Handedness in Pedophilia and Hebephilia

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A sample of 404 adult men underwent assessment following illegal or clinically significant sexual behaviors or interests. Patients' assessments included: administration of a modified version of the Edinburgh Handedness Inventory; recording of patients' phallometric (penile) responses to erotic stimuli depicting adults, pubescent children, and prepubescent children of both sexes; and a tabulation of the numbers of patients' victims, ages 0–11, 12–14, 15–16, and 17 and older, of both sexes. In Study 1, patients' right-handedness scores correlated negatively with their phallometric responses to stimuli depicting prepubescent children and positively with stimuli depicting adults, replicating the pattern described in a previous report (Cantor et al., 2004). Unlike the previous study, however, patients' handedness scores did not significantly correlate with their numbers of prepubescent victims. To explore this discrepancy, Study 2 combined the patients from this replication sample with those in the previously reported sample, categorizing them by the sex and age group of greatest erotic interest to them. The odds of non-right-handedness in men offending predominantly against prepubescent children were approximately two-fold higher than that in men offending predominantly against adults and three-fold higher after eliminating those men with intrafamilial (i.e., incest) offenses. Handedness differences between men erotically interested in males versus females were not statistically significant. These results indicate that the rates of non-right-handedness in pedophilia are much larger than previously suggested and are comparable to the rates observed in pervasive developmental disorders, such as autism, suggesting a neurological component to the development of pedophilia and hebephilia.

KEY WORDS: handedness; laterality; neuropsychology; pedophilia; phallometry; sexual abuse; sex offenders.

INTRODUCTION

Men with primary erotic interests either for prepubescent children or pubescent children show poorer performance on intelligence and other neuropsychological tests than do men with a primary erotic interest for adult sexual partners (e.g., Cantor et al., 2004). We refer to erotic interests for these age groups as *pedophilia* (von Krafft-Ebing, 1886/1965), *hebephilia* (Glueck, 1955), and *teleiophilia* (Blanchard, et al. 2000), respectively. Cognitive performance appears to relate more strongly to pedophilic and hebephilic interest than to the propensity to commit sexual offenses in general or to the propensity to commit offenses of a nonsexual nature. Unlike samples of men showing evidence of erotic interest in children, samples of sexual offenders against adults have not as consistently shown neuropsychological test scores lower than control groups or test norms (e.g., Quinsey, Arnold, & Pruesse, 1980; see also Blanchard, Cantor, & Robichaud, in press, for a review). Similarly, when compared with sexual offenders against children, men who have committed only nonsexual crimes typically score higher (e.g., Wormith, 1986).

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One possible explanation for the association between erotic interest in children and poorer cognitive ability is that they both reflect an underlying brain dysfunction, one that prevented the development of more typical intellectual and sexual characteristics, as we have previously proposed (Blanchard et al., 2002). Alternately possible is that the observed group differences on cognitive neuropsychological tests resulted from an ascertainment bias: Sexual offenders against children could be more likely to be apprehended if they have poorer cognitive abilities, and sexual offenders with greater cognitive abilities could be more likely to be well employed, to afford superior legal counsel, and to escape conviction (Blanchard et al., 2002; Cantor et al., 2004). Thus, sexual offenders against children might score lower on tests of intellectual function merely because such men are more likely to become available to research studies.

Developmental neuropathologies manifest in many cognitive and behavioral characteristics, one of which is an increased probability of non-right-handedness, and the evaluation of handedness comprises a standard component of neuropsychological assessment. Non-right-handedness occurs in approximately 8–15% of the general adult population (see Hardyck & Petrinovich, 1977 for a review), but 1.5–3.0 times more frequently in populations with any of several neurological disorders. Such disorders include Down's Syndrome (e.g., Batheja & McManus, 1985), epilepsy (e.g., Schachter et al., 1995), autism (e.g., Soper et al., 1986), learning disabilities and dyslexia (e.g., Cornish & McManus, 1996), and mental retardation (e.g., Grouios, Sakadami, Poderi, & Alevriadou, 1999).

The association of handedness with pedophilia and hebephilia can thus inform several issues regarding the etiology of erotic age preference. First, elevated rates of non-right-handedness would argue against the aforementioned ascertainment bias explanation of the poorer neuropsychological functioning among these men. Although it seems plausible to assert that men with poorer cognitive skills are more likely to be apprehended and convicted, it is much less plausible to posit that handedness would substantially affect rates of apprehension (over and above any effects of poor cognitive functioning itself). An elevated rate of non-right-handedness in pedo- and hebephilic men relative to that rate in teleiophilic men would instead suggest an association between erotic age preference and brain function. That is, non-right-handedness would be serving as a marker of an underlying neurological difference between teleiophilic and non-teleiophilic groups.

Researchers differentiate natural left-handers (who may have inherited an increased probability of sinistrality from their parents) from *pathological* left-handers, for whom sinistrality resulted from a compensatory reaction of the developing brain to some trauma (e.g., Bishop, 1990). When one hemisphere of the brain suffers damage during development, the other may take on additional functions, including those expressed through handedness (Bakan, 1971; Bakan, Dibb, & Reed, 1973). Because one cerebral hemisphere (the left) achieves functional dominance in the great majority of humans, any perturbations sufficient to alter hemispheric dominance and equally likely to occur in either will exaggerate the frequency of the less common outcome (Satz, 1973). That is, changes in cerebral dominance from left-to-right will be much more common than changes in dominance from right-to-left because many more cases start out with dominance in the left hemisphere to begin with (for reviews, see Bishop, 1990; Coren & Halpern, 1991). This property permits elevated rates of sinistrality to denote perturbation(s) occurring during brain development.

Although elevated rates of non-right-handedness in pedo- and hebephilia would argue for a neurological contribution to the etiology of those conditions, it would also argue against any simple, focal-lesion model of that contribution. Some investigators have described case studies of individuals who suffered brain injury or disease in adulthood and subsequently engaged in sexual offenses, often against children (e.g., Mendez, Chow, Ringman, Twitchell, & Hinkin, 2000). Based on the characteristics of the lesions, some authors concluded that the sexually offending behaviors were the result of a specific, localized neuropathology (e.g., Casanova, Mannheim, & Kruesi, 2002). Elevated rates of non-right-handedness in large samples of pedophiles, however, would indicate that a neurological explanation of pedophilia based on specific brain sites is incomplete at best. Except for gross deficits in the motor control of the preferred hand, handedness does not change following brain injury in adults. Elevated levels of non-right-handedness are, however, associated with biological stresses occurring pre- and perinatally, achieving frequencies of non-right-handedness comparable to those in the aforementioned pervasive developmental disorders (e.g., Searleman, Cunningham, & Goodwin, 1988). Such pre- and perinatal stressors include premature birth (e.g., Marlow, Roberts, & Cooke, 1989; Ross, Lipper, & Auld, 1992), twinning and multiple births (e.g., Coren, 1994; Davis & Annett, 1994; Williams, Buss, & Eskenazi, 1992), and low birth weight (e.g., O'Callaghan et al., 1987; Powls, Botting, Cooke, & Marlow, 1996). Notably, three-fold increases in rates of non-right-handedness occur in some such samples even in the absence of any dramatic difference in the groups' mean IQs.

Two reports have suggested elevated rates of non-right-handedness in pedophilia, although neither report provided an adequate estimate of the actual proportion of pedophilic or hebephilic men who are non-right-handed. Bogaert (2001) reanalyzed handedness data archived by the Kinsey Institute for Sex, Gender, and Reproduction. A sample of men who had committed sexual offenses and a sample of men who had committed no known offenses had been asked by the Kinsey Institute researchers to indicate their handedness as right-handed, left-handed, ambidextrous, or left- and retrained to right-hand-use. Collapsing the non-right-handed responses together, Bogaert (2001) reported a small difference in non-right-handedness between the sample of controls (11.5% non-right-handed, $n = 4706$) and the subsample of sexual offenders whose victims included at least one extrafamilial (i.e., non-incest) child of either sex, age 11 or younger (15.7% non-right-handed, $n = 286$). This group difference achieved statistical significance prior to partialing out differences in the men's level of education ($e^B = 1.61$, $p = .030$), but less so after ($e^B = 1.66$, $p = .054$).

The Kinsey sample may have underestimated the actual rate of non-right-handedness in pedophilia. An unreported proportion of the sexual offenders against children also committed sexual offenses against adults, obfuscating those participants' erotic age preferences. Moreover, at least some sexual offenders against children are actually teleiophilic (e.g., Freund, Watson, & Dickey, 1991). The Kinsey database does not include results of objective tests of sexual interest, such as psychophysiological tests of penile responses to erotic stimuli (i.e., phallometry), which would have permitted verification of participants' erotic age preference. Thus, it remains unknown what proportion of that sample was actually pedophilic, and the inclusion of non-pedophiles in the sample of sexual offenders against children would have served to reduce the group differences observed.

Cantor et al. (2004) recorded from a large sample of sexually anomalous men: handedness on a nine-item inventory, phallometric responses to erotic stimuli involving either males or females in three age groups (adults, pubescent children, or prepubescent children), and the numbers of sexual victims and consenting sexual partners in each of several age groups (ages 17 or older, ages 15–16, ages 12–14, or ages 11 or younger). Study participants were undergoing assessment following either a sexual offense for which they were charged or atypical sexual interests for which they or their health care providers requested more information. Scores on the handedness inventory correlated significantly with the number of victims ages 11 or younger and with the magnitude of the genital response to stimuli depicting prepubescent children. Greater non-right-handedness predicted more victims and a greater genital response, both before and after partialling out participants' estimated IQ scores and ages at testing.

In that report, however, we did not provide the actual proportion of its samples exhibiting non-right-handedness. This prevents direct comparison of its findings with those of the handedness literature. Moreover, although the association between handedness and the indicators of pedophilia achieved statistical significance, the magnitudes of the correlations were small, in absolute terms. The report drew no distinction between men who offended against their own children or step-children (i.e., intrafamilial offenders) and extrafamilial offenders; because intrafamilial offenders may be less likely to have genuine erotic interest in children (e.g., Freund et al., 1991), the inclusion of intrafamilial offenders might have decreased the magnitude of the association observed.

These findings therefore pose several questions: (1) because both Bogaert (2001) and Cantor et al. (2004) found handedness to correlate with pedophilia only modestly, the general determination of whether there exists an association between handedness and pedophilia bears repeating. (2) Because the sampling method of Bogaert (2001) could have included teleiophilic men in its sample of offenders against children, and because Cantor et al. (2004) did not provide handedness data in a dichotomous form, the actual proportions of non-right-handedness in conservatively diagnosed samples of pedophiles and hebephiles remain to be determined. (3) Whether there is an association of handedness with the sex of the victims also remains unknown. Bogaert (2001) collapsed offenders against female children with offenders against male children in his analysis, and Cantor et al. (2004) provided only equivocal results regarding this question. (4) Also unknown is whether the detection of an association of handedness with pedo- and hebephilia was hindered by the inclusion of intrafamilial offenders. The Bogaert (2001) sample excluded men whose offenses were limited to intrafamilial victims, but included men who had both intrafamilial and extrafamilial victims. The Cantor et al. (2004) sample collapsed into a single group men with either intrafamilial or extrafamilial victims.

We undertook Study 1 to address question (1), that is, to confirm our prior finding of an association between non-right-handedness and erotic age preference, using a non-overlapping sample of sexually atypical male patients that included individuals with pedophilic, hebephilic, or teleiophilic interests. Study 2, to follow, addressed questions (2)–(4). For each analysis, we adjusted for any extraneous effects on handedness from participants' chronological age and level of intellectual function.

Removing chronological age accounts for effects potentially introduced by the established association between handedness and age (e.g., Ashton, 1982; Porac, Coren, & Duncan, 1980); left-handedness appears to be related to shorter life expectancies (Coren & Halpern, 1991). Removing IQ accounts for the aforementioned association between increased rates of non-right-handedness and lower intelligence.

STUDY 1

Method

Participants

We recruited study participants from the Kurt Freund Laboratory at the Centre for Addiction and Mental Health (Toronto, Ontario, Canada), which provides evaluation services to male patients referred as a result of illegal or clinically significant sexual behaviors. The primary source of referrals to the facility was parole and probation officers, with some physicians and lawyers providing others. As detailed in the following, the standard assessment of the Laboratory consists of a psychophysiological (phallometric) assessment of the patients' erotic preferences, a semi-structured interview, a brief neuropsychological evaluation that includes handedness, and a review of supplementary psychiatric and legal documents supplied by the referral source. Upon the completion of his evaluation, each patient was invited to permit his clinical data to be used for research purposes.

The replication sample consisted of the 404 consecutive male patients of the Kurt Freund Laboratory who met the following inclusion/exclusion criteria and who completed assessment between February 1, 2002 and December 31, 2003. This time frame immediately followed that for the sample reported in Cantor et al. (2004). The replication sample excluded an additional 42 persons assessed in that time period who could not participate in the complete neuropsychological battery (because of deafness, insufficient English-language skills, etc.), who declined to consent to the use of their clinical results for research, or for whom there was no sexual behavior or interests information available other than self-report.

The sample showed mean and median ages of 37.7 years (SD = 13.3) and 38.0 years, respectively. The mean and median educational levels were 11.7 (SD = 2.73) and 12.0 years, respectively. The patients were predominantly of European descent, with 77.5% describing themselves as White, 2.5% as Asian, 7.4%

as Black, 4.0% as Southeast Asian, 3.0% as Aboriginal Canadian, 1.0% as Filipino or Pacific Islander, and 4.5% as "other," which included mixed ancestry. For one patient (0.2%), this information was unknown.

Of the replication sample, 47.8% committed a sexual offense against one or more victims ages 11 or under, 26.7% against one or more victims ages 12–14, 14.1% against one or more victims ages 15–16, and 30.4% against one or more victims ages 17 or over; 14.6% of the sample had no known victims of any sexual offenses. These latter patients received assessments following charges of possession of child pornography or because of the patient's concern regarding his own sexual interests, etc. The characteristics of the victims of additional 19 patients (4.7%) were not yet verified at the time of the present investigation and are included only in the phallometric analyses. The sum of these percentages exceeds 100% due to some offenders having victims in more than one age category. As in Cantor et al. (2004), no distinction was made in this analysis between intrafamilial offenses (i.e., incest offenses) and extrafamilial offenses.

Measures

Handedness. Patients indicated the hand they prefer to use (right, left, or no preference) for the following activities: writing, drawing, throwing, striking a match, opening a box, and using scissors, a toothbrush, a knife, and a spoon. This comprised a modified version of the Edinburgh Handedness Inventory (Oldfield, 1971; Williams, 1986). The arithmetic difference between the number of the "right" responses and the number of "left" responses, divided by the arithmetic sum of these two numbers yields the handedness quotient; that is, $\text{quotient}_{\text{handedness}} = (\text{right} - \text{left})/(\text{right} + \text{left})$. To maximize the normality of the resulting J-shaped distribution, the handedness quotients were arcsin transformed, and then were reflected and inverted, as recommended by Tabachnick and Fidell (1989).

Phallometric Measurement of Erotic Gender–Age Preferences. Blanchard, Klassen, Dickey, Kuban, and Blak (2001) described the phallometric procedure and data handling technique in detail. Briefly, a computer records an examinee's penile blood volume while the examinee observes a standardized set of stimuli that depict a variety of activities and persons of potential erotic interest to the examinee. Changes in the examinee's penile blood volume (i.e., his degrees of penile erection) indicate his relative erotic interest in each class of stimuli. Clinicians and researchers employ phallometry to quantify the erotic

interests of sexual offenders against children (e.g., Howes, 1995), and meta-analytic review of 61 studies indicated that such procedures represented the single most reliable predictor of which men will commit additional sexual offenses after release into society (Hanson & Bussière, 1998). The specific protocol in use at the Kurt Freund Laboratory over the course of the present investigation reliably distinguishes pedophilic from teleiophilic men (Blanchard et al., 2001).

The stimuli used in the phallometric test were audiotaped narratives presented through headphones and accompanied by slides. There were seven categories of narratives. They describe sexual interactions with either female children, female pubescents, female adults, male children, male pubescents, or male adults, or erotically neutral (i.e., solitary, nonsexual) activities. The accompanying slides depicted nude models corresponding in age and sex to the topic of the narrative. Neutral narratives accompanied slides of landscapes.

The data reduction process yielded seven category scores, one to reflect each of the six combinations of the age group and sex of the stimuli, plus the neutral category. For the present investigation, three scores were of interest: the response to prepubescent children overall (i.e., the reaction to prepubescent male stimuli or to prepubescent female stimuli, whichever was greater), the response to pubescent children overall, and the response to adult stimuli overall. Subjects who did not produce a valid result on the phallometric test (e.g., those who did not respond to any category) were dropped from the phallometric analyses.

Sexual History. A standardized form was used by the phallometric laboratory staff to record each patient's history of sexual offenses. The information came primarily from documents that accompanied the patient's referral, such as reports from police, probation, or parole officers. Some patients reported additional information themselves, regarding offenses that were not included in their files and for which they had not been formally charged.

For the present analyses, four sexual history variables were of interest: the patient's numbers of victims ages 11 or under (regardless of their sex), victims ages 12–14 (regardless of their sex), victims ages 15–16 (regardless of their sex), and victims ages 17 or older (regardless of their sex). For the patients with any victims in a given age category, the modal number of victims was one; however, some patients had very many victims, producing highly skewed distributions. Moreover, some patients were only able to provide estimates of their numbers of victims, rather than precise quantities. Therefore, the scores on these variables were capped at 10.

IQ and Age at Testing. A six subtest short-form of the WAIS–R (Information, Similarities, Digit Span, Arithmetic, Picture Completion, and Block Design) permitted estimation of each patient's level of intellectual functioning. IQ scores were estimated from the age-scaled subtest scores by the method detailed by Tellegen and Briggs (1967), using the intercorrelations among those subtests in the WAIS–R standardization sample. Each participant's age was recorded as his age at his last birthday.

Results

The sample sizes varied in the following analyses due to missing data: Some patients failed to provide valid phallometric test results and appeared only in the sexual history analyses. Similarly, the forensic files of some patients had not been verified at the time of the present study, and these patients appeared only in the phallometric analyses.

Greater right-handedness was significantly associated with patients' greater age at testing, $r(402) = .112$, $p = .025$, two-tailed, and with higher IQ, $r(402) = .114$, $p = .022$, two-tailed, as consistent with the literature. Table I shows the partial correlations between the handedness quotients and the phallometric responses in the laboratory to each age category, and between the handedness quotients and the patients' numbers of victims in each age category. Each entry represents a partial correlation; that is, the effects of estimated IQ and age at testing already have been removed. To facilitate comparison, the table also includes the original results from Cantor et al. (2004) as well as the results from combining the samples.

These partial correlations were very close to the zero-order correlations of handedness quotient with phallometric responses and numbers of victims (i.e., the correlations before partialling out effects of IQ and age). Right-handedness scores correlated with phallometric responses to prepubescents, pubescents, and adults at rs$(339) = -.161, .007,$ and $.134$, ps $= .003, .902,$ and $.013$, respectively. Right-handedness did not correlate significantly with numbers of victims ages 11 or under, ages 12–14, ages 15–16, and ages 17 or older, rs$(380) = .009, -.046, .057,$ and $-.009$, ps $= .867, .372, .264,$ and $.860$, respectively.

Discussion

This replication sample demonstrated the same pattern of associations between handedness and phallometric

Table I. Partial Correlations of Handedness with Phallometric Responses and Numbers of Victims

Indicator of erotic age preference	Sample		
	Original sample	Replication sample	Combined samples
Phallometric response	$n = 377$	$n = 341$	$n = 718$
Pedophilic stimuli	−.13*	−.16**	−.15***
Hebephilic stimuli	.04	−.00	.02
Teleiophilic stimuli	.07	.13*	.10*
Number of victims	$n = 455$	$n = 384$	$n = 839$
Ages 11 and under	−.13*	.01	−.07
Ages 12–14	−.04	−.05	−.04
Ages 15–16	−.06	.06	−.00
Ages 17 and older	.06	−.01	−.00

Note. Entries represent the partial correlations between handedness quotients on a modified version of the Edinburgh Handedness Inventory (Oldfield, 1971; Williams, 1986) and each phallometric age category or number of victims, with IQ and age at testing as covariates. Phallometric responses are quantified as ipsative z scores, based only on the patient's own data. Numbers of victims are capped at 10. Data for the original sample are from Cantor et al. (2004).
* $p \leq .05$, two-tailed. ** $p \leq .005$, two-tailed. *** $p \leq .0005$, two-tailed.

responses as did the original sample in Cantor et al. (2004). Phallometric responses to the youngest age category correlated negatively with handedness scores (indicating less right-handedness), and phallometric responses to the oldest age category correlated positively with handedness scores (indicating more right-handedness), the latter association being statistically significant in the replication sample only. For each of the replication, original, and combined samples, handedness correlated with the intermediate age category, hebephilia, at an intermediate level, not significantly different from zero. The lack of such a correlation, however, does not necessarily indicate that handedness is irrelevant to hebephilia. Rather, the uncorrelated scores may reflect the status of the hebephilic stimuli as an intermediate class among three ordinal and related characteristics. A man will show his greatest phallometric response to the class of stimuli that interest him the most and will show his second greatest response to the next closest age category. That is, a man most erotically interested in adults will show his greatest response to adults, but his second greatest responses to pubescents (Freund, 1967; Freund, Langevin, Cibiri, & Zajac, 1973). Similarly, men most erotically interested in children will react the most to children and show their second greatest responses to the next closest age category, in this case to pubescents, again (Freund, Langevin, Wescom, & Zajac, 1975). Thus, the magnitude of teleiophilic responses predicts greater right-handedness, and the magnitude of pedophilic responses predicts greater non-right-handedness, but the magnitude of hebephilic responses indiscriminately combines the secondary responses from both other types of men

together with those from men with genuine hebephilia, masking any underlying association. As a test of this possibility, samples of hebephilic men could be compared with independent samples of pedophilic and teleiophilic men. We explore this further in Study 2.

For neither the replication nor combined samples did patients' numbers of victims in any of the various age categories show any systematic association with handedness scores, unlike with their phallometric responses. Although phallometric response and sexual history both attempt to capture the same underlying construct—erotic age preference—sexual history may be more subject to misclassification. A man can sometimes suppress his phallometric responses during testing in controlled conditions, yielding an undifferentiating profile. Patients producing such profiles, however, are typically dropped from analysis, thus producing samples of demonstrably pedophilic men, demonstrably hebephilic men, and demonstrably teleiophilic men. Men unclassifiable by phallometric profile represent missing data for phallometric analysis, but still provide usable data for other analyses. Victim history data have the empirical advantage of not requiring the loss of the data from men who produce no valid phallometric profile, but suffer other disadvantages: (1) Victim history only reflects the victim history known to the researchers, and there may exist unknown victims in other age/sex categories unavailable to the categorization procedure applied to the victim history data. (2) Victim history can be influenced by the types of victims available to the offender and thus, again, fail to reflect his actual erotic preferences. This would be particularly true of men with a single (known) victim.

(3) Cantor et al. (2004) and the present analysis combined offenders with intrafamilial and extrafamilial victims, and intrafamilial offenders appear to be less likely to be genuinely pedophilic, as already mentioned. Assortment by phallometric response would separate teleiophilic offenders against intrafamilial children from pedophilic offenders against intrafamilial children; assortment by victim age group, however, would combine them. In his sample, Bogaert (2001) eliminated men who committed solely intrafamilial offenses; however, an intrafamilial offender would still have been included if he also had an extrafamilial victim. Thus, neither study included a sample of offenders against extrafamilial children only.

Given the reliability of the association between handedness and erotic age preference in general, we undertook Study 2 to answer questions (2)–(4) from the introduction. To identify any differences between patients most interested in male versus female victims and to identify any differences between patients most interested in prepubescent children versus pubescent children versus adults, men were assigned to non-overlapping groups, each representing one of the six combinations of the two sex and three age groups. Group assignments were carried out first using patients' phallometric test results to indicate their preferred category and again using the predominant sex and age group from the patients' actual victim history. The rates of non-right-handedness of each group appear as proportions to permit comparison of these proportions with those in the published literature. To determine whether the inclusion of intrafamilial offenders reduced group differences, analyses were repeated first including and then excluding patients who committed intrafamilial sexual offenses. To provide sufficient numbers of observations for reliable analyses of offender subtypes, these analyses combined the replication sample just described with the original sample first described in Cantor et al. (2004).

STUDY 2

Methods

Measures

Phallometric Group Assignment. Phallometric data were acquired as already described, and each patient received group assignment according to the stimulus category which elicited from him the greatest genital response: male adults, male pubescents, male children, female adults, female pubescents, or female children. That category provided the sex (male or female) and the age

group (children, pubescents, or adults) of greatest erotic interest to him. The analysis dropped patients who did not provide a valid phallometric profile.

Sexual History Group Assignment. The numbers of victims for which a patient was charged or for which he admitted contact were acquired as already described. Each patient was assigned to whichever sex and age group was his predominant victim type. In order to match the number of categories available to the phallometrically determined groups (six), the numbers of victims ages 12–14 and victims ages 15–16 were collapsed into a single variable representing the number of victims ages 12–16. The scores on this new variable were capped at 10, to maintain consistency with the other variables which were already capped at 10. Thus, each case was categorized according to his numbers of victims in six categories: females ages 17 or older, females ages 12–16, females ages 11 or younger, males ages 17 or older, males ages 12–16, and males ages 11 or younger.

We operationally defined *predominant victim type* conservatively. To be assigned to a category, a patient first had to have had more victims in that category than in any of the other five categories. This rule therefore had the additional and beneficial effect of removing from the analyses those patients whose preferred type of victim was indeterminate because of equal numbers of victims in more than one category. (Moreover, this rule dropped patients with zero victims, who necessarily would have the same, zero, number of victims in each category.) Although it is relatively intuitive that a patient with multiple victims of a particular sex and age group is erotically interested in such persons, it is not at all clear whether a patient with a *single* victim is most interested in that particular sex and age group. That is, some unknown number of men committing sexual offenses did so against a person not of their genuinely preferred sex and age category, and the risk of misclassification is greatest among men with single victims. To minimize such misclassifications, we therefore applied the additional criterion that the number of victims in the predominant category had to be greater than the number of victims in the next most frequent category *plus one*. Thus, for example, someone with victims numbering 1, 1, 3, 0, 0, and 0 across the six categories would be assigned to the group indicated by the category with three victims, but someone with victims numbering 1, 1, 2, 0, 0, and 0 or with victims numbering 0, 0, 0, 1, 0, and 0 would remain unassigned (and dropped from analysis), lacking a predominantly preferred category of victim.

Assignment to one of the categories (homosexual teleiophilia) required handling by an alternate method. The Kurt Freund Laboratory receives only very few cases

of persons with any sexual offenses against adult males. The Laboratory does, however, conduct assessments of non-criminal men seeking evaluation to help them identify their own sexual orientation as straight or gay men. Thus, a person was also classified as predominantly interested in adult males if his number of consenting, adult male sexual partners outnumbered his number of consenting, adult female sexual partners and if the patient had no sexual contacts after his 16th birthday with anyone who was both younger than 15 and more than 5 years younger than the patient.

The category to which each patient was assigned thus provided the sex (male or female) and the age group (children, pubescents, or adults) of greatest erotic interest to him. The numbers of intrafamilial and extrafamilial victims were recorded separately.

Handedness. Because the clinical database records patients' individual responses to each item on the Edinburgh Handedness Inventory, patients could be dichotomously categorized according to their response to the single item, "Which hand do you write with?" The following analyses classified cases as simply right-handed or non-right-handed; patients indicating no preference for writing hand were scored as non-right-handed.

IQ and Age at Testing. The IQ and age at most recent birthday were acquired as already described.

Data Analysis

Logistic regression provided the significance testing for the main effects of preferred sex of victim and preferred age group of victim on writing hand, both before and after entering IQ and age at testing as covariates. Analyses were conducted first with all cases classifiable with the preceding methods and again after eliminating cases who had any intrafamilial victims, to determine whether intrafamilial offenders masked underlying associations, as already described.

Results

Sorting the intrafamilial and extrafamilial offenders by the category of their greatest phallometric response classified 727 cases: 325 cases responded the most to female adults, 242 to female pubescents, 41 to female children, 38 to male adults, 40 to male pubescents, and 41 to male children.

Panel A of Fig. 1 indicates the proportions of each of these six categories who used their right hand for writing. The non-right-handedness rates of both of the teleiophilic categories—men who phallometrically respond the most to either adult women, 10.5%, or to adult men, 7.9%—

fell within the range of the general population. The men who responded the most to the pedophilic categories, however, showed non-right-handedness at approximately triple those rates. Logistic regression of writing hand onto the sex and the age group of cases' most preferred category indicated a significant association, $\chi^2(3, N = 727) = 15.07$, $p = .002$; the model adding IQ and age at testing as covariates was also significant, $\chi^2(5, N = 727) = 28.45$, $p = .00003$. Table II provides the logistic regression coefficients and their standard errors, the odds ratios and their 95% confidence intervals, the Wald statistics, and the reliability for each predictor and covariate. The age group, but not the sex, represented by each patient's foremost erotic interest significantly predicted the patient's handedness. Although both the pedophilic and hebephilic samples showed higher rates of non-right-handedness than the teleiophilic sample, only the pedophilic sample was significantly so.

The criteria already described for sorting cases by predominant victim type classified 295 cases: 101 cases were most erotically interested in female adults, 44 in female pubescents, 71 in female children, 19 in male adults, 22 in male pubescents, and 38 in male children. Panel B of Fig. 1 indicates the proportions of men in each category who use the right hand for writing. Although the profile of the proportions for each group somewhat resembled that from sorting by phallometric responses, the overall model was not significant, $\chi^2(3, N = 295) = 2.58$, $p = .46$. The model including the two covariates approached significance, $\chi^2(5, N = 295) = 10.03$, $p = .074$, but this reflected the association of handedness with the covariates, age and IQ (see Table III).

To determine whether the failure of sexual history to reveal any group differences was attributable, at least in part, to misclassifications of men with intrafamilial victims, the preceding categorizations and analyses were repeated, eliminating cases with any history of intrafamilial victims. Sorting only the extrafamilial offenders by phallometric responses now yielded 251 cases responding the most to female adults, 183 to female pubescents, 32 to female children, 28 to male adults, 37 to male pubescents, and 39 to male children. The removal of cases with any intrafamilial victims from the phallometrically derived categories produced virtually the same pattern of results as did the phallometrically derived categories that included intrafamilial offenders (cf., panels A and C of Fig. 1). Handedness significantly related to preferred category, $\chi^2(3, N = 570) = 8.89$, $p = .03$ and remained significant after the addition to the model of the two covariates, $\chi^2(5, N = 570) = 17.72$, $p = .003$. The age group of stimulus category was the most reliable predictor in each model (see Table IV).

Table II. Logistic Regression of Writing Hand onto Sex and Age Group of Phallometric Category Eliciting Maximum Response

Predictor	B	SE_B	Wald statistic	Odds ratio (e^B)	CI of odds ratio	p
Model one						
Sex of category	0.33	0.32	1.11	1.40	0.75–2.60	.29
Age group of category			15.84			.0004
Adult vs. child	1.30	0.33	15.83	3.68	1.94–6.98	.00007
Adult vs. pubescent	0.39	0.24	2.53	1.47	0.91–2.37	.11
Model two						
Patient IQ	−0.01	0.01	2.91	0.99	0.97–1.00	.09
Patient age at testing	−0.03	0.01	8.28	0.98	0.96–0.99	.004
Sex of category	0.26	0.32	0.64	1.29	0.69–2.44	.43
Age group of category			14.25			.0008
Adult vs. child	1.26	0.34	14.25	3.54	1.84–6.81	.0002
Adult vs. pubescent	0.38	0.25	2.40	1.47	0.90–2.38	.12

Note. $N = 727$; SE_B = standard error of the regression coefficient; CI = 95% confidence interval.

Table III. Logistic Regression of Writing Hand onto Sex and Age Group of Predominant Victim Category

Predictor	B	SE_B	Wald statistic	Odds ratio (e^B)	CI of odds ratio	p
Model one						
Sex of category	0.00	0.39	0.00	1.00	0.46–2.16	1.00
Age group of category			2.36			.31
Adult vs. child	0.61	0.42	2.09	1.83	0.81–4.16	.15
Adult vs. pubescent	0.57	0.47	1.46	1.77	0.70–4.46	.23
Model two						
Patient IQ	−0.02	0.01	3.15	0.98	0.96–1.00	.08
Patient age at testing	−0.02	0.01	2.84	0.98	0.95–1.00	.09
Sex of category	−0.12	0.40	0.09	0.89	0.40–1.96	.77
Age group of category			2.83			.24
Adult vs. child	0.63	0.43	2.20	1.88	0.82–4.35	.14
Adult vs. pubescent	0.70	0.48	2.14	2.02	0.79–6.19	.14

Note. $N = 295$; SE_B = standard error of the regression coefficient; CI = 95% confidence interval.

Table IV. Logistic Regression of Writing Hand onto Sex and Age Group of Phallometric Category Eliciting Maximum Response—Excluding Patients with Intrafamilial Victims

Predictor	B	SE_B	Wald statistic	Odds ratio (e^B)	CI of odds ratio	p
Model one						
Sex of category	0.30	0.34	0.80	1.35	0.70–2.60	.37
Age group of category			9.20			.01
Adult vs. child	1.10	0.36	9.16	2.99	1.47–6.08	.002
Adult vs. pubescent	0.36	0.27	1.87	1.44	0.85–2.42	.17
Model two						
Patient IQ	−0.02	0.01	3.92	0.99	0.97–1.00	.048
Patient age at testing	−0.02	0.01	3.24	0.98	0.97–1.00	.07
Sex of category	0.19	0.34	0.32	1.21	0.62–2.37	.57
Age group of category			7.54			.02
Adult vs. child	1.01	0.37	7.52	2.75	1.34–5.66	.006
Adult vs. pubescent	0.33	0.27	1.50	1.39	0.82–2.36	.22

Note. $N = 570$; SE_B = standard error of the regression coefficient; CI = 95% confidence interval.

Men with Either Extrafamilial or Intrafamilial Victims

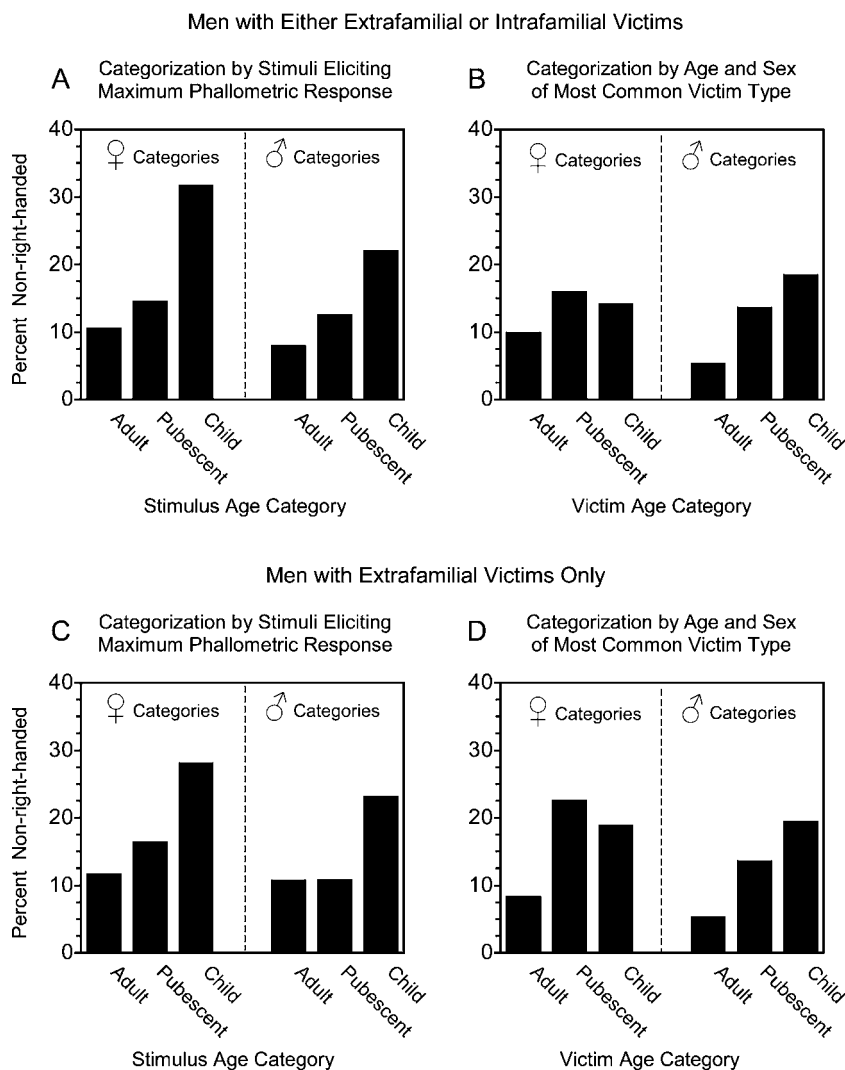Men with Extrafamilial Victims Only

Fig. 1. Proportions of patients in each group who use the left hand for writing. The six groups represent the sex (female or male) and the age group (adult, pubescent child, or prepubescent child) of primary erotic interest to the patient. Panels A and B represent both extrafamilial and intrafamilial (i.e., incest) offenses; Panels C and D represent only those patients who committed extrafamilial and no intrafamilial offenses. For Panels A and C, patients were grouped according to the stimuli that elicited their greatest genital (phallometric) response. For Panels B and D, patients were grouped according to the sex and age group of their predominant victim type. See text for the exact classification procedures. Results of the logistic regressions of the handedness rates in Panels A–D appear in Tables II–V, respectively.

Re-applying the grouping criteria for sexual history after removing the cases with intrafamilial victims resulted in 96 patients most erotically interested in female adults, 31 in female pubescents, 48 in female children, 19 in male adults, 22 in male pubescents, and 31 in male children. After excluding intrafamilial offenders, the proportions of non-right-handedness among the six categories of extrafamilial offenders much more closely

resembled those shown by the phallometrically derived categories (cf., panels D, A, and C of Fig. 1). Logistic regression indicated that handedness related to the set of predictors after including IQ and chronological age, $\chi^2(5, N = 247) = 14.26$, $p = .01$, but only marginally so beforehand, $\chi^2(3, N = 247) = 7.06$, $p = .07$. Once again, the age group, but not the sex, of the categories significantly related to handedness (see Table V). In this

Table V. Logistic Regression of Writing Hand onto Sex and Age Group of Predominant Victim Category—Excluding Patients with Intrafamilial Victims

Predictor	B	SE_B	Wald statistic	Odds ratio (e^B)	CI of odds ratio	p
Model one						
Sex of category	0.26	0.42	0.39	1.30	0.57–2.96	.54
Age group of category			6.42			.04
Adult vs. child	1.07	0.46	5.45	2.93	1.19–7.21	.02
Adult vs. pubescent	1.07	0.50	4.51	2.92	1.09–7.85	.03
Model two						
Patient IQ	−0.03	0.01	5.17	0.97	0.95–1.00	.02
Patient age at testing	−0.01	0.02	0.82	0.99	0.96–1.02	.36
Sex of category	0.13	0.44	0.09	1.14	0.49–2.68	.76
Age group of category			6.37			.04
Adult vs. child	1.06	0.47	5.13	2.90	1.15–7.28	.02
Adult vs. pubescent	1.13	0.52	4.79	3.09	1.13–8.46	.03

Note. $N = 247$; SE_B = standard error of the regression coefficient; CI = 95% confidence interval.

analysis, both the pedophilic and the hebephilic samples differed significantly from the teleiophilic sample, showing odds of non-right-handedness approximately triple that of offenders against adults.

Discussion

These analyses confirmed the association between handedness and erotic age preference. Study 1 indicated that the procedures of Cantor et al. (2004) provided a reliable, albeit small, correlation between these characteristics. Study 2, using both the former and a new sample, indicated that the rate of non-right-handedness in pedophilic men was nearly triple that in teleiophilic men. With an odds ratio of approximately three, after accounting for group differences in IQ and chronological age, the association of pedophilia with handedness equals or exceeds that of several major neurological disorders, including Down's syndrome and autism. The elevated rates of non-right-handedness seem to be associated specifically with pedophilia and not with sexual offending in general; men who sexually offended against two or more female adults—and against no children—showed rates of non-right-handedness clearly within the range shown by the general population.

Before accounting for the covariates, the patients with erotic interest in males showed 1.30–1.40 greater odds of being non-right-handed than did patients with erotic interest in females (with the exception of the analyses shown in Table III). Although these odds ratios did not achieve statistical significance, they were very close both in direction and in magnitude to a prior meta-analytic comparison of heterosexual men with homosexual men

(all presumably teleiophilic), which found an odds ratio of 1.34, with male homosexuality showing greater odds of being non-right-handed before controlling for age (Lalumière, Blanchard, & Zucker, 2000). This suggests, therefore, not that hetero-/homosexuality is unrelated to handedness, but that the present sample did not have as much statistical power as did the meta-analysis to detect a difference of similar magnitude.

These data provided only partial evidence for a difference in rates of non-right-handedness between hebephilia and teleiophilia. Although the hebephilic sample scored midway between the pedophilic and teleiophilic samples in most analyses, the contrast between the hebe- and teleiophilic samples did not always achieve statistical significance, and neither phallometric responses to pubescents nor number of victims 12–14 nor 15–16 correlated with handedness scores. As already discussed, the correlations may reflect, not a lack of an association, but an association that becomes masked by responses to related erotic categories of stimulus. The rates of non-right-handedness among hebephilic men intermediate between the other groups is consistent with this interpretation. It would be worthwhile to repeat the group analyses with a sample of hebephiles and teleiophiles only.

The relative difficulty in identifying a significant handedness difference between hebephilic and teleiophilic groups may serve as a caution to future investigators. As used here, the age range of victims used to indicate hebephilia was 12–16, while the victim age range taken to indicate pedophilia was 0–11 years. Thus, one would expect increasing difficulty in detecting group differences in handedness (and, perhaps, in other characteristics) with increasing mean age of victims. That is, samples of sexual offenders against children may be less likely

to demonstrate group differences in handedness (and perhaps in other characteristics) when those samples include larger proportions of sexual offenders against older children.

The present results argue against IQ and chronological age as explanations of the association between handedness and erotic age preference, because the association remained significant after removing any effects of IQ and age. Societal efforts to change one's handedness can also be ruled out as an explanation. Efforts to alter handedness pertain to one type of change only: training natural left-handers to use their right hand. Such unidirectional efforts would serve to reduce any group differences in handedness. Thus, detection of a significant group difference in rates of non-right-handedness should be interpreted as having occurred despite any pressures to change handedness, rather than because of it.

The clinical data available for study did not permit any distinction between natural left-handedness and pathological left-handedness. Thus, for some unknown proportion of the present sample, left-handedness developed for reasons unrelated to any pathological process. The link between handedness and pedophilia suggests that pedophilic samples (and, possibly, the hebephilic samples) would contain an excess specifically of pathological left-handers and not natural left-handers. Conversely, the teleiophilic left-handers would be more likely to be natural rather than pathological left-handers. If true, then the better an investigation is able to distinguish pathological from natural left-handedness, the greater the group difference in handedness the investigation would detect. Some researchers have used the left-handedness of one or both of a patient's parents as a marker suggesting that the patient is more likely to have developed left-handedness from a normal, genetic route rather than from a pathological factor (e.g., Bradshaw-McAnulty, Hicks, & Kinsbourne, 1984); however, familial sinistrality can serve only as an approximation (see Bishop, 1990).

The three-fold increase in rate of non-right-handedness in pedophilia relative to that in teleiophilia detected here is consistent with hypotheses of a relationship between pedophilia and brain organization on par with other major neurological conditions. Although numerous psychosocial explanations of child molestation have been proffered (see Araji & Finkelhor, 1985 for a review), none predicts a group difference in handedness. Although there may exist psychosocial factors that contribute to the development or the expression of erotic age preference, any complete theory must account for, not only the differences in handedness, but also for the differences in other neuropsychologically relevant traits, including

lower mean IQs (e.g., Cantor et al., 2004) and increased frequencies of head injuries in childhood but not in adulthood (Blanchard et al., 2002, 2003). Research regarding psychosocial factors in pedophilia may advance more readily by pursuing data—not to reveal how psychosocial factors might cause pedophilia—but how psychosocial factors might interact with predisposing biological factors or how the psychosocial differences themselves reflect pre-existing biological differences.

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