

## ORIGINAL RESEARCH—PSYCHOLOGY

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# Executive Dysfunctions in Pedophilic and Nonpedophilic Child Molesters

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### ABSTRACT

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**Introduction.** There is some evidence that child molesters show neuropsychological abnormalities which might reflect specific structural and/or functional brain alterations, but there are also inconsistencies in the existing findings which need to be clarified. Most of the different outcomes can either be explained by the fact that different types of child molesters were examined or by not having accounted for basically confounding factors such as age, education/intelligence, or criminality.

**Aim.** The present study therefore sought to determine whether pedophilic and nonpedophilic child molesters, compared to relevant control groups, show different profiles of executive dysfunction when accounting for potentially confounding factors.

**Methods.** The performance of 30 child molesters (15 pedophilic and 15 nonpedophilic) and 33 age- and education-matched controls (16 nonsexual offenders and 17 healthy controls) was assessed regarding several neuropsychological functions.

**Main Outcome Measures.** Scores on different neurocognitive tests and semistructured diagnostic interviews.

**Results.** Results indicate that pedophilic child molesters exhibited less performance deficits in cognitive functioning than nonpedophilic child molesters. Compared to healthy controls and nonsexual offenders, the pedophilic child molesters only showed executive dysfunction concerning response inhibition, whereas the nonpedophilic child molesters revealed more severe dysfunction, especially on tasks associated with cognitive flexibility and verbal memory.

**Conclusions.** These results enhance our knowledge about executive dysfunction associated with criminality and/or pedophilia, as they suggest different profiles of impairment between groups. In summary, data suggest that nonpedophilic child molesters showed more severe cognitive deficits than pedophilic child molesters. However, as response inhibition is associated with prefrontal (i.e., orbitofrontal) functioning, the deficits observed in both child molester groups indicate dysfunction in the orbitofrontal cortex. This has to be further examined with functional imaging approaches in larger samples and a full-factorial approach which allows for a clear distinction between criminality and pedophilia in a factorial manner. **Schiffer B and Vonlaufen C. Executive dysfunctions in pedophilic and nonpedophilic child molesters. J Sex Med 2011;8:1975–1984.**

**Key Words.** Pedophilia; Child Molester; Sexual Abuse; Neuropsychological Assessment; Executive Functions

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### Introduction

According to estimates of German authorities (Bundeskriminalamt), the incidence of child sexual abuse in Germany amounts to 550 cases per day (200,000 per year) and in the United States even to 500,000 per year [1]. These high preva-

lence rates and associated public concern have supported research efforts focusing on the neurobiologic basis of pedophilia.

Sexual deviations in men may have multiple causes: genetically initiated events [2], social learning [3], and brain morphology [4–6]. Data from neuropsychological, personality, sexual history,

and plethysmography research suggest that pedophilia is linked to early neurodevelopmental perturbation [7–9]. This hypothesis is also substantiated by the results of one recent structural imaging study [4] reporting about abnormalities in the amygdala and interconnected areas, like the hypothalamus or the bed nucleus of the stria terminalis. All these regions are critical for sexual development and, therefore, might be involved in the pathogenesis of pedophilia. They possibly reflect developmental impairment or environmental insults at critical periods. Furthermore, morphological abnormalities were found in the prefrontal cortex, the ventral striatum, the medial temporal cortex [4,5,10,11], and two major fiber bundles [6]. The results of several functional imaging studies additionally suggest pedophilia-related alterations in the processing of emotional stimuli and the activation of frontostriatal regions and the amygdala–hippocampus complex [12,13]. Alterations were also found for the processing of salient sexual stimuli [14–16] and other specific cognitive or affective functions including empathy or impulsivity paradigms [9,10,17,18]. However, results of functional imaging studies are not able to clarify whether functional abnormalities are the cause or the consequence of specific symptoms or syndromes and therefore need to be interpreted with caution.

The percentage of child sexual abusers who meet the criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV [19] for pedophilia varies between different studies. According to the Mayo Clinic, approximately 95% of incidents of sexual abuse of children age 12 and younger are committed by offenders who meet the diagnostic criteria for pedophilia. However, they only represent 65% of child molestation offenders [20].

Nonetheless, several methodological concerns limit the interpretability of previous research on neuropsychological correlates of pedophilia and might also be able to explain the inconsistencies in the result patterns. The limitations are: the lack of a forensic control group (comprising nonsexual offenders) and the recruitment of “pedophiles” only on the basis of committed crimes (i.e., child sexual abuse) instead of psychiatric symptoms/syndromes or underlying motivation. Thus, it is not yet possible to clearly distinguish between neuropsychological impairment due to pedophilia and/or criminality.

Still, there are several reasons to believe that there are important (and clinically relevant) differences between pedophilic and nonpedophilic child

molesters, as well as nonsexual offenders at neurological, neuropsychological, and psychological levels. The problem is that up to now, it is still a matter of debate, when to classify a child molester as pedophilic. Being persistently attracted to prepubescent children neither means that the individual is not capable of sex with older partners nor that sexual desires or fantasies are limited to adolescents or children. Therefore, many authors prefer to distinguish between “true and opportunistic” pedophiles or “preferential and situational” pedophiles (e.g., Prentky et al. [21]). However, due to their diagnostic specificity, the terms pedophilic vs. nonpedophilic child molesters are used throughout this article.

Pedophilic child molesters show persistent and focused sexual attraction to prepubescent children. They show specific arousal to pedophilic stimuli on physiological measures of sexual arousal and have repeated sexual encounters with or recurrent sexual urges toward children. Nonpedophilic child molesters are less sexually focused on children. Their sexual engagement with children rather depends on certain circumstances like the availability of a child victim, disinhibition following substance abuse, or difficulty in connecting with an adult sexual partner [22,23]. Furthermore, there is some controversy whether pedophilic and nonpedophilic child molesters can be categorized that clearly or if their behaviors and activities can better be described by a continuum [24]. Anyhow, adults who molest children clearly have different motivations. While pedophilic child molesters may rather be driven by abnormal sexual desires, nonpedophilic child molesters may have grave difficulties with inhibiting their impulses [23].

It seems reasonable, therefore, to assume that sexual offenders have characteristic cognitive deficits, but also that they may differ across subtypes of child molesters. Analyzing heterogeneous samples may have obscured their detection [2] up to now. Furthermore, it has been suggested that the different types of child molesters (pedophilic and nonpedophilic) may not only be characterized by different profiles of cognitive but also executive functioning [25]. However, it remains unclear whether the reported findings in the referenced study by Suchy et al. were confounded by criminality-related alterations or not.

Thus, the major aim of the present study was to further analyze existing executive dysfunctions in different types of child molesters and to address the limitations of the past research. We therefore accounted for different types of child molesters and

the lack of experimental control of variables such as age, intelligence, education level, or criminality. Moreover, we assumed that there may be a difference between pedophiles and nonpedophilic child molesters regarding impulsivity, and investigated their behavioral or response inhibition [25,26] which is considered a lower-order executive function associated with orbitofrontal functions (e.g., Stuss and Knight [27]). However, structural deficits and functional alterations in orbitofrontal regions have been observed in pedophilic child molesters [5,15], even though those patients—in contrast to nonsexual delinquents and nonpedophilic child molesters—are not necessarily impulsive. We therefore hypothesized that, compared to healthy controls, child molesters, in particular nonpedophilic ones and nonsexual offenders, would show larger performance deficits in behavioral inhibition and problem solving. According to previous findings [28–30], and their characteristically fixed preoccupation with the object of their sexual desire, we further hypothesized that tests on the higher-order executive function of cognitive flexibility would be able to discriminate between pedophiles and nonpedophilic child molesters. We also expected that pedophilic child molesters would tend to perseverate on the Wisconsin Card Sorting Test (WCST), whereas nonpedophilic child molesters, nonsexual offenders, and healthy controls would probably show equal performances. Finally, as aggression has been linked to impairment in the working memory [31], we further expected that offenders with a more aggressive offense style (i.e., nonsexual offenders and nonpedophilic child molesters) would show larger performance deficits on this domain than healthy controls and pedophilic child molesters.

## Method

### Participants

The entire sample comprised 63 male participants. The healthy control group (HC) comprised 18 men without a history of criminal offending recruited by media advertisement from the community. The forensic comparison group comprised 16 male nonsexual offenders currently convicted for homicide or grievous bodily harm with a long history of instrumental rather than impulsive violent offending. They were recruited from two different penitentiaries in North Rhine-Westfalia, Germany. Child sexual abusers were recruited from three different penitentiaries (partly treatment facilities) in North Rhine-

Westfalia, Germany. Thirty-eight of those 52 men, convicted of having sexually offended against a child younger than 13 years in at least two cases, agreed to participate in the study. All others refused without giving a reason. They were subdivided into two groups: (i) 19 who met the DSM-IV criteria of pedophilia, exclusive type, characterized by a primary sexual interest in prepubescent children (i.e., younger than 13 years), referred to below as “pedophilic” (CMP+); and (ii) 19 who, despite of having offended against prepubescent children, exhibited a primary sexual interest in adults, referred to as “non-pedophilic” (CMP–). All participants were neither medicated at the time point of measurements nor were their crimes limited to incestuous offenses only. Offenders’ pedophilic status was derived from three information sources: the therapist, the study interviewer, and a specially constructed self-report questionnaire about masturbation fantasies and scales of the Multiphasic Sex Inventory (MSI) [32]. As we were concerned that child molesters might minimize or even deny their pedophilic inclinations, only those offenders who had been classified as trustworthy by the MSI scores (Scales: Social Sexual Desirability and Lie Scale for Child sex abuse), and accordingly revealed predominantly deviant sexual masturbation fantasies, were classified as pedophilic. As provided by the MSI manual, the cutoff scores to determine trustworthiness were set to >23 for the Social Sexual Desirability Scale and <8 for the Lie Scale. The Social Sexual Desirability Scale helps to identify persons who are responding to the MSI in a socially desirable response set. The Lie Scale measures the openness vs. dishonesty regarding the sex offender’s sexually deviant thoughts and behaviors.

Abusers with scores above cutoff values on the lie scale or below cutoff values on the social desirability scales were only classified as pedophilic if they had never had an adult partnership in their life, had frequently been convicted (>4 times) of child sexual abuse with a moderate violence level, and were diagnosed as pedophilic by expert opinion (therapist and/or forensic assessor). Otherwise, they were classified as nonpedophilic child molesters.

From the initial sample, we excluded five child molesters whose sexual abuses were limited to incestuous offenses. For age matching purposes, we further excluded three older child molesters and one younger participant from the HC, so that the final sample comprised 63 subjects.

None of the participants had neurologic diseases or serious medical illnesses known to affect

the central nervous system, a history of neurological or systemic illness, head injury, any form of current addictive behavior except nicotine use, or a personal or family history of major psychiatric illness such as psychotic or bipolar disorders, as assessed by a self-report questionnaire and a clinical interview.

This study was approved by the Committee on Medical Ethics of the Medical Faculty, University of Duisburg-Essen, Germany and carried out in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki). After all participants had been informed about the contents of the study in detail, they gave their written informed consent. All participants were financially compensated with 20 euros.

### *Neuropsychological Assessment*

In order to be able to test for the executive functions of interest, subjects completed a neuropsychological test battery, including the modified WCST [33], the Trail Making Test Version A and B (TMT-A and TMT-B) [34], the Regensburger Wortflüssigkeitstest (i.e., a test of verbal fluency) [35], two subtests of the Wechsler Memory Scale-Revised (WMS-R) [36], the Corsi Block Tapping Test (CBT) [37], a Go/No-go paradigm embedded in the Test for Attentional Performance [38], and a Tower of London task in a computerized version [39].

The TMT [34] is a paper-and-pencil task which assesses the ability to shift attention between different verbal sets. It consists of two parts, TMT-A and TMT-B. The TMT-A, which is used as measure of attention and psychomotor speed, is always implemented first and requires of subjects to rapidly draw a connecting line between the numbers 1 and 25, which are randomly distributed on a sheet of paper in ascending order. In the TMT-B part, both numbers (1–13) and letters (A–L) are randomly positioned on the paper and subjects have to alternately connect the numbers and the letters in ascending order (i.e., 1-A-2-B-3-C-4-D . . .) as quickly as possible. This is a more complex task that requires cognitive flexibility and maintenance of a complex response set. Part B measures the ability to shift strategy and assesses executive function and visuospatial working memory, thus reflecting the activity of frontal lobes. Each subtask is given once and the speed of performance on both subtasks is used as dependent variable. Set shifting costs were defined as the difference in performance speed between the two

subtests (TMT B—TMT A), and were used as additional dependent variable.

The computerized version of the Wisconsin Card Sorting Task (WCST) [33] measures the ability to alter a behavioral response in the context of changing contingencies (set-shifting). In this test, the subject was asked to match test cards to reference cards according to the color, shape, or number of stimuli on the cards. Feedback was provided after each match, enabling the subject to identify the correct rule of classification. After a certain number of correct matches, the rule was changed, and the subject had to shift to a new mode of classification. Dependent variables were the number of categories achieved, the total number of correct responses, the total number of errors, and the number of perseverative errors.

The “Regensburger Wortflüssigkeitstest” was applied to measure verbal (category) fluency or speed of access to semantic information [35]. Subjects were asked to generate as many words as possible to a specific category (in this study: animals) within a given period of time (in this study: 60 seconds).

The CBT [37] and the visual reproduction task of the WMS-R [36] were taken to measure the visuospatial memory capacity. In the visual reproduction test of the WMS-R, four line drawings are presented one at a time for a 10-second exposure period. After removing the drawing, the subject is asked to draw the figure from memory immediately and also after a delay of approximately 30 minutes. For each of the four line drawings, a maximum of 10 points could be achieved (one point for each detail). The Corsi task is also a test for visuospatial memory capacity. The test material consists of nine wooden blocks (1.25-inch cubes) unevenly distributed on (and fixed upon) a flat board. In the test, the experimenter taps sequences of blocks at the rate of one block per second, and then the test person is asked to tap the same sequences. The difficulty level is progressively raised by increasing the number of blocks tapped. There are three trials at each difficulty level. The subject’s spatial span is conventionally taken to be the longest sequence in which at least two out of the three sequences are correctly reproduced. As indicators for the visual memory domain, we used the Corsi spatial span and the raw scores for immediate and delayed reproduction of figures from the WMS-R.

Analogue to the visual reproduction task of the WMS-R [36], participants were asked to perform the Logical Memory task I and II (i.e., to orally

reproduce a short verbally presented story immediately and after a 30-minute delay). As indicator for verbal memory, we used the number of correctly recalled segments (25 points maximum) of the story in immediate and delayed recall.

The psychological concept of inhibition is commonly used to detect an active/intentional process underlying cognitive control. Many authors suggest that subjects try to achieve cognitive control over unwanted stimuli, task sets, responses, memories, and emotions by inhibiting them, and that frontal lobe damage induces distractibility, impulsivity, and perseveration because of damage to an inhibitory mechanism [40]. In modern experimental psychology, the concept of inhibition has many meanings and has been used in different paradigms [40]. In the present study, we used a Go/No-go task, taken from a German standard battery [38], to assess response inhibition. The test consists of five types of stimuli including lines in different directions. The subjects were asked to press a button if one of the two defined target stimuli were presented. In total, 60 stimuli were presented, 24 of which were target stimuli. Short reaction times and high numbers of false alarms (button-press when seeing a nontarget stimulus) indicate impaired response inhibition abilities and high impulsivity.

Finally, a computerized Tower of London task [39], an adaptation of the Tower of Hanoi task [41], was used to measure planning or problem-solving abilities. Subjects were asked to move colored balls within a limited number of moves in order to achieve a given goal configuration. Dependent variables included the number of correct solutions, the total processing time for each trial, and the mean response latency for each trial.

### Statistics

In order to characterize the sample, we first conducted a series of one-way analyses of variance (ANOVAs) to examine between-group differences in all demographic and forensic characteristics of study participants. Second, we executed a series of one-way ANOVAs for the neuropsychological measures to detect between-group differences. Due to the relatively small sample size, we conducted univariate analyses with and without Bonferroni corrections to detect differences between pairs of groups. For all analyses, the Statistical Package for the Social Sciences (SPSS, 16.0 for Windows, SPSS Inc., Chicago, IL, USA) was used.

## Results

### Demographic and Forensic Characteristics

As shown in Table 1, we did not find between-group differences regarding demographic variables such as age or education level. Thus, neither age nor education level were considered as potentially confounding factors in the subsequent analyses. However, examination of forensic characteristics revealed that pedophilic child molesters abused more and younger children and marginally more male children compared to nonpedophilic child molesters. There was also a marginally significant difference for age at first violent offense suggesting that both molester groups offended later in their life compared to nonsexual offenders. We did not find differences for the number of convictions and imprisonments or length of incarceration. As a consequence of the diagnostic classification procedure (i.e., child molesters who scored low on the MSI Lie Scale and high on the MSI Social Sexual Desirability Scale were classified as pedophilic rather than nonpedophilic, whereas child molesters who scored high on the MSI Lie Scale and low on the MSI Social Sexual Desirability Scale were classified as nonpedophilic rather than pedophilic), pedophilic child molesters showed lower scores on the MSI Lie Scale for child sexual abuse. However, they did not significantly differ in their scores on the Social Sexual Desirability Scale.

### Neuropsychological Measures

Data on neuropsychological measures are presented in Table 2. As there was no significant difference in intelligence quotient (IQ) levels between all groups, IQ was not considered to be a potential confound in subsequent analyses.

However, we found that, compared to healthy controls, nonpedophilic child molesters showed significant performance deficits on all measures of the WCST, whereas pedophilic child molesters revealed deficits only regarding perseverative errors. However, of these differences, only one survived Bonferroni correction (i.e., the difference between healthy controls and nonpedophilic child abusers on the number of categories achieved). Compared to healthy controls, there was also a significant fluency deficit in both groups of child molesters and the group of nonsexual offenders which, however, did not survive Bonferroni correction. Additionally, we found that, compared to healthy controls and pedophilic child molesters, the nonpedophilic child molesters and the

**Table 1** Demographic and forensic characteristics (mean ± SD) of study participants (N = 63)

Measure	Pedophilic child molesters (N = 15)	Nonpedophilic child molesters (N = 15)	Forensic controls (N = 16)	Healthy controls (N = 17)	ANOVA P	Pair-wise t-tests between groups P < 0.05	Bonferroni corrected alpha for 11 univariate tests P < 0.005
<b>Demographic</b>							
Age in years	38.7 ± 8.9	44.2 ± 7.9	37.4 ± 9.1	37.7 ± 10.2	0.145	NA	NA
Education in years	9.7 ± 1.5	9.4 ± 1.5	9.4 ± 1.0	9.9 ± 0.9	0.671	NA	NA
<b>Forensic</b>							
Age at first violent offence	27.3 ± 8.4	28.3 ± 10.9	21.2 ± 4.8	NA	0.052	GMP+, CMP- > FC	NA
No. of convictions	2.9 ± 1.8	4.9 ± 5.3	4.9 ± 3.7	NA	0.253	NA	NA
No. of imprisonments	2.1 ± 4.7	1.7 ± 4.0	0.7 ± 1.0	NA	0.585	NA	NA
Length of incarceration	4.7 ± 1.4	7.2 ± 3.7	6.8 ± 6.2	NA	0.227	NA	NA
No. of victims	4.8 ± 4.6	2.1 ± 1.6	NA	NA	<b>0.026</b>	CMP+ > CMP-	NA
Age of victims (years)	9.3 ± 1.6	11.2 ± 2.3	NA	NA	<b>0.008</b>	CMP- > CMP+	CMP- > CMP+
Sex of victims (% male)	41.3	20.0	NA	NA	0.056	NA	NA
MSI social sexual desirability scale	27.4 ± 4.4	28.6 ± 3.6	NA	NA	0.417	NA	NA
MSI lie scale child sex abuse	4.1 ± 3.3	8.2 ± 3.2	NA	NA	<b>0.001</b>	CM - P > CM + P	CM - P > CM + P

Note: Significant differences are stated in bold type. CMP+ = pedophilic child molesters; CMP- = nonpedophilic child molesters; FC = forensic controls; HC = healthy controls; ANOVA = analysis of variance; MSI = multiphasic sex inventory.

nonsexual offenders showed reduced performance on both measures of the verbal memory task (i.e., immediate and delayed recall), which also both survived Bonferroni correction.

However, the most conspicuous difference was observed for the number of errors in the Go/No-go task. Compared to healthy controls and nonsexual offenders, both child molester groups revealed significant more errors but showed no differences on reaction times. As resulted by the post hoc analysis with Bonferroni correction, only the difference between nonpedophilic child molesters and healthy controls or nonsexual offenders remained significant.

Finally, we found no significant between-group differences regarding set-shifting costs or speed of performance on the TMT, and there were also no between-group differences on visuospatial memory tasks or the Tower of London task. However, for the latter, there was a marginally significant effect showing that although nonpedophilic child molesters needed more time to complete each trial than all other groups, they showed the worst performance.

**Discussion**

The current study sought to determine whether pedophilic and nonpedophilic child molesters would show different profiles of executive dysfunction compared to a group of nonsexual offenders and a group of healthy control subjects with respect to potential confounding factors (i.e., age, education, intelligence, and length of incarceration), which have been carefully matched over the groups.

We hypothesized that child molesters (pedophilic or not) and nonsexual delinquents would show larger performance deficits in the impulsivity-related domain of behavioral inhibition when compared to healthy controls. However, as indicated by the results of the Go/No-go task, our results did not reveal any dysfunction on response inhibition for nonsexual delinquents but for both groups of child molesters. The fact that nonsexual offenders did not show any deficit on this task might be ascribed to the less impulsive character of their offenses. The group of nonsexual offenders consisted of mainly habitual violent offenders convicted for various forms of instrumental rather than impulsive crimes. For the child molester groups, however, this finding is consistent with those previous reports, which documented specific frontal, in particular

**Table 2** Neuropsychological performance (mean ± SD) of study participants (N = 63)

Measure	Pedophilic child molesters (N = 15)	Nonpedophilic child molesters (N = 15)	Forensic controls (N = 16)	Healthy controls (N = 17)	One-way ANOVAS P	Pair-wise ttests between groups P < 0.05	Bonferroni corrected alpha for 21 univariate tests P < 0.002
Intelligence (MWT-B-IQ)	108.5 ± 10.1	107.5 ± 14.2	103.2 ± 7.1	110.2 ± 11.9	0.321	NA	NA
Wisconsin Card Sorting Test							
No. of categories achieved	4.67 ± 1.72	3.67 ± 1.29	4.63 ± 1.54	5.47 ± 0.62	<b>0.005</b>	HC > CMP-	HC > CMP-
No. of correct answers	34.6 ± 10.9	30.9 ± 7.53	35.6 ± 7.66	40.2 ± 4.60	<b>0.015</b>	HC > CMP-	NA
No. of errors	9.16 ± 5.76	12.33 ± 5.14	9.44 ± 5.34	6.18 ± 3.19	<b>0.023</b>	HC > CMP-	NA
No. of perseverations	4.33 ± 4.78	4.80 ± 3.12	2.94 ± 2.96	1.65 ± 1.62	<b>0.035</b>	HC > CMP-, CMP+	NA
Go/No-go task							
Mean reaction time (msec.)	591 ± 70	606 ± 75	595 ± 56	556 ± 78	0.211	NA	NA
No. of errors	5.40 ± 8.65	8.73 ± 9.81	0.44 ± 1.26	0.47 ± 1.01	<b>0.001</b>	CMP-, CMP+ > HC, FC	CMP- > HC, FC
Trail making test							
TMT-A duration (msec.)	30.6 ± 10.1	39.8 ± 14.3	39.6 ± 10.9	33.9 ± 9.6	0.074	NA	NA
TMT-A No. of errors	0.13 ± 0.35	0.07 ± 0.26	0.06 ± 0.25	0.00 ± 0.00	0.513	NA	NA
TMT-B duration (msec.)	97.3 ± 48.4	131.7 ± 83.0	116.3 ± 37.7	90.5 ± 27.1	0.125	NA	NA
TMT-B No. of errors	1.13 ± 2.20	1.67 ± 2.64	1.38 ± 2.85	0.88 ± 1.83	0.819	NA	NA
Set shifting costs	66.7 ± 41.4	91.9 ± 75.2	76.7 ± 37.5	56.6 ± 26.1	0.208	NA	NA
Category fluency (no. of words)	20.3 ± 3.9	19.6 ± 5.7	21.9 ± 6.7	25.1 ± 5.9	<b>0.035</b>	HC > CMP-, CMP+, FC	NA
Visual memory							
Immediate recall	37.8 ± 2.3	37.7 ± 4.1	38.9 ± 2.5	38.8 ± 2.4	0.526	NA	NA
Delayed recall	36.4 ± 4.1	34.5 ± 6.6	36.7 ± 3.7	36.3 ± 4.1	0.583	NA	NA
Corsi spatial span	5.2 ± 1.0	4.9 ± 1.1	5.2 ± 0.6	5.4 ± 0.5	0.572	NA	NA
Verbal memory							
Immediate recall	12.4 ± 5.0	8.6 ± 3.5	9.9 ± 3.9	15.5 ± 3.5	<b>0.000</b>	HC > FC, CMP-	HC > FC, CMP-
Delayed recall	11.3 ± 5.2	7.9 ± 4.1	7.6 ± 3.0	12.5 ± 4.0	<b>0.002</b>	HC > FC, CMP-	HC > FC, CMP-
Tower of London							
No. of correct answers	12.1 ± 1.3	11.3 ± 2.7	11.6 ± 1.8	11.9 ± 2.2	0.763	NA	NA
Mean first reaction time	14.0 ± 3.1	16.5 ± 6.1	15.2 ± 6.9	14.7 ± 5.9	0.690	NA	NA
Mean duration/task	32.3 ± 7.9	39.3 ± 13.3	34.2 ± 14.3	30.7 ± 10.0	0.072	NA	NA

Note: Significant differences are stated in bold type. MWT = Multiple Choice Vocabulary Test; CMP+ = pedophilic child molesters; CMP- = nonpedophilic child molesters; FC = forensic controls; HC = healthy controls; ANOVA = analysis of variance.

orbitofrontal dysfunction [5,9,15,42–44] in child sexual abusers. Analogue results were found in addicted, compulsive, and impulsive behaviors [45], which could be summarized as obsessive-compulsive spectrum disorders [46,47], even though, for different reasons, all these syndromes are characterized by concurrent behavioral disinhibition [18,48].

Problem solving and planning abilities, as assessed by the Tower of London task, are associated with frontal, in particular, dorsolateral prefrontal functioning [39]. In the current study, we expected specific performance deficits in problem-solving abilities in nonsexual offenders and nonpedophilic child molester which were considered as highly impulsive. However, we found no significant between-group differences on the number of correct solutions. Contrary to our hypothesis, nonpedophilic child molesters responded rather nonimpulsive, as they needed more time than all other groups to complete the trials. As the results regarding the number of correct solutions principally showed the hypothesized tendencies, it might be possible that this task lacks sensitivity to detect potentially existing group differences.

We further hypothesized that reactive cognitive flexibility, a higher-order executive function assessed by the WCST, would be able to discriminate between pedophiles and nonpedophilic child molesters. As expected, compared to healthy controls, the pedophilic child molesters tend to perseverate on the WCST, but in contrast to our hypothesis, there was no significant difference between pedophilic and nonpedophilic child molesters. Contrary to our hypothesis, nonpedophilic child molesters showed the most severe deficits on this task. Only the difference between nonpedophilic child molesters and healthy controls, regarding the number of categories accomplished, survived post hoc analysis with Bonferroni correction. Hence, our hypothesis could not be confirmed. Apparently, the characteristically fixed preoccupation with the object of their sexual desire in pedophilic child molesters did not reflect a more general deficit in cognitive flexibility or set shifting as assessed by the WCST.

Regarding spontaneous cognitive flexibility, as indicated by the performance on the verbal (category) fluency task, both molester groups and the nonsexual offenders revealed significant performance deficits compared to healthy controls. The results, however, did not survive post hoc analysis with Bonferroni corrections and thus need to be interpreted with caution. However, it cannot be

excluded that there might be a relationship between criminal behavior and spontaneous cognitive inflexibility. Such performance deficits could reflect (dorsolateral) prefrontal dysfunction, which would be in line with previous results [12,15]. As verbal fluency also requires other cognitive functions, such as speed of processing and in particular verbal skills, word retrieval, etc., it is not surprising that we also found criminality or violence-related deficits in verbal memory function. Both the nonpedophilic child molesters and the nonsexual offenders showed significant performance deficits on both subtasks of the verbal memory task (immediate and delayed recall) compared to healthy controls, whereas pedophilic child molesters did not. As previous studies could show that deficits in verbal memory were associated with aggressive behavior [49,50], it seems reasonable that pedophilic child molesters showed no or less deficits on this task. In the end, pedophilic child molesters were rather characterized by a nonviolent offense style, whereas nonpedophilic child molesters and nonsexual offenders revealed stronger aggressive tendencies through their offenses.

Our results might be limited by insufficient power to detect all group differences with this relatively small sample size and the relatively large number of variables and comparisons. Therefore, some caution is required in the cases of nonsignificant results which do not necessarily indicate that there really is a lack of group differences. Additionally, the results of the pedophile child molesters are limited to pedophiles who have already sexually abused children. Finally, the application of the described test battery represents an indirect way of measuring the neuroanatomical substrate underlying the executive functions. To be able to identify the neuroanatomical substrate of the described executive dysfunctions, future investigations should also include brain-imaging techniques.

In summary, several of our hypotheses could not be confirmed. We found that nonpedophilic child molesters showed the worst performance of all four groups in all tested cognitive functions even though not all reached significance regarding group comparison statistics. Nevertheless, we found that different types of offenders are characterized by different deficit profiles among the tested executive functions. Our results support the hypothesis that nonpedophilic child molesters show more comprehensive performance deficits in executive functions than pedophilic child molesters. However, a majority of the neuropsychologi-

cal deficits, in particular those associated with verbal (memory) skills, seem to be associated with criminality or violence rather than pedophilia. To be able to discuss possible implications of the reported findings in terms of understanding the mechanisms behind child molesting in either group, as well as in terms of interventions, further research with larger samples is needed, to allow for a valid distinction between pedophilia and criminality in a factorial manner. We therefore suggest the implementation of a two-factorial design with criminality and pedophilia as separate between group factors in future studies, which would require the examination of pedophile patients already having abused children sexually and those who have not yet, as well as a group of nonpedophilic child molesters and a HC.

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