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Intelligence, Memory, and Handedness in Pedophilia

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A sample of 473 male patients with pedophilia (assessed by the patients' sexual history and penile response in the laboratory to standardized, erotic stimuli) or other problematic sexual interests or behaviors received brief neuropsychological assessments. Neuropsychological measures included a short form of the Wechsler Adult Intelligence Scale—Revised (D. Wechsler, 1981), the Hopkins Verbal Learning Test—Revised (R. H. B. Benedict, D. Schretlen, L. Groninger, & J. Brandt, 1998), the Brief Visuospatial Memory Test—Revised (R. H. B. Benedict, 1997), and the Edinburgh Handedness Inventory (S. M. Williams, 1986). Pedophilia showed significant negative correlations with IQ and immediate and delayed recall memory. Pedophilia was also related to non-right-handedness even after covarying age and IQ. These results suggest that pedophilia is linked to early neurodevelopmental perturbations.

Individuals with *pedophilia* are people, predominantly men, who demonstrate "intense" erotic interest in children (American Psychiatric Association, 2000). Because there is no objective definition of *intense*, the present investigation used the operational definition that people with pedophilia are individuals whose interest in prepubescent children exceeds their interest in adult sexual partners (Freund, 1981). In contrast, people with *teleiophilia* possess a primary erotic interest in adult sexual partners (Blanchard et al., 2000). An intermediate group has also been described; people with an erotic interest in pubescent children (as opposed to prepubescent children) have been referred to as having *hebephilia* (Glueck, 1955).

Neurological factors have been suspected to contribute to the etiology of pedophilia since the 19th century (e.g., Krafft-Ebing, 1886/1965). Despite subsequent investigation, evidence of a causal relationship between abnormal brain functioning and pedophilia has remained elusive. This is partly attributable to neuropsychological investigations of pedophilia being fraught with methodological difficulties, producing inconsistent findings. That is, some samples of individuals who have committed sexual offenses against children have shown poorer cognitive function than controls or than normative means, whereas other samples have shown no differences. Also hampering any firm conclusions is that, should a correlation between pedophilia and poorer general brain function be verified, causality cannot be easily inferred. Because it is plausible that men with pedophilia and inferior brain function are more likely than those without inferior brain function to be apprehended, convicted, and available to research studies, it is possible that correlations between lower cognitive test scores and pedophilia are attributable to ascertainment bias. The present investigation was aimed at confirming the basic association between pedophilic sexual interest and low brain functioning and identifying neuropsychological variables that would argue that this relationship is actually attributable to perturbations in brain development rather than to ascertainment bias.

The great majority of neuropsychological investigations of pedophilia have examined groups of men charged with sexually approaching children or adolescents with regard to their rates of mental retardation or their performance on tests of general intelligence. Unfortunately, inadequate reporting has limited the evaluation and the potential contributions of many such investigations. Authors have often failed to include descriptions of their groups' composition, test statistics, variance estimates, sample sizes, or actual mean scores. Although several of the better detailed reports have suggested a relation between pedophilia and intellectual functioning, their results remain contradictory. In some studies conducted without control groups, it has been reported that the pedophilic offenders had mean IQs in the average range (e.g., Baldwin & Roys, 1998; Fisher & Howell, 1970; Mohr, Turner, & Jerry, 1964), whereas in other studies IQ has been reported to be below average (e.g., Hambridge, 1994; Virkkunen, 1976). When compared with men who have committed sexual offenses against adults or men committing nonsexual crimes, men who have com-

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mitted sexual offenses against children scored lower in IQ (e.g., Hucker et al., 1986; Langevin et al., 1985; Langevin, Wortzman, Dickey, Wright, & Handy, 1988; Langevin, Wortzman, Wright, & Handy, 1989), lower in clinical ratings of intelligence (Blanchard et al., 1999), or higher in rate of mental retardation (e.g., Frosh & Bromberg, 1939; Henn, Herjanic, & Vanderpearl, 1976). This result, however, has not been consistent, with other studies failing to detect such differences (e.g., Abracen, O'Carroll, & Ladha, 1991; Quinsey, Arnold, & Pruesse, 1980; Segal & Marshall, 1985). Moreover, many of the studies reporting an IQ difference have come from a single research team (Langevin and colleagues), repeatedly using the same group of controls.

As is true for intelligence, memory performance provides information regarding brain function. Unfortunately, most studies have indiscriminately combined men who have committed sexual offenses against children with men who have committed sexual offenses against adults, making it impossible to isolate whether any detected differences were attributable to pedophilia or to other problematic sexual behaviors. Relative to control groups or to population norms on memory tests, heterogeneous groups of individuals who have committed sexual offenses have sometimes been reported to perform more poorly (Flor-Henry, 1987; Stone & Thompson, 2001) and, sometimes, equally (Gillespie & McKenzie, 2000; O'Carroll, 1989); in one investigation, individuals committing sexual, but nonviolent, crimes actually performed better than individuals committing nonsexual, nonviolent crimes (Knox-Jones, 1994). In only one published study did researchers examine a group composed solely of men committing sexual offenses against children, finding them not to differ from controls (Abracen et al., 1991). Because of the small sample size (12 per group), however, this conclusion remains tentative.

The rate of non-right-handedness among men with pedophilia is of interest for two reasons. First, conditions associated with perturbations of neurological development commonly exhibit reduced, inconsistent, or ambiguous right-handedness. Such conditions include Down syndrome (e.g., Batheja & McManus, 1985; Murphy, 1962; Vlachos & Karapetsas, 1999), epilepsy (e.g., Bingley, 1958; Lewin, Kohen, & Mathew, 1993), autism (e.g., Colby & Parkison, 1977; Cornish & McManus, 1996; Soper et al., 1986), and learning disabilities and dyslexia (e.g., Cornish & McManus, 1996; Eglinton & Annett, 1994; Orton, 1925). Thus, a lower rate of right-handedness among men with pedophilia would be an indicator of an association between pedophilia and brain organization (albeit a nonspecific one). Second, handedness develops very early in life—fetuses exhibit a hand preference in utero (Hepper, Shahidullah, & White, 1991)—and handedness does not substantially change in adulthood (Coren & Halpern, 1991). Thus, the detection of a lower rate of right-handedness among men with pedophilia would associate pedophilia with events occurring early in brain development, demonstrating that the differences in brain organization existed long before the subsequent sexual offenses occurred.

Bogaert (2001) examined the handedness of sex offenders, reanalyzing data collected and archived by the Kinsey Institute. Bogaert compared the proportion of non-right-handedness of noncriminal men (controls) with various groups and subgroups of participants who were criminals: men convicted of any crime, men convicted of nonsexual crimes only, men convicted of any sexual crime, and men convicted of any sexual crime involving a child. After differences in the demographic variables—parental income, age, year of birth, and education—were controlled for, handedness was unrelated to group status when controls were compared with the men convicted of any crime, men convicted of a nonsexual crime, and men convicted of any sexual crime. The data did, however, suggest a relationship between handedness and group membership when controls were compared only with individuals who had committed sexual crimes against children.

Caution must be applied when discerning the meaning of a putative relationship between handedness and pedophilia. Because of the elevated rate of non-right-handedness among the mentally retarded, it is possible that a relationship between non-right-handedness and pedophilia results from a confound: Non-right-handedness might be elevated because of an elevated occurrence of mental retardation within the sample with pedophilia, and that elevated rate of mental retardation might be due to the same ascertainment bias described previously. In Bogaert's (2001) study, covarying education—which can be seen as a proxy for intelligence—did not eliminate the relationship. That study could not show, however, whether the relationship between handedness and pedophilia would remain if intellectual capacity were represented more directly, that is, by IQ measurement rather than by self-reported level of education.

We undertook the present study to identify the relationships among the preceding variables, using more sensitive, direct, and nondichotomous measures of pedophilic sexual interest, handedness, and intellectual capacity in a large, prospectively gathered, contemporary sample of individuals who have committed sexual offenses against children. To allow direct comparisons, we administered the same measures to men who were sexually atypical but evidenced teleiophilia.

Method

Participants

The participants were selected from the 527 male patients with consecutive appointments at the Kurt Freund Laboratory at the Clarke Site of the Centre for Addiction and Mental Health (Toronto, Ontario, Canada) between January 19, 2000, and January 31, 2002. In every case, the complaint concerned illegal or disturbing sexual behavior, and the primary purpose of the referral was psychophysiological—specifically, phallometric—assessment of the patient's erotic preferences. Approximately 10% of patients who came to the laboratory were not included here, such as those who could not participate in neuropsychological testing because of inadequate English-language skills, those who declined to consent to their clinical assessment data's being used for research purposes, and those for whom there was no information available regarding their sexual behavior or interests beyond their self-report. For the 473 patients meeting the inclusion–exclusion criteria, the additional sexological information came from legal, psychiatric, or other documents for 91 patients (i.e., valid phallometric test results were unavailable); psychophysiological test results for 10; and both sources of information for 372.

In this article, we use the term *sexual offenses* to include charges, convictions, credible accusations, and self-disclosures of criminal sexual behavior. *Credible accusations* were defined by default; that is, they included all accusations excepting those that were made by an individual who stood to gain in some way from criminal charges against the accused, that had no corroborating evidence, and that were not voiced at the time the alleged offense(s) occurred. Only a small proportion of accusations were

not considered credible; typical examples were allegations—not followed by criminal charges—from estranged spouses in child custody-and-access disputes.

The 463 patients whose sexological self-report could be cross-checked with independent documentation included 14% with no known sexual offenses, 52% with offenses against children under age 12, 30% with offenses against pubescents ages 12 to 14, 17% with offenses against minors ages 15 to 16, and 30% with offenses against adults ages 17 and older. These exceed 100% because 37% had victims in more than one age range. In this research, no distinction was made between intrafamilial (i.e., incest) offenses and extrafamilial offenses.

Of patients whose known victims were teenagers or adults, 53% had displayed coercive or sadistic sexual behavior. Offenses against teenagers and adults also included the various manifestations of *courtship disorder* (Freund, 1976; Freund & Seto, 1998): 24% displayed "hands-off" manifestations (voyeurism, exhibitionism, or obscene telephone calling), and 28% displayed "hands-on" manifestations (toucheurism, frotteurism, or other types of unwanted physical contact).[1] Paraphilic behaviors that, for the most part, did not involve criminal acts were reported by 19%; these behaviors included masochism, fetishism, transvestism, and autogynephilia.[2] The foregoing percentages, once again, add up to more than 100% because some patients had a history of activities in more than one category.

The mean age of the patients was 37.9 years (SD = 13.5), and the median was 38. The mean and median educational levels were high school graduation. The patients were predominantly of European descent, with 81% describing themselves as White, 3% as Asian, 7% as Black, 2% as Southeast Asian, 2% as Aboriginal Canadian, 1% as Filipino or Pacific Islander, and 4% as "other," which included mixed ancestry.

Materials and Measures

Sexual history and self-report of erotic preferences. A standardized form was used to record the patient's history of sexual offenses. Most of this information came from documents that accompanied the referral, such as reports from probation and parole officers. The offense history data were cross-checked against, and supplemented by, three other kinds of information provided by the patient himself. The first of these was the number and nature of any additional sexual offenses that were admitted by the patient but for which he was never charged. The second was his lifetime number of consenting adult sexual partners, including prostitutes. The third was the patient's self-report regarding the age and gender of persons who most interest him sexually. The patient's information was solicited by a laboratory technician in a structured interview accompanying his psychophysiological testing appointment.

The patient's sexual history was quantified, for purposes of the present research, using 10 variables: the patient's total numbers of male and of female victims under age 12, male and female victims ages 12 to 14, male and female victims ages 15 to 16, male and female victims ages 17 and older, and male and female consenting sexual partners ages 17 and older. Scores on these variables were capped at 10, for two reasons. Some patients had very many victims, skewing the distribution. Second, some patients were able to provide estimates of their numbers of victims only, rather than precise quantities. The patient's self-reported gender–age preferences were quantified by asking him about his relative attraction to males and to females in each of the following categories: childhood, pubescence, adolescence, and adulthood.

Phallometric measurement of erotic gender–age preferences. Psychophysiological assessment consisted of phallometric testing. In this procedure, the examinee's penile blood volume is monitored while he is presented with a standardized set of stimuli depicting a variety of potentially erotic activities or objects. Increases in the examinee's penile blood volume (i.e., degrees of penile erection) indicate his relative attraction to the different classes of stimuli.

The specific test used in this study was described in detail by Blanchard, Klassen, Dickey, Kuban, and Blak (2001). The test stimuli are audiotaped narratives presented through headphones and accompanied by slides. There are seven categories of narratives, which describe sexual interactions with prepubescent girls, pubescent girls, adult women, prepubescent boys, pubescent boys, and adult men, as well as solitary, nonsexual activities (i.e., neutral stimuli). The accompanying slides show nude models corresponding in age and sex to the topic of the narrative. Neutral narratives are accompanied by slides of landscapes. The data reduction process, outlined by Blanchard et al. (2001), yields seven category scores, which reflect the patient's relative erotic interest in the seven categories.

Measures of cognitive functioning. Neuropsychological testing is included as part of all sexological evaluations at the Kurt Freund Laboratory. The battery includes six subtests from the Wechsler Adult Intelligence Scale—Revised (WAIS–R; Wechsler, 1981): Information, Similarities, Digit Span, Arithmetic, Picture Completion, and Block Design. Full Scale IQ (FSIQ) was estimated from the subtests by the method detailed by Tellegen and Briggs (1967), using the age-scaled subtest scores and the intercorrelations between those subtests in the WAIS–R standardization sample.

The WAIS–R was supplemented with two brief memory tests. One was Form 1 of the Hopkins Verbal Learning Test—Revised (HVLT–R; Benedict, Schretlen, Groninger, & Brandt, 1998; Brandt, 1991). This test consists of a list of 12 nouns from three semantic categories (e.g., gemstones). The sum of the number of correctly recalled items from each of three trials constitutes the Total Immediate Recall score. Following a 20-min delay, examinees are again asked to recall as many words as possible from the list. The number correct is the Delayed Recall score. Finally, examinees receive a recognition trial in which they are asked to distinguish the stimulus words from 12 distractors. This trial yields three scores: Recognition Hits; Recognition False Positives; and their arithmetic difference, the Recognition Discrimination Index. Also calculated is the Learning score, the difference between the Immediate Recall score from Trial 1 and the greater of Trials 2 and 3. Each of these scores is a well-established index of memory functioning, with demonstrated reliability and validity (e.g., Benedict et al., 1998; Brandt, 1991).

The other memory test was Form 1 of the Brief Visuospatial Memory Test—Revised (BVMT–R; Benedict, 1997). Like the HVLT–R, the BVMT–R consists of three immediate recall trials, a delayed recall trial (after 25 min), and a recognition trial. Thus, the BVMT–R also yields the scores Total Immediate Recall, Delayed Recall, Recognition Hits, Recognition False Positives, Recognition Discrimination Index, and Learning. The stimuli of the BVMT–R are six simple line diagrams arranged 2 × 3 on a stimulus sheet. The examiner provides an 8½ × 11 in. (approximately 21.6 × 27.9 cm) sheet of paper on which the examinee draws his or her recall responses. Each figure the examinee draws receives 1 point per correct shape and 1 point per correct position. For the recognition trial, the examinee distinguishes the six target stimuli from six distractors; the test does not include an examination of recognition of stimulus location.

Handedness was assessed with a revised version of the Edinburgh Handedness Inventory (Oldfield, 1971; Williams, 1986). Patients indicated the hand they preferred 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. A 10th item, which asked about hand placement when using a broom, was discarded

[1] *Toucheurism* is a marked erotic interest in grasping the breasts, buttocks, or genital area of an unwilling and unprepared person, without apparent intention of proceeding to forced copulation. *Frotteurism* is a marked interest in rubbing one's crotch against a stranger in a crowded, usually public, place.

[2] *Autogynephilia* is a male's propensity to be erotically aroused by the thought or image of himself as a woman.

because a preliminary factor analysis showed that it correlated poorly with the other items. One point was added to a right-hand subscore for each item for which the patient preferred the right hand, and likewise for the left. For items for which the patient had no preference, 1 point was added to both subscores. The handedness quotient was calculated as the difference of the two subscores divided by their sum, that is, (right − left)/(right + left). Thus, a score of +1.0 indicates complete right-handedness, and −1.0, complete left-handedness.

Results

Data Analysis

The primary hypothesis for all comparisons between the neuropsychological measures and the sexual measures was that poorer cognitive scores would be associated with greater pedophilic responses. Also explored was whether the neuropsychological differences appeared generally or only in specific domains.

Variables that demonstrated extreme positive skewness received a square-root transformation (False Positives on the HVLT–R and BVMT–R), and variables that demonstrated extreme negative skewness (Hits and the Recognition Discrimination Index on both memory tests, and the handedness quotient) were arcsine transformed, and then were reflected and inverted, as recommended by Tabachnick and Fidell (1989).

Samples of individuals who commit sexual offenses against children are greater in mean age than those of individuals who commit sexual offenses against adults (e.g., Frosh & Bromberg, 1939; Henn et al., 1976). Consistent with this, the mean ages of both the group with pedophilia (36.6 years, $SD = 15.4$) and the group with hebephilia (38.2 years, $SD = 13.3$) were greater than that of the teleiophilia group (35.2 years, $SD = 11.1$), who largely committed sexual offenses against adults. To reduce any effect this might have on the identification of between-groups differences in cognitive ability, we covaried the age at testing variable. Also considered was the possibility that results might be affected by cultural or ethnic factors. Not all patients spoke English as a native language or were raised in North America. Thus, the cognitive neuropsychological test data were analyzed using a second covariate, age at learning English as a second language (ESL; scored as 0 for native English speakers).

Categorical Analysis

In the first phase of data analysis, patients were divided into three discrete groups. Group differences on FSIQ and the handedness quotient were then assessed by analysis of covariance (ANCOVA) and follow-up *t* tests. Group differences on families of subscores (e.g., subscales of the WAIS–R, HVLT–R, and BVMT–R) were assessed by multivariate ANCOVA (MANCOVA). Each set of neuropsychological scores (e.g., the subtests of the WAIS–R, etc.) was expected to be highly intercorrelated. The effect size, η^2, of each subscore appears with the subsequent, univariate analyses to permit assessment of its association relative to the other variables.

A patient was classified as having pedophilia if he responded more to prepubescent child categories than to any other gender–age category on the phallometric test. If the patient lacked a valid phallometric test, he was categorized as having pedophilia if he admitted to greater attraction to prepubescent boys or girls than to any other gender–age category. A patient was classified as having hebephilia by the analogous criteria. Because teleiophilia is the socially and psycholegally desirable diagnosis, many patients with pedophilia or hebephilia endeavor to obtain it in interviews and on phallometric testing (see Blanchard et al., 2001). Thus, the classification of a patient as falling in the teleiophilia category was made more stringent by the addition of a second criterion. The first criterion was the same as for the other two categories—a greater response to adult males or females than to other categories on the phallometric test, or (lacking a valid phallometric test) the patient stated that he is more attracted to persons past their 17th birthday than to younger persons. The second criterion was that the patient lacked any history that might contradict his phallometric results or self-report (i.e., he lacked any known offenses against male or female victims under age 17).

Although they were erotically interested in adults, men in the teleiophilia category were not normal controls; they exhibited a wide range of sexually atypical interests and offenses. Thus, they provide a more conservative comparison for men with pedophilia than would healthy males. That is, if men with pedophilia were compared with typical males, it would be unclear whether any differences were attributable to sexual atypicality in general or to pedophilia specifically. By using sexually atypical men in the teleiophilia category as controls, any detected differences may be more clearly attributed to pedophilia.

Forty-eight patients were classified as having pedophilia; 161, hebephilia; and 95, teleiophilia, for a total of 304. The remaining 169 patients were not classifiable according to the foregoing rules. The group sizes varied slightly in the analyses reported below because of missing data, especially on the BVMT–R, which was a later addition to the neuropsychological test battery.

Table 1 shows the mean FSIQs of each of the three groups as well as the result of their comparison. ANCOVA, entering age at testing and age at learning ESL as covariates, revealed a significant overall difference, and follow-up testing showed that both the pedophilia and the hebephilia groups differed significantly from the teleiophilia group. The standard deviations of the groups were quite close to the standard deviation of the general population, with no significant differences among them, Levene's test of equality of error variances, $F(2, 295) = 0.49$, $p = .61$. There were also significant associations between FSIQ and age at testing, $F(1, 293) = 5.06$, $p = .03$, and age at learning ESL, $F(1, 293) = 15.06$, $p < .0005$.

As one would expect, the same result and virtually the same effect size were obtained when the groups' WAIS–R age-scaled scores were analyzed by MANCOVA as a single set of six variables with the same covariates, Wilks's $\Lambda = .905$, $F(12, 576) = 2.44$, $\eta^2 = .048$, $p = .004$. Table 1 shows each of the groups' mean, age-scaled scores. On all six subtests, the pedophilia group scored the lowest. Furthermore, with the exception of Picture Completion, the effect sizes fell within only a narrow range, .020 to .057. The failure of Picture Completion to show the same pattern does not likely represent an area of preserved normal function in pedophilia. The result is more plausibly attributed to limited range; Picture Completion scores showed substantially less variance than did scores on the other five subtests.

Table 1
Wechsler Adult Intelligence Scale—Revised Age-Scaled Subtest Scores by Age Orientation

Test or subtest	Age orientation group: Pedophilia (n = 47)	Hebephilia (n = 158)	Teleiophilia (n = 93)	$F(2, 293)$	η^2	p
Full Scale IQ	89.5 (14.6)***	93.7 (15.5)*	97.8 (16.6)	6.77	.044	≤ .001
Information	7.85 (3.03)***	8.70 (3.30)**	9.74 (3.46)	8.86	.057	< .0005
Similarities	8.21 (3.27)*	8.59 (3.07)	9.22 (3.40)	2.94	.020	.054
Digit Span	8.62 (3.01)*	8.99 (2.94)*	9.88 (3.16)	4.34	.029	.014
Arithmetic	7.57 (3.04)***	8.59 (2.95)*	9.46 (3.10)	8.42	.054	< .0005
Picture Completion	8.62 (2.68)	9.26 (2.55)	8.96 (2.57)	1.59	.011	.207
Block Design	9.28 (3.33)*	9.92 (3.31)	10.48 (3.40)	3.07	.021	.048

Note. Group differences were analyzed by analysis of covariance, with age at testing and age at learning English as a second language as covariates. Values in parentheses are standard deviations.
* $p \leq .05$, two-tailed, versus teleiophilia. ** $p \leq .005$, two-tailed, versus teleiophilia. *** $p \leq .0005$, two-tailed, versus teleiophilia.

The three groups also differed in their memory testing. MANCOVA of the set of six HVLT–R subscores, covarying age at testing and age at learning ESL, identified significant overall group differences, Wilks's $\Lambda = .919$, $F(12, 584) = 2.10$, $\eta^2 = .041$, $p = .015$. Similarly, MANCOVA of the set of six BVMT–R subscores with the same covariates revealed significant omnibus group differences, Wilks's $\Lambda = .908$, $F(12, 500) = 2.06$, $\eta^2 = .047$, $p = .018$. The groups' mean raw scores for recall, learning, and recognition on the HVLT–R and BVMT–R appear in Tables 2 and 3, respectively. Lower scores signify poorer performance, except in False Positives.

Notably, the univariate tests of the individual subscores on both memory tests revealed significant group differences on the recall scores, but not on the learning or recognition scores. This invites speculation regarding a memory deficit specific to retrieval. However, because men who have committed sexual offenses are not a grossly cognitively impaired population, it remained alternatively possible that no group differences in recognition were detected because of a ceiling effect. That is, large proportions of patients may have performed perfectly on the relatively easy recognition tasks of each test. Indeed, examination of the distribution of scores on the memory tests argued for this interpretation: 49.7% of all patients received perfect scores on HVLT–R Recognition Hits, 35.4% on HVLT–R Recognition False Positives (i.e., 35.4% of the sample provided no false positives), 19.9% on HVLT–R Recognition Discrimination Index, 74.6% on BVMT–R Recognition Hits, 87.3% on BVMT–R Recognition False Positives, and 68.8% on BVMT–R Recognition Discrimination Index.

One may reasonably hypothesize that these group differences in memory testing actually reflect the aforementioned group differences in IQ. Thus, the MANCOVAs on both the HVLT–R and BVMT–R were repeated, adding estimated FSIQ as an additional covariate. When IQ was controlled, there were no longer any significant group differences in either the HVLT–R, Wilks's $\Lambda = .946$, $F(12, 574) = 1.35$, $\eta^2 = .027$, $p = .187$, or the BVMT–R, Wilks's $\Lambda = .949$, $F(12, 492) = 1.09$, $\eta^2 = .026$, $p = .371$.

Both the pedophilia group (n = 47) and the hebephilia group (n = 158) showed less right-handedness than the teleiophilia group (n = 94), with mean raw handedness quotients of .428 (SD = .761), .642 (SD = .618), and .753 (SD = .529), respectively. One-way analysis of variance indicated the group differences to be significant, $F(2, 296) = 6.57$, $\eta^2 = .043$, $p = .002$. It is well established, however, that lower right-handedness is associated with lower IQ (e.g., Bradshaw-McAnulty, Hicks, & Kinsbourne, 1984; Gordon, 1921; Pipe, 1988) and, in cross-sectional samples, with age (for a review, see Coren & Halpern, 1991). (The relation between handedness and age is generally interpreted as a confound of the shorter life spans associated with non-right-handedness, on

Table 2
Hopkins Verbal Learning Test—Revised (HVLT–R) Raw Scores by Age Orientation

HVLT–R score	Age orientation group: Pedophilia (n = 47)	Hebephilia (n = 161)	Teleiophilia (n = 94)	$F(2, 297)$	η^2	p
Total Immediate Recall	21.1 (5.49)**	22.7 (5.53)	23.8 (5.82)	5.08	.033	.007
Delayed Recall	7.34 (2.60)*	7.48 (2.52)*	8.35 (2.83)	4.34	.028	.014
Learning	3.15 (1.60)	3.38 (1.47)	3.39 (1.51)	0.44	.003	.643
Recognition Hits	10.9 (1.41)	11.0 (1.22)	11.2 (1.16)	1.25	.008	.288
Recognition False Positives	1.51 (1.32)	1.30 (1.54)	1.39 (1.87)	1.12	.007	.327
Recognition Discrimination Index	9.43 (2.23)	9.70 (2.11)	9.84 (2.39)	1.52	.010	.219

Note. Group differences were analyzed by analysis of covariance, with age at testing and age at learning English as a second language as covariates. Values in parentheses are standard deviations.
* $p \leq .05$, two-tailed, versus teleiophilia. ** $p \leq .005$, two-tailed, versus teleiophilia.

Table 3
Brief Visuospatial Memory Test—Revised (BVMT–R) Raw Scores by Age Orientation

BVMT–R score	Age orientation group: Pedophilia (n = 43)	Hebephilia (n = 138)	Teleiophilia (n = 79)	$F(2, 255)$	η^2	p
Total Immediate Recall	17.0 (6.84)***	19.5 (8.44)*	21.9 (8.16)	6.51	.049	.002
Delayed Recall	7.07 (3.31)***	8.04 (3.20)*	9.06 (2.84)	6.92	.051	.001
Learning	4.00 (2.20)	4.25 (2.18)	4.35 (1.80)	0.39	.003	.675
Recognition Hits	5.74 (0.54)	5.59 (0.74)	5.63 (0.85)	0.48	.004	.620
Recognition False Positives	0.16 (0.49)	0.20 (0.62)	0.27 (0.96)	0.04	.000	.957
Recognition Discrimination Index	5.58 (0.85)	5.39 (1.06)	5.43 (1.24)	0.58	.005	.558

Note. Group differences were analyzed by analysis of covariance, with age at testing and age at learning English as a second language as covariates. Values in parentheses are standard deviations.
* $p \leq .05$, two-tailed, versus teleiophilia. *** $p \leq .0005$, two-tailed, versus teleiophilia.

average. Thus, there are proportionately more right-handers with increasing age, producing a correlation in cross-sectional samples.) To control for these effects, we reanalyzed handedness using ANCOVA, with age at testing and FSIQ as the covariates. The present sample confirmed those associations, with handedness significantly related to age at testing, $F(1, 294) = 12.67$, $p \leq .0005$, and with a nonsignificant trend in the expected direction for FSIQ, $F(1, 294) = 3.40$, $p = .066$. The group differences did not change appreciably after the addition of the covariates, $F(2, 294) = 6.31$, $\eta^2 = .041$, $p = .002$, and simple effects contrasts showed that both the pedophilia group and the hebephilia group reported significantly less right-handedness than did the teleiophilia group, $t(294) = -3.51$, $\eta^2 = .040$, $p \leq .001$ (two-tailed), and $t(294) = -2.14$, $\eta^2 = .015$, $p = .033$ (two-tailed), respectively.

Multidimensional Analysis

The categorical approach used in the first phase of data analysis permits comparison of the performance of each group with normative data and with the prior literature, the great majority of which has used that approach. It also, however, has several disadvantages, which are discussed later. The second phase of data analysis, therefore, used a multidimensional approach. Rather than divide patients into groups, each patient was assessed along multiple dimensions: the magnitude of his erotic interest in prepubescent females, the magnitude of his erotic interest in prepubescent males, the magnitude of his erotic interest in pubescent females, and so on.

The sexual interests were assessed in two different ways: by the degree of penile tumescence recorded during phallometric testing and by the numbers of victims (or consenting adult sexual partners) in a given category. The analyses based on phallometric testing used the 382 patients who had valid phallometric test results, and the analyses based on sexual history used the 463 patients whose sexological self-report could be cross-checked with independent documentation. As before, differences in the number of participants among phallometry-based and among sexual-history-based analyses reflect missing neuropsychological test data.

The same covariates were used in these analyses as in the prior analyses, namely, age at testing and age at learning ESL for the cognitive neuropsychological variables and age at testing and FSIQ for handedness.

Erotic interests quantified by relative phallometric responses. The relations between the primary measures of cognitive performance and pedophilia, assessed by phallometric response, are summarized in Table 4. This table shows the partial correlations between the patients' penile responses to male and female children, pubescents, and adults on the phallometric test with their neuropsychological performance. The results indicated that, in general, measures of cognitive ability correlated negatively with sexual response to children and positively with sexual response to adults. Handedness, however, was significantly related to phallometric response to children, only. There was little evidence of association between the neuropsychological variables and sexual response to stimuli depicting pubescents in the laboratory.

Table 5 provides the partial correlations between patients' phallometric responses to test stimuli and the WAIS–R subtests. Overall, performance correlated negatively with attraction to children and positively with attraction to adults, supporting the analogous results from the categorical approach in Table 1. The magnitude of the relationships was notably consistent among the subtests; the range of correlations between the WAIS–R subtests and the phallometric responses to children (over both sexes) ranged from −.13 to −.18. Unlike the categorical analyses, these data separate penile responses to male stimuli from those to female stimuli; the WAIS–R subtests suggest that scores may be related more strongly to responses to female stimuli.

Multidimensional analysis of the two memory tests provided consistent, albeit partially redundant, information (see Table 4). The two recall scores on each test (Total Immediate Recall and Delayed Recall) were again significantly related to phallometric response. The other subscores were not significant, except that the HVLT–R Learning score was significantly correlated with phallometric response to adult males, $r(377) = -.12$, $p = .025$; the HVLT–R Hits score was significantly correlated with phallometric response to adult females, $r(377) = .10$, $p = .046$; and BVMT–R False Positives was significantly correlated with the phallometric response to pubescent females, $r(327) = -.14$, $p = .014$.

Erotic interests quantified by numbers of victims and of consenting partners. Table 6 presents the partial correlations between the primary neuropsychological measures and pedophilia, now measured as patients' sexual history. In addition to confirming the results of the phallometric data with an independent method, the sexual history data incorporate a distinction between consen-

Table 4
Partial Correlations Between Penile Responses to Phallometric Stimulus Categories and Primary Neuropsychological Test Variables

	Neuropsychological variable					
		HVLT–R		BVMT–R		
Stimulus category	WAIS–R Full Scale IQ (N = 378)	Total Immediate Recall (N = 381)	Delayed Recall (N = 381)	Total Immediate Recall (N = 331)	Delayed Recall (N = 331)	Edinburgh Handedness Inventory (N = 377)
Prepubescents						
Female	−.19***	−.11*	−.10*	−.12*	−.09	−.03
Male	−.08	−.07	−.07	−.14*	−.13*	−.15**
Combined	−.19***	−.13*	−.12*	−.19**	−.15**	−.13*
Pubescents						
Female	−.07	.04	.03	.04	.06	.07
Male	−.02	−.06	−.07	−.10	−.09	−.04
Combined	−.10	−.01	−.04	−.05	−.02	.04
Adults						
Female	.17**	.14**	.14*	.17**	.17**	.05
Male	.05	.01	.01	.04	−.00	.03
Combined	.18***	.14*	.14*	.18**	.15*	.07

Note. The partial correlation between each phallometric variable and each neurological test variable is shown. Phallometric responses are quantified as ipsative *z* scores, based only on the examinee's own data. The combined score is the sum of scores in response to males and females within a given age category. Age at testing and age at learning English as a second language were covariates for IQ and memory testing variables; age at testing and Full Scale IQ were covariates for handedness. HVLT–R = Hopkins Verbal Learning Test—Revised; BVMT–R = Brief Visuospatial Memory Test—Revised.
* $p \leq .05$, two-tailed. ** $p \leq .005$, two-tailed. *** $p \leq .0005$, two-tailed.

sual and nonconsensual interactions with adults. These results indicate that, in general, the patient's cognitive abilities correlated negatively with his number of victims under age 12, correlated positively with his number of consenting partners ages 17 and older, but did not correlate significantly with his number of victims ages 17 and over. These results, therefore, confirm and expand on those obtained using phallometric assessment of erotic interests.

Multidimensional analysis of the two memory tests again confirmed the association between recall memory scores and pedophilia, measured by offense history (see Table 6). The learning and recognition scores on both memory tests showed some significant relationships with pedophilia, consistent with the previously discussed patterns. Number of female child victims correlated with HVLT–R False Positives, $r(456) = .09$, $p = .045$; number of male child victims correlated with BVMT–R False Positives, $r(392) = .13$, $p = .008$; total number of child victims correlated with both HVLT–R False Positives, $r(456) = .12$, $p = .013$, and HVLT–R Recognition Discrimination Index, $r(456) = -.12$, $p = .013$; and number of adult male victims correlated with BVMT–R Learning, $r(392) = -.14$, $p = .007$, and with BVMT–R False Positives,

Table 5
Partial Correlations Between Penile Responses to Phallometric Stimulus Categories and Wechsler Adult Intelligence Scale—Revised (WAIS–R) Age-Scaled Subscales

	WAIS–R subtest					
Stimulus category	Information	Similarities	Digit Span	Arithmetic	Picture Completion	Block Design
Prepubescents						
Female	−.12*	−.14**	−.20***	−.20***	−.10	−.12*
Male	−.07	−.03	−.02	−.04	−.09	−.09
Combined	−.14*	−.13*	−.17**	−.18***	−.13*	−.15**
Pubescents						
Female	−.03	−.08	−.11*	−.10*	.03	−.03
Male	−.04	.02	−.02	.01	−.04	−.06
Combined	−.07	−.06	−.14*	−.10	−.01	−.09
Adults						
Female	.14*	.10	.16**	.16**	.11*	.13*
Male	.00	.09	.03	.05	.00	.06
Combined	.13*	.15**	.16**	.18***	.10	.16**

Note. N = 378. The partial correlation between each phallometric variable and each WAIS–R subtest is shown. Phallometric responses are quantified as ipsative *z* scores, based only on the examinee's own data. The combined score is the sum of scores in response to males and females within a given age category. Age at testing and age at learning English as a second language were covariates in each analysis.
* $p \leq .05$, two-tailed. ** $p \leq .005$, two-tailed. *** $p \leq .0005$, two-tailed.

Table 6
Partial Correlations Between Offense History and Primary Neuropsychological Test Variables

	Neuropsychological variable					
		HVLT–R		BVMT–R		
Number of victims or consenting partners	WAIS–R Full Scale IQ (N = 454)	Total Immediate Recall (N = 460)	Delayed Recall (N = 460)	Total Immediate Recall (N = 396)	Delayed Recall (N = 396)	Edinburgh Handedness Inventory (N = 455)
Victims < age 12						
Female	−.14**	−.15**	−.07	−.12*	−.14**	−.09*
Male	−.12*	−.07	−.10*	−.12*	−.14**	−.09
Combined	−.19***	−.16**	−.12*	−.17**	−.20***	−.13*
Victims ages 12 to 14						
Female	−.03	−.01	−.00	.04	.01	−.02
Male	−.06	−.06	−.09	−.08	−.05	−.03
Combined	−.06	−.04	−.05	−.02	−.02	−.04
Victims ages 15 to 16						
Female	−.06	−.06	−.04	.00	−.01	−.05
Male	−.07	−.03	−.01	−.08	−.03	−.03
Combined	−.08	−.07	−.04	−.03	−.02	−.06
Victims ≥ age 17						
Female	−.07	−.06	−.05	−.06	−.07	.01
Male	−.07	−.13*	−.15**	−.13*	−.13*	−.05
Combined	−.08	−.06	−.06	−.07	−.08	.00
Partners ≥ age 17						
Female	.14**	.16**	.15**	.19***	.20***	.08
Male	.06	.09	.08	−.00	−.01	−.00
Combined	.17***	.20***	.18***	.20***	.19***	.06

Note. The partial correlation between each sexual history variable and each neurological test variable is shown. The numbers of female, male, and total victims in each age range are capped at 10. Thus, if a patient had molested 3 girls under age 12 and 11 boys under age 12, his scores for victims < age 12 would be 3, 10, and 10, for female, male, and combined, respectively. Age at testing and age at learning English as a second language were the covariates for the cognitive neuropsychological variables; Full Scale IQ and age at testing were the covariates for handedness. HVLT–R = Hopkins Verbal Learning Test—Revised; BVMT–R = Brief Visuospatial Memory Test—Revised.
* $p \leq .05$, two-tailed. ** $p \leq .005$, two-tailed. *** $p \leq .0005$, two-tailed.

$r(392) = .21$, $p < .0005$. Second, numbers of consenting adult sexual partners (of either sex) were associated with superior test performance. Number of female adult partners correlated with HVLT–R Recognition Hits, $r(456) = .10$, $p = .029$, and with BVMT–R Learning, $r(392) = .10$, $p = .045$; number of male adult partners correlated with HVLT–R False Positives, $r(456) = -.10$, $p = .035$; and total number of adult partners correlated with HVLT–R Recognition Hits, $r(456) = .13$, $p = .006$, and with HVLT–R Recognition Discrimination Index, $r(456) = .11$, $p = .015$. The detection of these relationships in the dimensional approach, but not in the previous group approach, highlights the utility of the greater statistical power of the dimensional approach.

Table 7 shows the partial correlations between the age-scaled WAIS–R subtests and patients' offense histories, controlling for age at testing and age at learning ESL. Consistent with prior analyses, subtest scores correlated negatively with number of child victims and positively with number of consenting adult sexual partners. Overall, the numbers of victims in the intermediate age categories, 12 to 14 and 15 to 16, appear less strongly associated with WAIS–R performance than is phallometric response to that age group (the pubescent stimuli).

Both the phallometric and the offense history analyses revealed an asymmetry between the findings for the FSIQ, BVMT–R, and HVLT–R, on the one hand, and the Edinburgh Handedness Inventory, on the other. The three measures of cognitive ability correlated with erotic interest in prepubescent children and with erotic interest in (consenting) adults; the Edinburgh Handedness Inventory correlated only with erotic interest in children. One possible explanation for this asymmetry was a floor effect: There was no effective methodological limitation on how intelligent or mnemonically gifted a patient could test out, but he could not be more right-handed than completely right-handed. The frequency distribution for the Edinburgh Handedness Inventory was extremely skewed, as with recognition memory scores; 58% of patients produced the minimum score.

Discussion

The prior literature on the cognitive functioning of people with pedophilia has failed to produce reliable conclusions, likely owing to its widely varying methodology. The present investigation sought to resolve those contradictions through improved procedures. The total sample size of 473 makes the present sample one of the largest data sets of its kind, providing greater statistical power than has been available to most previous studies. Also maximizing statistical power was the use of continuous rather than discrete measures of handedness (Edinburgh Handedness Inventory vs. ratings of right-/not-right-handed), intelligence (FSIQ vs. proportion of mental retardation), and pedophilia (numbers of victims and relative phallometric response vs. binary classification

Table 7
Partial Correlations Between Offense History and Wechsler Adult Intelligence Scale—Revised (WAIS–R) Subtests

Number of victims or consenting partners	WAIS–R subtest					
	Information	Similarities	Digit Span	Arithmetic	Picture Completion	Block Design
Victims < age 12						
Female	−.17***	−.16***	−.05	−.12*	−.05	−.07
Male	−.06	−.05	−.09	−.14**	−.09	−.16**
Combined	−.17***	−.16**	−.10*	−.18***	−.10*	−.16**
Victims ages 12 to 14						
Female	−.05	−.05	.05	.04	−.05	−.05
Male	−.02	−.07	−.08	−.05	−.04	−.01
Combined	−.05	−.09	−.01	.00	−.07	−.04
Victims ages 15 to 16						
Female	−.04	−.10*	.01	.02	−.07	−.08
Male	−.03	−.04	−.10*	−.04	−.08	−.03
Combined	−.05	−.10*	−.03	−.00	−.10*	−.09
Victims ≥ age 17						
Female	−.06	−.07	−.01	−.05	−.13*	−.03
Male	−.03	−.03	−.01	−.07	−.09	−.13*
Combined	−.07	−.07	−.01	−.06	−.14**	−.04
Partners ≥ age 17						
Female	.04	.10*	.17***	.14**	.15**	.09
Male	.07	.05	.04	.04	−.02	.07
Combined	.07	.11*	.19***	.14**	.16***	.13**

Note. $N = 454$. The partial correlation between each sexual history variable and each WAIS–R subtest is shown. The numbers of female, male, and total victims in each age range are capped at 10. Thus, if a patient had molested 3 girls under age 12 and 11 boys under age 12, his scores for victims under age 12 would be 3, 10, and 10, for female, male, and combined, respectively. Age at testing and age at learning English as a second language were the covariates in each analysis.
* $p \leq .05$, two-tailed. ** $p \leq .005$, two-tailed. *** $p \leq .0005$, two-tailed.

as an individual who has offended against children). Finally, in contrast with prior studies comparing pedophilic men with college students, men who committed nonsexual offenses, or no control group at all, the present investigation used the most closely related comparison group feasible: men with atypical (but nonpedophilic) sexual interests or with a history of sexual offenses against adults. Thus, where differences detected by many prior studies might have resulted from general criminality or the presence of any sexual atypicality, the differences detected by the present investigation may be attributed more decisively to pedophilia itself.

The present findings confirm the association between pedophilia and poor brain functioning. Sexual interest in prepubescent children was significantly associated with lower FSIQ, with each of the administered subtests of the WAIS–R, with immediate and delayed verbal free-recall memory, and with immediate and delayed visuospatial free-recall memory. In addition, sexual interest in prepubescent children correlated significantly with lower right-handedness, an association remaining significant after associations with age and FSIQ were covaried. This latter result confirms the previous report of decreased right-handedness in men who have sexually assaulted children (i.e., Bogaert, 2001) and demonstrates that the handedness differences were not merely a confound of lower average intelligence. Overall, these results show not only that there is an association between pedophilia and poor cognitive functioning but also that the association is not attributable to an ascertainment bias. That is, although one may posit that less intelligent individuals with pedophilia may be more likely to be apprehended, it is implausible to hypothesize that, controlling for IQ, non-right-handed individuals with pedophilia are more likely to be apprehended or available for study.

The present results were internally consistent. Sexual attraction to children was related to poorer intellectual capacity whether the analysis was conducted with the categorical approach or with the multidimensional approach, whether attraction to children was operationalized by offense history or by phallometric responses, whether cognitive function was represented by tests of IQ or by tests of memory capacity, and whether attraction to children was reflected by greater attraction to children or by lesser attraction to adults. The otherwise inconsistent identification of these relationships in the literature is likely due to two complicating factors: (a) The causal association between cognitive capacity and pedophilic interest is only indirect, making correlations between them inherently small, and (b) most prior studies used small samples and dichotomized data, providing insufficient statistical power with which to detect modest correlations.

We have previously theorized a causal model with an indirect association between pedophilia and other brain-related correlates (Blanchard et al., 2002), contrasting it with models that hypothesize a direct causal association. Other researchers have postulated that sexually offending behavior results directly from poor decision making or inability to control sexual impulses (e.g., Galski, Thornton, & Shumsky, 1990; Stone & Thompson, 2001). This causal model is represented by the upper diagram of Figure 1. Any direct, causal connection between intellectual function and pedophilia, however, is implausible; 23% of the general population has IQs below 89—the mean of the sample with pedophilia in the

categorical analysis here—yet the vast majority of people, including the mentally retarded, do not have pedophilia. More plausible is the third-variable model (lower diagram of Figure 1), where a perturbation occurs in early brain development and causes each of the characteristics measured here: lower cognitive capacity, decreased rates of right-handedness, and pedophilic interest. The correlates, in this model, are markers associated with pedophilia, not causal agents. The common etiology among these characteristics, then, is what produced the consistent (yet expectedly low) associations among them. The inconsistent conclusions in the literature, then, are more likely attributable to Type II errors of the negative reports than to Type I errors of the positive reports.

These results indicated no specific pattern of cognitive weakness but suggest that people with pedophilia possess a broad cognitive deficit. Preliminary indications of dysfunction in any specific cognitive domain were ruled out upon closer analysis. The relationship between pedophilic interest and recall memory functioning was both significant and comparable in magnitude to that between pedophilic interest and IQ. The relationship was observed both for verbal and for visuospatial recall. Pedophilic interest was not, however, significantly correlated with recognition or learning scores on either the verbal or visuospatial memory tests (although those scores were significantly associated with attraction to physically mature persons). This pattern held true whether pedophilic interest was measured by sexual offense history or by phallometric response in the laboratory. Although it would be interesting should this pattern prove to be a dissociation of neuropsychological functioning, the difference may also be an artifact, a ceiling effect obscuring scores on recognition but not recall. In future research, memory testing of otherwise non-brain-injured individuals with pedophilia should be conducted using tests with more difficult recognition tasks.

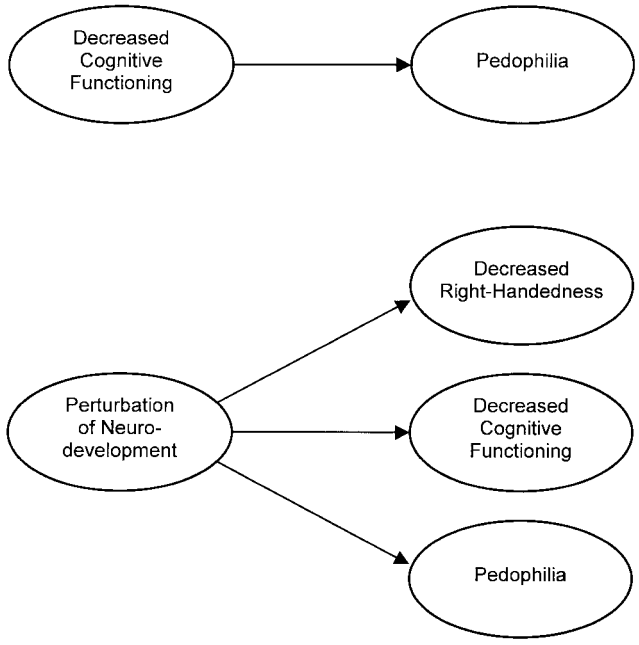

Figure 1. Hypothesized causal model of pedophilia and correlates of pedophilia. Adapted from "Retrospective self-reports of childhood accidents causing unconsciousness in phallometrically diagnosed pedophiles," by R. Blanchard, B. K. Christensen, S. M. Strong, J. M. Cantor, M. E. Kuban, P. Klassen, et al., 2002, *Archives of Sexual Behavior, 31,* p. 524. Copyright 2002 by Kluwer Academic. Adapted with permission.

As previously mentioned, the categorical approach to the present research area (i.e., assigning individuals who have committed sexual offenses or clinical sexology patients to discrete groups) has certain disadvantages. The first is that this approach presupposes knowledge of the underlying taxa. Taxonomic knowledge of the paraphilias is, in fact, incomplete at present. It is clear, for example, that there exist men who are more attracted to pubescents than they are to younger or older persons, but what do such men—those with hebephilia—really represent? Is this pedophilia oriented toward the oldest possible children, teleiophilia oriented toward the youngest possible sexually mature persons, some third orientation that is etiologically distinct from both pedophilia and teleiophilia, or a mixture of all three? The second disadvantage is that classification rules are arbitrary, and many equally reasonable rules for assigning individuals to discrete categories could be devised. The third disadvantage is that the categorical approach necessarily entails the loss to research of many patients who do not fit into any homogeneous category. In the present study, for example, 36% of the patients could not be classified. Such data loss does not merely reduce a study's sample size; it also lays a study open to the criticism that its findings are somehow unrepresentative of the full population of sex offenders (or men with paraphilias, or sexology patients). The fourth disadvantage is the inherent loss of statistical power in reducing (truly) continuous variables to categorical ones. For the foregoing reasons, we felt it was important to confirm the general conclusions of our categorical analyses with multidimensional analyses, and we recommend that other researchers also consider doing this.

These results pose a number of questions for future investigation. First, despite that individuals with pedophilia appeared to have a general cognitive deficit on the present battery, it remains possible that there may exist areas of preserved cognitive ability or of more severe deficit, characteristics that may yet be identified by a still more comprehensive neuropsychological battery. Second are questions regarding which brain areas might be affected in pedophilia, such as whether and to what extent these areas are the same as those involved in typical sexual functioning. Such information may provide insights into the process, location, or timing in development that went awry. Third, the involvement of decreased right-handedness establishes clear linkage between brain development and pedophilia and invites questions regarding whether these brain perturbations are alone sufficient to produce pedophilia or are a vulnerability that interacts with subsequent events. That is, it is possible that the evidence of perturbations in brain development reflects an early, nonspecific risk factor, or, alternatively, reflects an independent pathological process alone sufficient to produce pedophilia. The answers to these questions may, in turn, guide future efforts to detect and prevent the development of pedophilia.

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