The questions were the following: "To which age group did the person belong that you during the last 12 months (i) felt sexually interested in and had sexual fantasies about, (ii) thought of while masturbating, and (iii) engaged in sexual activity with?" Responses were indicated as age category options: 0–6, 7–12, 13–15, 16–19, 20–25, 26–30, 31–35, 36–40, 41–50, 51–60, and 61 and up. For the present analyses, dichotomous categories were created, consisting of affirmative replies to any of the first three age categories (ages 0–15). Hereafter, variables were age regressed for use in genetic analyses.

Statistical Analyses

All phenotypical statistical analyses were conducted using SPSS 19 (SPSS Inc., Chicago, IL, USA). The genetic analyses were conducted using the program Mx [60] (Neale, Boker, Xie, & Maes, 2002), a software using structural equation modeling specialized for twin data. The standard quantitative genetic model for twin data rests on the assumption that the observed (phenotypical) variance (Vp) in a trait is a linear function of additive genetic influences (A), nonadditive genetic influences (D), common environmental influences (C), and nonshared environmental influences (E) (i.e., $Vp = A + D + C + E$). Additive genetic influence refers to the total effects of multiple alleles on the phenotype. Nonadditive genetic influence refers to the interactive effect among multiple alleles that occupy the same loci on different chromosomes (i.e., dominance) and multiple genes (i.e., gene–gene interaction) on the phenotype. Shared and nonshared environmental influences refer to non-genetic influences that contribute to familial resemblance among relatives and nongenetic influences that uniquely influence individuals, respectively [61]. When estimating these components, measurement error is subsumed under the nonshared environmental source of variance. A twin model that includes additive genetic influences, nonadditive genetic influences, and shared and nonshared environmental influences simultaneously would not be statistically identified [62]. Therefore, either nonadditive or common genetic effects are measured together with additive genetic and unique environmental effects. In the present

work, both *ACE* and *ADE* models were estimated for comparative purposes.

The relative contributions of *A*, *C/D*, and *E* effects for each measure were estimated using a series of structural equation model-fitting analyses. Models were estimated by full-information maximum likelihood estimation, using the program Mx [60]. The goal of this process was to minimize twice the negative log likelihood ($-2LL$), which is essentially an index of the discrepancy between the data and the model. A $-2LL$ estimate is estimated for each individual, and the individual $-2LL$ estimates are summed over the entire sample to estimate the overall $-2LL$. Comparisons between models were made using the likelihood comparison of the $-2LL$ estimate for the models, which is distributed as a chi-square statistic. A nonsignificant decrease in the $-2LL$ indicates that the model with fewer parameters provides a reliable and more parsimonious fit to the data compared with the full model and should therefore be preferred. We also compared models using Akaike Information Criterion (AIC) [63] and sample size adjusted Bayesian Information Criterion (SABIC) [64]. Models having lower *AIC* and *SABIC* values are preferred. Raw data were used in the analyses with Mx.

Results

Prevalence of Sexual Interest in and Sexual Behavior with Children under the Age of 15

Of all participants, 148 individuals reported sexual interest in, masturbatory fantasies about, or sexual activity with children under the age of 16. Sexual interest in children was reported by 123 men, whereas masturbation to fantasies of children under age 16 was reported by 104 individuals. Sexual behavior together with a child under age 16 was reported by 10 individuals. Table 1 shows that some participants had chosen several categories,

Table 1 Number of participants aged 21 or above reporting sexual interest in and behavior with children below 16 years of age

	Age categories			
	0–6	7–12	13–15	0–15 (%)
Interest	4	19	121	123 (3.0)
Masturbation	3	13	102	104 (2.7)
Sexual behavior	2	—	8	10 (0.3)

Note. N varied between 3,730 and 3,909 due to missing values. The participants responded to the following question: "To which age group did the person belong that you during the last 12 months (i) felt sexually interested in and had sexual fantasies about, (ii) thought of while masturbating, and (iii) engaged in sexual activity with?"

as the total number of participants who reported sexual interest in children is lower than the sum of participants for each variable over the three age categories.

Correlations with Age of Participants

Small negative associations were found between participant age and sexual interest in and masturbation while thinking about children, indicating that younger respondents (albeit above 21 years of age) tended to report higher sexual interest ($r_p = -0.08$, $P < 0.01$, Wald $\chi^2 = 8.61$, $P < 0.01$) and masturbation ($r_p = -0.09$, $P < 0.01$, Wald $\chi^2 = 4.32$, $P < 0.05$) involving children from these age groups. A nearly significant negative association was found also between participant age and sexual behavior with children ($r_p = -0.08$, $P < 0.01$, Wald $\chi^2 = 3.4$, $P = 0.06$).

Twin Intraclass Correlations (ICCs)

ICCs were computed separately for the two variables of sexual interest toward children. There were, however, too few cases to calculate twin ICC reliably for the sexual behavior with children variable. For the other two variables, the correlations indicated that genetic influences contributed to the variance in these measures, as MZ correlations were consistently higher than DZ correlations (Table 2). There was no suggestion of the involvement of shared environmental influences as the DZ correlations were not higher than half the MZ correlations. Genetic factors did not account completely for the observed variance because the MZ twin correlations were not united. This denotes that nonshared environmental influences and/or measurement error also contribute to variance in the variables of interest.

Genetic Model Fitting

Results from model-fitting analyses are presented in Table 3. Analyses were not conducted for sexual behavior with children because there were too few participants reporting such activity.

Small genetic influences were found for both the sexual interest and masturbatory fantasies. No common environmental influences were found, and an ADE model better fitted the data. When estimating whether a significant decrease in model fit occurred when a parameter (A , D) was left out of the model, leaving both genetic parameters out of the model resulted in a significant decrease in model fit. However, it was not possible to identify what kind of genetic influences were more influential. That is, if genetic influences were entirely left out of the model, then the model did not describe the observed data as well as a model including genetic influences. The nonshared environmental component explained the largest proportion of the variation in the individual responses for both the sexual interest in and masturbatory fantasies about children variables.

Discussion

The present study was the first behavior genetic study on male sexual interest in and masturbatory fantasies about children and adolescents under the age of 16. This is the first study that has been able to empirically demonstrate a heritable component to sexual interest in children. The study was based on a population-based large sample, avoiding many of the sampling problems of prior research.

A heritable component was found for both sexual interest in and masturbatory fantasies about children, as expressed by the items "I have felt sexual interest toward and had sexual fantasies about persons below age 16" and "I have masturbated to fantasies of persons below age 16." The genetic component was small and the remaining variation between participants was explained by a large nonshared environmental component. The present study was, thereby, able to resolve why Gaffney et al. [8] as well as Labelle et al. [9] found pedophilia to be a familial paraphilia. The researchers in the first study found that pedophilia was specifically transmitted in the family, in

Table 2 Twin intraclass correlations (95% confidence intervals) for sexual interest in, masturbation with, and sexual activity with children

	MZM	DZM	Sibling-sibling	Twin-sibling
Sexual interest	0.20 (0.07, 0.31)	-0.04 (-0.16, 0.08)	-0.03 (-0.32, 0.27)	-0.03 (-0.25, 0.18)
Masturbation	0.19 (0.06, 0.31)	-0.05 (-0.17, 0.08)	-0.03 (-0.36, 0.31)	-0.03 (-0.26, 0.19)
Sexual activity	—	—	—	—

Note. There were too few cases per cell to estimate correlations for sexual activity. N varied between 3,730 and 3,909 due to missing values. The participants responded to the following question: "To which age group did the person belong that you during the last 12 months (i) felt sexually interested in and had sexual fantasies about, (ii) thought of while masturbating, and (iii) engaged in sexual activity with?" Variables were age-regressed prior to calculating the correlations. MZM = monozygotic male pairs; DZM = dizygotic male pairs

Table 3 Estimates and 95% confidence intervals from full ACE and ADE models for male sexual interest and masturbation to thoughts of children below age 15

	A	C/D	E	-2LL*	AIC	BIC adjusted for sample size	$\Delta\chi^2$			
							ACE vs. CE ADE vs. DE	ACE vs. AE ADE vs. AE	ACE vs. E ADE vs. E	
Sexual interest Masturbation	ACE									
	0.106 (0.000; 0.197) 0.131 (0.000; 0.256)	0.000 (-0.000; 0.072) 0.000 (0.000; 0.092)	0.894 (0.803; 0.985) 0.869 (0.744; 0.996)	-2,764.933 -3,190.416	-10,700.933 -10,792.416	-11,098.546 -10,842.909	3.334 2.811	0.00 0.00	5.223 4.117	
Sexual interest Masturbation	ADE									
	0.000 (0.000; 0.158) 0.000 (0.000; 0.200)	0.146 (0.000; 0.245) 0.198 (0.000; 0.332)	0.854 (0.756; 0.956) 0.802 (0.668; 0.950)	-2,767.562 -3,193.126	-10,703.562 -10,795.126	-11,099.861 -10,844.264	0.000 0.000	2.629 2.710	7.852* 6.827*	

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

The best fitting models are bolded.

A = additive genetic influences; C = common environmental influences; D = nonadditive genetic effects; E = nonshared environmental influences; AIC = Akaike Information Criterion; -2LL = twice the negative log likelihood;

BIC = Bayesian Information Criterion

contrast to other paraphilias, which were nonspecifically transmitted. The findings of the latter study supported the heterogeneity and familiarity of paraphilias. The question raised by the studies was whether the transmission was caused by genetic influences or family environment. It seems, in light of the present results, that at least part of the transmission could be due to genetic influences.

The fact that a genetic component to sexual interest in children was found would seem at a first glance to suggest a Darwinian paradox. Why would genes that do not promote reproductive success remain in the gene pool? As presented in the introduction, there are several alternative theoretical explanations according to which sexual interest in children could be genetically influenced. Considering that also adolescents (those aged 15) were included in the object age group, it is possible that a more general youthfulness attraction might account for (part of) the genetic influences. However, the present study was not able to resolve which of these possibilities is most likely.

The results about the prevalence rates of pedophilic and hebephilic sexual interest and behavior are consistent with the reported results using a subgroup from the same sample [3]. The present study reported on an additional item: masturbation to thoughts about children of specific age groups. The prevalence of male participants reporting masturbating to thoughts about children below age 16 was 2.7, which is in line with the sexual interest prevalence estimate. The assumption made during data collection was that masturbation to thoughts about children would be less frequent than sexual interest to children. Mechanisms controlling for acting out fantasies behaviorally, even in private, were thought to be stricter than those for sexual thoughts and interest. This finding is also in accordance with the data reported by Ahlers et al. [4], as well as by Brière and Runtz [5] who noted lower frequencies for overt behavior than for ideation. Furthermore, the prevalence data showed that sexual interest in pubescent children is more common than sexual interest in prepubescent children—an outcome that is plausible if pedophilic sexual interest is considered a more extreme (and therefore less common) variant of sexual age preference than hebephilic sexual interest [3]. A small negative correlation was found between sexual interest and age, that is, younger men reported slightly more sexual interest in children below age 16. The correlation might be explained by a trend by younger participants to

report on sexual interest in adolescents (or children), for example, there might be fewer restrictions for a 22-year-old than for a 45-year-old to report that he can find a 15-year-old attractive. If considering the youthfulness attraction hypothesis, it could be that men in their most fertile years express a stronger attraction to youthfulness than slightly older men.

Limitations and Future Research

It was not possible to differentiate between pedophilic and hebephilic interest, or interest in adolescents aged 15 (i.e., aged above what has been considered age limits of hebephilia), due to the low frequency of both types of sexual interest. Moreover, there were too few informative pairs of twins reporting sexual activity with children to enable statistical analyses. Therefore, the results and the subsequent discussion mainly concern sexual interest in and masturbatory fantasies about children.

There are some limitations that need to be considered. First, it is likely that the extent to which participants have reported sexual interest, masturbatory fantasies, and, especially, sexual activity with children is an underestimate of true prevalence rates. Very likely, social desirability and fear of consequences of being detected might have led some participants not to report truthfully. Furthermore, it is possible that self-selection bias and attrition bias were influencing individuals who decided to fill in the questionnaire and to complete it. Individuals with socially undesirable sexual interests might have not wanted to fill in the questionnaire in the first place or then decided not to complete it. However, it is also possible that individuals who were concerned about their sexual interests actually were more eager to participate and complete the questionnaire, as they might have felt that somebody at last openly asked about the topic.

These first results suggest that future research should aim at studying genetic influences on sexual interest in children and pedophilia more in depth. A pertinent question to study would be gene-environment interactions involving childhood maltreatment and sexual abuse experiences. Furthermore, the relevance of genetic correlations should be explored. Given the low prevalence of the phenotype of sexual interest in children, it seems challenging, however, to combine it with another relatively rare condition. Between 1% and 3% of boys, for instance, were estimated to become victims of sexual abuse in Finland until the age of 15 years [65]. Consequently, an even

much larger sample than the present one or other research designs would be necessary to study both phenotypes in conjunction.

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Statement of Authorship

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