Pedophilia & the Brain: Conclusions from the 2nd Generation of Research

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Associate Professor, University of Toronto Faculty of Medicine

Child molester: An adult who engages in sexual behavior physically involving one or more children.
Pedophile: An adult whose primary sexual attraction is towards prepubescent children.

• Not all child molesters are pedophiles.
• Not all pedophiles are child molesters.
• Behavior versus attraction.
• Definitions use primary sexual attraction.

Pedophilia
Pedophilia

Child molester: An adult who engages in sexual behavior physically involving one or more children.

Pedophile: An adult whose primary sexual attraction is towards prepubescent children.

- Pedophilia differs from child molestation.
- Pedophilia motivates child molestation.

Pedophilia

Child molester: An adult who engages in sexual behavior physically involving one or more children.

Pedophile: An adult whose primary sexual attraction is towards prepubescent children.

Pedophile: Attraction to prepubescent children.
Hebephile: Attraction to pubescent children.
Teleiophile: Attraction to adults.
Gerontophile: Attraction to the elderly.

Meta-Analysis of all reports, 1931–2004

- 75 reports with IQ data
- 236 non-overlapping samples
- 25,146 cases (7,045 sexual offenders and 18,101 controls)

Eight decades of IQ testing

Sexual Offenders Against Children

Sexual Offenders Against Adults

Nonsexual Offenders

Nonoffenders

Sexual Offenders, Victims' Ages Mixed or Unknown

Adjusted Mean IQ Score (s.e.)

IQ of adult samples by victims’ age group

F (4, 158) = 7.74  p < .0001

k = 56

k = 8

k = 53

k = 12

k = 36

Frontal Lobe vs. Temporal Lobe Theories

Frontal Lobe vs. Temporal Lobe Theories

### Inhibition/self-control

**Trail-Making**
- Bowden (1987)
- Cohen et al. (2002)
- Knox-Jones (1994)
- Langevin et al. (1989)
- Stone & Thompson (2001)
- Tarter et al. (1983)

**Stroop**
- Cohen et al. (2002)
- Dolan et al. (2002)
- Knox-Jones (1994)
- Rubenstein (1992)
- Stone & Thompson (2001)
- Tarter et al. (1983)
- Yeudall et al. (1987)

**Wisconsin Card Sort**
- Cohen et al. (2002)
- Dolan et al. (2002)
- Miler (1997)
- Rubenstein (1992)
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- Tarter et al. (1983)
- Yeudall et al. (1987)

**Bender Gestalt Test**
- Lewis et al. (1979)
- Yeudall et al. (1986)

**Controlled Oral Word Assoc.**
- Cohen et al. (2002)
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**Wechsler Memory Scale**
- Dolan et al. (2002)
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- Rubenstein (1992)
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**Finger Tapping**
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- Yeudall et al. (1986)

**Williams Verbal Learning Test**
- Abracen et al. (1991)
- Baker (1985)
- O’Carroll (1989)
- Yeudall et al. (1986)

**Individual neuropsychological tests**

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Individual neuropsychological tests

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<td>Digits (10 sec)</td>
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<td>Finger-Tapping</td>
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<td>Indications of general impairment.</td>
<td>No reliable localization.</td>
</tr>
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<td>Methodological confound?</td>
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Indicators of general impairment.

Methological Issues

- Very small samples.
- Heterogeneous offender types.
- Poorly validated (or not-validated) instruments.
- Excessive "data-mining."
- Lack of control samples.
- Very selective citation of findings.

Intelligence Quotient (IQ)

Mean (SE; Full-Scale IQ)

- Pedophiles (n=47)
- Hebephiles (n=158)
- Teleiophiles (n=93)

Covariates:
- age, age@ESL

Pedophiles (n=47)  Hebephiles (n=158)  Teleiophiles (n=93)

Mean (SE) Full-Scale IQ

Covariates:
age, age@ESL

F (2, 293) = 6.77
p = .001


Verbal memory by phallometric group

Covariates:
age, age @ ESL

F (2, 297) = 5.08
p = .007

Visuospatial memory by phallometric group

Covariates:
age, age @ ESL

F (2, 255) = 6.51
p = .002

Accidents causing unconsciousness

Pedo (n=70)  Hebe (n=225)  Teleio (n=133)

Age < 13  Age ≥ 13
3+ Injuries  2 Injuries  1 Injury

p = .01  p = .96

Proportions failing or in spl. ed. by group

Pedophile Nonoffenders  Teleiophilic Sexual Offenders  Hebephilic Men  Pedophilic Men

Wald = 16.72  p = .001

Co-variates: IQ, parental edu, age, age @ ESL


Pedophiles
Hebephiles
Teleiophilic
Sexual
Offenders
Teleiophilic Non-
offenders

Mean (s.e.) Height, in cm

F(4, 1220) = 4.11
p = .003

Covariate: age


Handedness in Pedophilia and Hebephilia

% non-right-handed

Homo Pedo
Homo Hebe
Homo Teleio
Het Pedo
Het Hebe
Het Teleio

Covariates: IQ, parental ed., age, age @ ESL

Are Brain Differences Observable Directly?

How we are going to attack this. In English.

- Little math or physics, some fancy slides
- Vocabulary that you really can use
- Magnetic Resonance Imaging (MRI)

Current brain imaging technologies

- CT
- PET
- MRI
- MRI

Can also do DTI (of white matter)
Current brain imaging technologies

- **CT**
  - Structure: x-rays
  - Limitation: low clarity, limit exposure

- **PET**
  - Function: radio-labeling (positrons)
  - Limitation: low clarity, limit exposure

- **MRI**
  - Structure: magnetism (water)
  - Limitation: 1 mm artifacts, no metal

- **fMRI**
  - Function: magnetism (deoxy-hemoglobin)
  - Limitation: 5 mm artifacts, no metal

Can also do **DTI** (of white matter)

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**MRI Physics**

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### Structural MRI studies of pedophilia

<table>
<thead>
<tr>
<th>Study</th>
<th>Theory</th>
<th>Prediction</th>
<th>Subjects</th>
<th>Statistics</th>
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<tbody>
<tr>
<td>Schiltz et al. (2007)</td>
<td>Limbic</td>
<td>&quot;temporal&quot; grey</td>
<td>15 pedophiles 15 community controls</td>
<td>small volume corrected</td>
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<tr>
<td>Schiffer et al. (2007)</td>
<td>OCD/ impulsivity</td>
<td>&quot;frontal&quot; grey</td>
<td>18 pedophiles 24 community controls</td>
<td>small volume corrected</td>
</tr>
<tr>
<td>Cantor et al. (2008)</td>
<td>Unbiased, atheoretical</td>
<td>uncorrected whole brain</td>
<td>65 pedophiles 62 nonsexual offenders</td>
<td>whole brain volume corrected</td>
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### Frontal Lobe vs. Temporal Lobe Theories

Inhibition/self-control

The 4 Fs

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Subjects
Patients
n = 65 sexology patients
Recruited from the Kurt Freund Laboratory (CAMH, Toronto)

Controls
n = 62 nonsexual offenders
Recruited from federal and provincial parole/probation offices

Exclusion criteria
<18 years age
>300 lbs weight
Ever suffered traumatic brain injury
Ever diagnosed with schizophrenia
Ever employed grinding metal
Any other metal object in body, counterindicating MRI

What's a Voxel?
But, what does this mean?

1. Humans have multiple social instincts.
2. In typical men, multiple grey matter regions are networked together to identify socially significant stimuli and evoke the species-typical response:
   - Nurturance, parenting
   - Obedience, imitation
   - Sexual arousal, courtship
   - Competition, combat
   - Escape
   - etc.
3. In pedophiles, the white matter tissue is underdeveloped and connects the wrong stimulus to the wrong response.

fMRI Studies of Sexual Arousal
So, this is where we were in 2010.

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<td>17 ROIs</td>
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<tr>
<td>Cantor (2008)</td>
<td>atheoretical</td>
<td>any brain structure</td>
<td>65 pedophiles 82 prisoners/ offenders</td>
<td>white matter (connecting sex network)</td>
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Replicate the Grey
Replicate the White

vs?
So, this is where we were in 2010.

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<td>65 pedophiles, 62 nonsexual offenders</td>
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<tr>
<td>Poeppl</td>
<td>replicate</td>
<td>grey</td>
<td>9 pedophiles, 11 nonsexual offenders</td>
<td>0/3 limbic grey, 17 &quot;frontal&quot; grey, 1/17 frontal</td>
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Structural MRI studies of pedophilia

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<td>“temporal”</td>
<td>15 pedophiles 15 community</td>
<td>3 ROIs</td>
</tr>
<tr>
<td>(2007)</td>
<td></td>
<td>grey</td>
<td>controls</td>
<td></td>
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<tr>
<td>Schiffer</td>
<td>OCD/</td>
<td>“frontal”</td>
<td>16 pedophiles 25 community</td>
<td>17 ROIs</td>
</tr>
<tr>
<td>(2007)</td>
<td>impulsivity</td>
<td>grey</td>
<td>controls</td>
<td></td>
</tr>
<tr>
<td>Cantor</td>
<td>atheoretical</td>
<td>any brain</td>
<td>85 pedophiles 23 nonsexual</td>
<td>9 ROIs</td>
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<tr>
<td>(2010)</td>
<td></td>
<td>correlated</td>
<td>offenders</td>
<td></td>
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<tr>
<td>Poeppl</td>
<td>replicate</td>
<td>grey</td>
<td>5 pedophiles 10 community</td>
<td>14 ROIs</td>
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<tr>
<td>(2013)</td>
<td></td>
<td>“frontal”</td>
<td>offenders</td>
<td></td>
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<tr>
<td>Cantor</td>
<td>replicate</td>
<td>white</td>
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<td>(2015)</td>
<td></td>
<td>white</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gerwinn</td>
<td>replicate</td>
<td>white</td>
<td></td>
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<tr>
<td>(2015)</td>
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What’s DTI?

Current brain imaging technologies

- CT
- PET
- MRI
- MRI

Can also do DTI (of white matter)
Current brain imaging technologies

- CT: structure, function, low clarity, limit exposure
- PET: function, radio-labeling (positrons), low clarity, limit exposure
- MRI: structure, function, magnetism (water), 1 mm, artifacts no metal
- fMRI: function, magnetism (deoxy-hemoglobin), 5 mm, artifacts no metal

Can also do CT (of white matter)

Structural MRI studies of pedophilia

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<td>Schiltz (2007)</td>
<td>limbic</td>
<td>&quot;amostral&quot; grey</td>
<td>15 pedophiles + 15 community controls</td>
<td>3 PDDs</td>
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<tr>
<td>Schiffer (2007)</td>
<td>OCD symmetrically</td>
<td>&quot;amostral&quot; grey</td>
<td>18 pedophiles + 24 community controls</td>
<td>17 ROIs</td>
</tr>
<tr>
<td>Cantor (2008)</td>
<td>neurodevelopmental</td>
<td>any brain (unbiased)</td>
<td>65 pedophiles + 24 community controls</td>
<td>white matter (connecting sex network)</td>
</tr>
<tr>
<td>Fornell (2013)</td>
<td>replicate white</td>
<td>2 &quot;temporal&quot; grey 17 &quot;frontal&quot; grey</td>
<td>24 pedophiles + 11 nonsexual offenders</td>
<td>SCX analysis 5/17 frontal</td>
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<tr>
<td>Cantor (2015)</td>
<td>replicate white</td>
<td>any white, unbiased</td>
<td>32 pedophiles + 32 community controls</td>
<td></td>
</tr>
<tr>
<td>Gerwinn (2015)</td>
<td>replicate white</td>
<td></td>
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DTI Subjects

Patients
n = 24 pedophilic sex offenders
Recruited from the Kurt Freund Laboratory (CAMH, Toronto)
Phallo responses greater to a child than either adult category
1+ sexual offenses vs. child age 14 or younger (or child porn)
No sexual offenses vs. person age 17 or older

Controls
n = 32 healthy nonoffenders
Recruited from craigslist.org

Exclusion criteria
<18 or >60 years age, ...
**DTI Subjects**

<table>
<thead>
<tr>
<th>Characteristic (sd)</th>
<th>Pedophiles</th>
<th>Nonoffenders</th>
</tr>
</thead>
<tbody>
<tr>
<td># of participants</td>
<td>24</td>
<td>32</td>
</tr>
<tr>
<td>Age</td>
<td>35.6 (9.5)</td>
<td>37.0 (10.7)</td>
</tr>
<tr>
<td>Years of education</td>
<td>12.8 (2.3)**</td>
<td>15.3 (9.5)</td>
</tr>
<tr>
<td>IQ</td>
<td>100.9 (15.4)</td>
<td>103.5 (10.9)</td>
</tr>
<tr>
<td>non-right-handed</td>
<td>19%</td>
<td>9.3%</td>
</tr>
<tr>
<td>Levenson Psychopathy Scale</td>
<td>51.2 (13.0)*</td>
<td>44.7 (8.5)</td>
</tr>
<tr>
<td>Conflito Tactics Scale</td>
<td>23.4 (17.7)**</td>
<td>12.5 (6.4)</td>
</tr>
<tr>
<td>Widom Childhood Neglect Index</td>
<td>3.3 (3.9)</td>
<td>2.5 (3.1)</td>
</tr>
<tr>
<td>Phallometric Pedophilia Index</td>
<td>1.62 (1.36)**</td>
<td>-1.50 (1.07)</td>
</tr>
<tr>
<td>CAGE</td>
<td>1.06 (1.14)</td>
<td>0.6 (1.6)</td>
</tr>
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</table>

***p<0.001 *p<.05

**DTI Results 1: Locate Main Cluster**

**DTI Results 2: Follow those tracts**
DTI Results 2: Follow those tracts

DTI Results 2: Now, what does *that* mean?
DTI Results 2: Now, what does *that* mean?

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Structural MRI studies of pedophilia

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<td>OCD/ impulsivity</td>
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<td>17 pedophiles 24 controls</td>
<td>17 ROIs</td>
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<td>Canton (2004)</td>
<td>atheoretical</td>
<td>any tissue</td>
<td>62 pedophiles 32 controls</td>
<td>white matter connecting sex network</td>
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<tr>
<td>Pienaar (2013)</td>
<td>replicate grey</td>
<td>temporal grey</td>
<td>6 pedophiles 10 controls</td>
<td>6/10 1/T temporal</td>
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<tr>
<td>Canton (2015)</td>
<td>replicate white</td>
<td>any white</td>
<td>24 pedophiles 20 controls</td>
<td>White matter connecting sex network</td>
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<td>any brain, unbiased</td>
<td>65 pedophiles, 65 community controls</td>
<td>white matter (connecting sex network)</td>
</tr>
<tr>
<td>Cantor (2015)</td>
<td>replicate white</td>
<td>any white, unbiased</td>
<td>24 pedophiles, 20 community controls</td>
<td>White matter (connecting sex network)</td>
</tr>
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<td>24 pedophiles, 20 community controls</td>
<td>No group diff’s</td>
</tr>
</tbody>
</table>

### The score

- Replicate the Grey
- Replicate the White
Can also do **DTI**
(of white matter)

**functional MRI (fMRI)**

**functional MRI (fMRI)**
**Functional MRI (fMRI)**

Subject performs no tasks, shows brain in "resting state."
Voxels grouped by their increasing/decreasing together.
Analyses "subtract" states, reflecting differences in activity.

Higher bloodflow = higher activity

---
Subject performs no tasks, shows brain in "resting state."
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Subject performs two+ tasks, including a control task.
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Potential experiments:
What does resting state fMRI say about white matter networks?
How do pedophilic and teleophilic processing differ?
Can fMRI be used to diagnose like PPG?

functional MRI (fMRI)
### What does resting state fMRI say about WM?

<table>
<thead>
<tr>
<th>Study</th>
<th>Anatomy</th>
<th>Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habermeyer (2013b)</td>
<td>whole</td>
<td>11 het pedophiles 7 het controls</td>
</tr>
<tr>
<td>Kärgel (2015)</td>
<td>DMN</td>
<td>12 Pedophiles w/ CSA 14 Pedophilic w/o CSA 14 controls</td>
</tr>
<tr>
<td>Poepppl (2015)</td>
<td>candidate regions</td>
<td>Open access data</td>
</tr>
<tr>
<td>Cantor (2016)</td>
<td>whole</td>
<td>37 pedophiles 28 nonsexual offenders 39 nonoffender controls</td>
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### What does resting state fMRI say about WM?

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<td>Kärgel      (2015)</td>
<td>DMN, Limbic net</td>
<td>12 Pedophiles w/ CSA, 14 Pedophiles w/ CSA, 14 controls</td>
<td></td>
</tr>
<tr>
<td>Poepppl     (2015)</td>
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<tr>
<td>Cantor      (2016)</td>
<td>whole brain</td>
<td>37 pedophiles, 26 nonsexual offenders, 39 nonoffender controls</td>
<td>Replicates Cantor Connectivity Hypothesis</td>
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## What does resting state fMRI say about WM?

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<td>Attenuated DMN response.</td>
</tr>
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<td>Kärgel (2015)</td>
<td>DMN, Limbic net</td>
<td>12 Pedophiles w/ CSA, 14 Pedophiles and CSA, 14 controls</td>
<td>P+CSA ≠ P-CSA</td>
</tr>
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<td>Cantor (2016)</td>
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<td>37 pedophiles, 25 sexual offenders, 39 nonoffender controls</td>
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"The present results indicate functional dysconnectivity within brain regions that serve to identify sexually relevant stimuli. This confirms the dysconnectivity hypothesis proposed by Cantor et al. [2008]."
The score

Replicate the Grey
Replicate the White

Structural MRI studies of pedophilia

<table>
<thead>
<tr>
<th>Study</th>
<th>Theory</th>
<th>Prediction</th>
<th>Subjects</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schiltz, 2007</td>
<td>limbic</td>
<td>&quot;temporal&quot; grey</td>
<td>15 pedophiles, 15 community controls</td>
<td>3 ROIs</td>
</tr>
<tr>
<td>Schiffer, 2007</td>
<td>OCDP</td>
<td>&quot;frontal&quot; grey</td>
<td>18 pedophiles, 24 community controls</td>
<td>17 ROIs</td>
</tr>
<tr>
<td>Cantor, 2006</td>
<td>atheoreal</td>
<td>any brain, unbiased</td>
<td>60 pedophiles, 62 nonsexual offenders</td>
<td>white matter (connecting sex networks)</td>
</tr>
<tr>
<td>Poeppl, 2013</td>
<td>replicate grey</td>
<td>3 &quot;temporal&quot; grey, 17 &quot;frontal&quot; grey</td>
<td>9 pedophiles, 11 nonsexual offenders</td>
<td>0/3 limbic, 1/17 frontal</td>
</tr>
<tr>
<td>Cantor, 2015</td>
<td>replicate white</td>
<td>any white, unbiased</td>
<td>26 pedophiles, 28 community controls</td>
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<td>26 pedophiles, 28 community controls</td>
<td>No group diff</td>
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Resting-state fMRI studies of pedophilia

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<td>P+CSA - P-CSA</td>
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### How do pedo- & teleio- processing differ?

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<td>whole</td>
<td>pedophiles, healthy controls</td>
<td>pedophiles respond analogously to controls</td>
</tr>
<tr>
<td>Schiffer (2008a)</td>
<td>whole</td>
<td>homosexual pedophiles, healthy gay men</td>
<td>pedophiles respond analogously to controls</td>
</tr>
<tr>
<td>Schiffer (2008b)</td>
<td>whole</td>
<td>heterosexual pedophiles, heterosexual controls</td>
<td>no pedophilic responses</td>
</tr>
<tr>
<td>Pueppel (2011)</td>
<td>whole</td>
<td>pedophiles, nonsexual offenders</td>
<td>pedophiles respond analogously, but &gt; controls</td>
</tr>
<tr>
<td>Habermeyer (2013)</td>
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<td>8 het pedophiles, 8 het controls</td>
<td>pedophiles respond part analogously, &quot;heterogenous&quot;</td>
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<tr>
<td>Ponseti (2014)</td>
<td>whole</td>
<td>heterosexual</td>
<td>pedophiles respond to face analogously to controls</td>
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<td>ERP, not fMRI</td>
<td>22 pedophiles (SCID dx?)</td>
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Can fMRI diagnose like PPG?

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<tbody>
<tr>
<td>Sartorius (2008)</td>
<td>amygdala centre</td>
<td>homosexual pedophiles heterosexual controls</td>
<td>≅ 67% sens; ≅ 67% spec w/ admitters</td>
</tr>
<tr>
<td>Ponseti (2012)</td>
<td>empirical subset</td>
<td>34 pedophiles</td>
<td>89% sens; 100% spec (faces w admitters)</td>
</tr>
<tr>
<td>Ponseti (2016)</td>
<td>whole brain</td>
<td>24 pedophiles</td>
<td>91% sens; 95% spec (faces w admitters)</td>
</tr>
</tbody>
</table>

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The State of the Art

Research • Clinical • Screening • Evidence
Validit of Phallometry

So, can fMRI detect arousal to child stimuli?

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So, can fMRI detect arousal to child stimuli?

Towards a Grand Unified Theory

Pedophilia/ephebophilia
Fetishism, vorarephilia, urophilia, acrotomophilia, autogynephilia, …

Hypersexuality
Avoidant Masturbation
Paraphilic Hypersexuality
Chronic Adultery
(sexual guilt, designated patients)

Asexuality
Distict from hypoactive and loss of sexual desire.

Summary

Does pedophilic processing differ from teleiophilic processing? N
Can fMRI serve the same function as a phallometric test? Y

- Overall features suggest early (pre-natal) origins
- Pedophilic brain structure slightly different from typical
- Brain differences not consistent with what changes with therapy, surgery, or current stem cell research
- Pedophilic brain “lights up” in same pattern as non-pedophiles (pedophiles respond to stimuli of children rather than adults)
The Public Response

- The Media
- Right-wing
- Left-wing
- Boychat, girlchat
- Virtuous Pedophiles

These slides (and more) available at:
JamesCantor.org