Understanding sexual offending and the brain: From the basics to the state of the art

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Remember: MRI is painless

<u>Basics</u>
Vocabulary *(for people who don't tweet, vlog, or sext)*
Brief history: classic, neuropsych., early imaging
Phallometry
Sensitivity/specificity of diagnostic tests
Physics *(for folks over 40)*
CT, PET, MRI vs *f*MRI
How MRIs are analyzed statistically

<u>The state of the art</u>
MRI results
MRI results*…explained?*
*f*MRI results
*f*MRI results*…explained?*
Sensitivity/specificity
Issues & implications

Sexual offending and the Brain: History

1886	Founding of modern sexology
1900–2000	Large scale studies of forensic samples
1980–1999	Neuropsych testing, early imaging (CT) studies
1999	First neuroimaging study of sexual arousal
2000–	Large-scale studies of homogeneous samples
2007–2008	High-resolution studies of pedophilia published
2007	First fMRI studies of pedophilia published

Richard von Krafft-Ebing (1840–1902)

Psychopathia Sexualis (1886)

Sexual anomalies are a "diseased condition of the central nervous system" (p. 61).
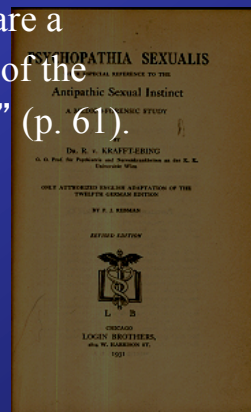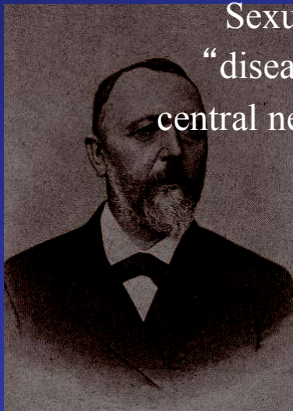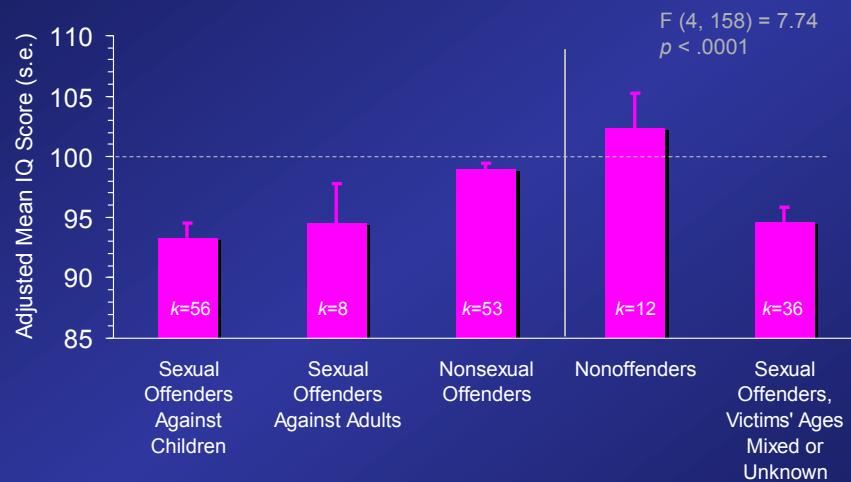
Eight decades of IQ testing

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)

—Cantor, Blanchard, Robichaud, & Christensen (2005). *Psychological Bulletin, 131,* 555–568.

IQ of adult samples by victims' age group

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

Adjusted Mean IQ Score (s.e.)

110
105
100
95
90
85

Sexual Offenders Against Children	Sexual Offenders Against Adults	Nonsexual Offenders	Nonoffenders	Sexual Offenders, Victims' Ages Mixed or Unknown
k=56	k=8	k=53	k=12	k=36

—Cantor, Blanchard, Robichaud, & Christensen (2005). *Psychological Bulletin, 131,* 555–568.

## IQ by Definition of "Child" Victim
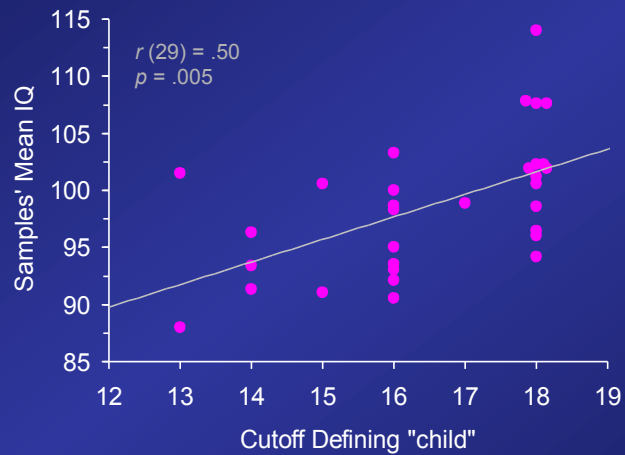
—Cantor, Blanchard, Robichaud, & Christensen (2005). *Psychological Bulletin, 131,* 555–568.

Sexual offending and the Brain: History

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2007–2008	High-resolution studies of pedophilia published
2007	First fMRI studies of pedophilia published

Frontal Lobe vs. Temporal Lobe Theories
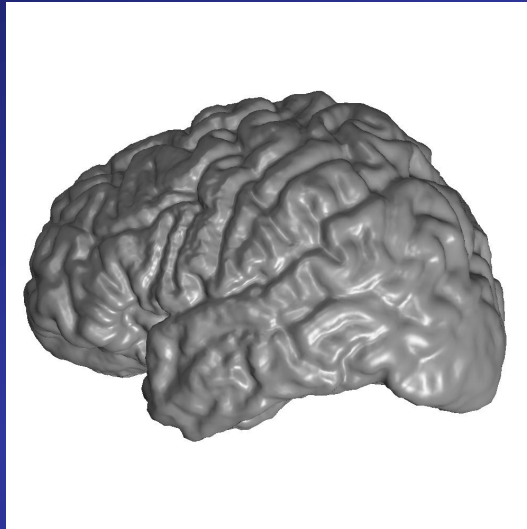
Neuropsychological Batteries

Halstead-Reitan Battery

Yeudall (1977)	Rapists
Yeudall et al. (1979)	Heterogeneous
Langevin et al. (1985)	Sadists
Langevin et al. (1988)	Sexual killers, aggressives
Langevin et al. (1989)	Exhibitionists

Luria-Nebraska Battery

Graber et al. (1982)	Heterogeneous
Scott et al. (1984)	Offenders vs. children, adults
Hucker et al. (1986)	Pedophiles
Hucker et al. (1988)	Sadists, sexual aggressives
Langevin et al. (1988)	Sexual killers, aggressives
Galski et al. (1990)	Heterogeneous

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Indications of general impairment.
No reliable localization.

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Individual neuropsychological tests

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

Controlled Oral Word Assoc.
Cohen et al. (2002)
Dolan et al. (2002)
Gillespie & Mckenzie (2000)
Knox-Jones (1994)
Rubenstein (1992)
Stone & Thompson (2001)
Yeudall et al. (1987)

Wisconsin Card Sort
Cohen et al. (2002)
Dolan et al. (2002)
Miller (1997)
Rubenstein (1992)
Stone & Thompson (2001)
Westergren (2002)
Yeudall et al. (1987)

Wechsler Memory Scale
Dolan et al. (2002)
Knox-Jones (1994)
Langevin et al. (1989)
Rubenstein (1992)
Tarter et al. (1983)

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

Finger-Tapping
Knox-Jones (1994)
Langevin et al. (1989)
Tarter et al. (1983)
Yeudall et al. (1986)

Stroop
Cohen et al. (2002)
Dolan et al. (2002)
Stone & Thompson (2001)
Gillespie & Mckenzie (2000)

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

Individual neuropsychological tests

Indications of general impairment.
(Methodological confound?)
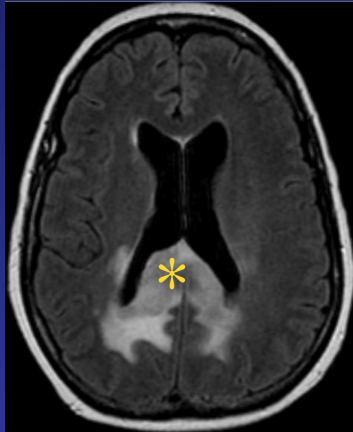No reliable localization.

Early brain imaging

CT studies

Graber et al. (1982)   Offenders vs. women, children
Langevin et al. (1985)   Sadists, nonsadistic offenders
Hucker et al. (1986)   Pedophiles
Hendricks et al. (1988)   Offenders vs. children
Hucker et al. (1988)   Sadists, nonsadistic vs. women
Langevin et al. (1988)   Incest offenders
Langevin et al. (1989)   Pedophiles
Wright et al. (1990)   Offenders vs. women, pedophiles,
                                  incest offenders, nonsex offenders
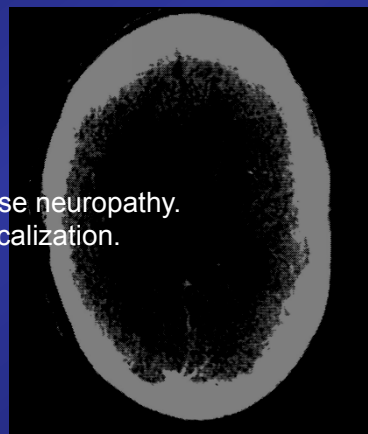
Early brain imaging

CT studies

http://knol.google.com/k/brain-ct-mri#
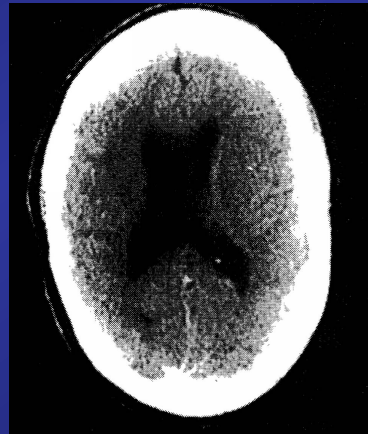
Langevin et al. (1988)

Early brain imaging

CT studies

Indications of diffuse neuropathy.
No reliable localization.

http://knol.google.com/k/brain-ct-mri#

Langevin et al. (1988)

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.

What do I need to remember?

<u>1886–1999</u>

IQ (global functioning)

LNNB/HRB   Consistent but only general

                                   indications of poor brain
function
Neuropsych testing

CT scans

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.

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

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 *pre* pubescent children.

Hebephile: Attraction to *pubescent* children.

Teleiophile: Attraction to *adults*.

Gerontophile: Attraction to *the elderly*.

Phallometry

Psychophysiological technique for assessing erotic interests in males.

Examinee's penile blood volume is monitored while he is presented with a standardized set of laboratory stimuli depicting a variety of potentially erotic activities or objects.

Examinee's penile blood volume increases are taken as an index of his relative attraction to the different classes of stimuli.

Phallometry

Phallometry

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Phallometry

Phallometry

Phallometry

Phallometric Stimuli

Stimulus modality: Audiotaped
narratives, slides of nudes
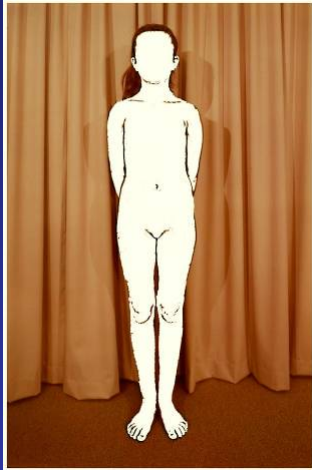
Sample narrative:

"*You are watching a late movie on TV
with your neighbours' 12-year-old
daughter. You have your arm around
her shoulders, and your fingers brush
against her chest. You realize that her
breasts have begun to develop...*"
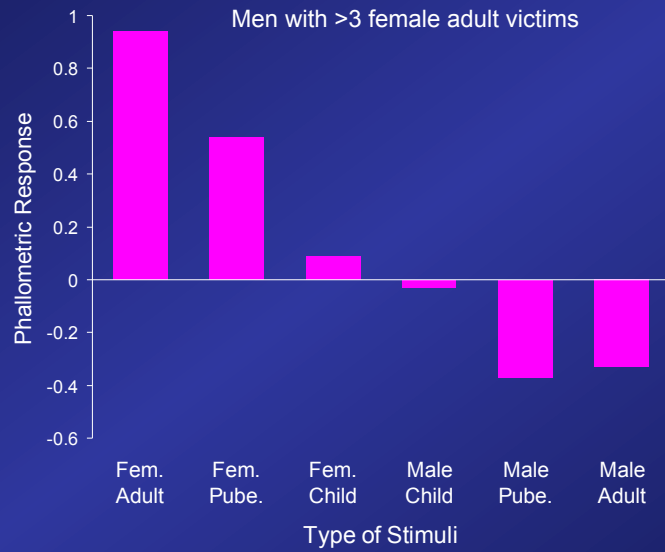

Phallometric Stimuli

Stimulus categories:

prepubescent girls   pubescent girls   adult women
prepubescent boys   pubescent boys   adult men
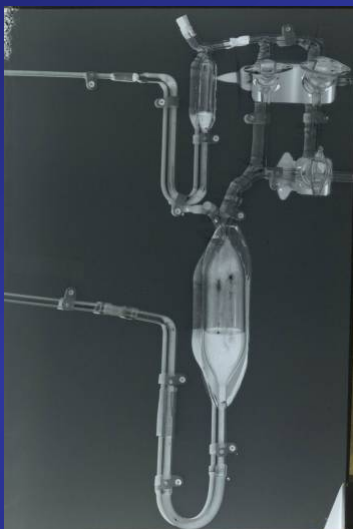
neutral stimuli
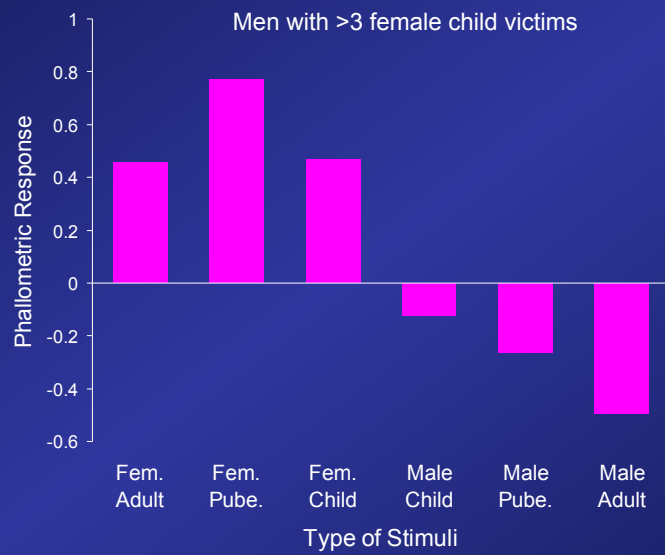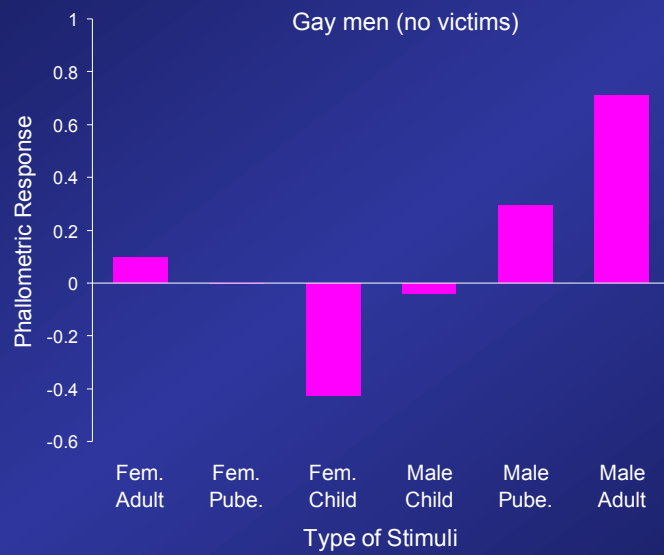
Phallometry
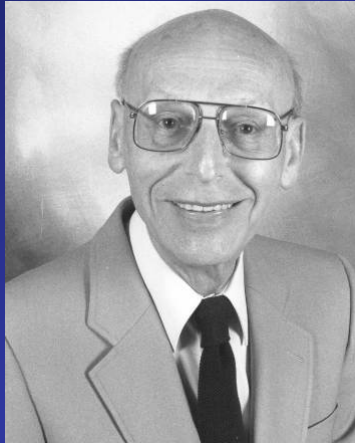
Kurt Freund
(1914–1996)

Phallometry
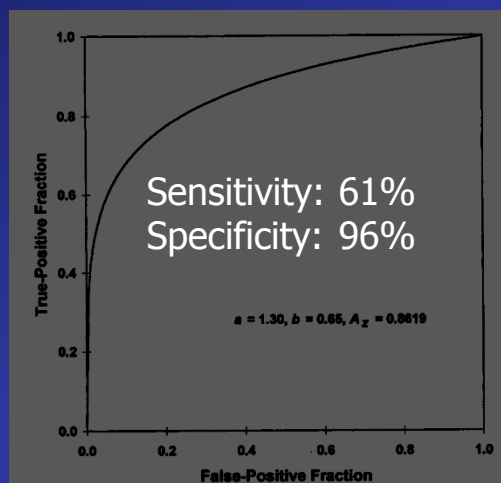
Phallometry
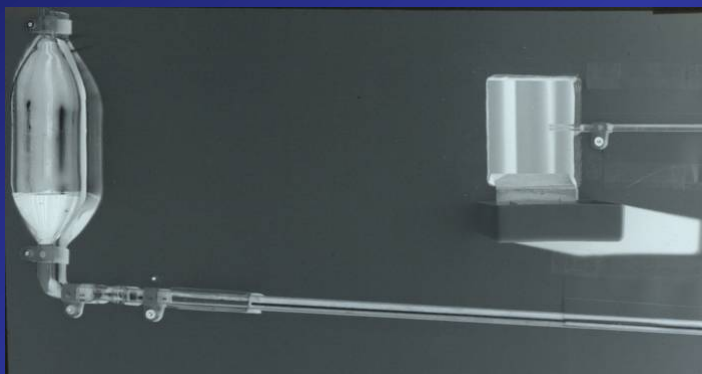
Phallometry

Validity of Phallometry
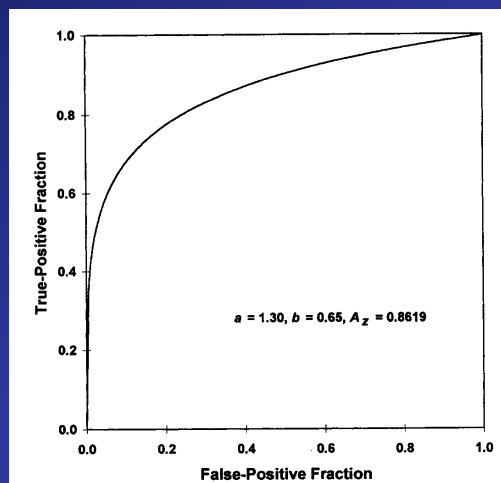
$a = 1.30, b = 0.65, A_z = 0.8619$

—Blanchard, Klassen, Dickey, Kuban, & Blak (2001). *Psychological Assessment, 13,* 118–126.

Validity of Phallometry

Sensitivity: 61%
Specificity: 96%

$a = 1.30, b = 0.65, A_z = 0.8619$

—Blanchard, Klassen, Dickey, Kuban, & Blak (2001). *Psychological Assessment, 13,* 118–126.

Validity of Phallometry

Risk Prediction

Hanson & Bussière (1998)
Meta-analysis of 61 follow-up studies
n = 28,972 sexual offenders

Validity of Phallometry

Strongest predictors of sex recidivism:	_r_
phallometric assessment (*children*)	.32
MMPI scale 5 (M–F scale)	.27
severe psychological maladjustment	.25
prior sex offenses	.19
failure to complete treatment	.17
negative relationship with mother	.16
any personality disorder	.16

Hanson & Bussière (1998). *J Consult Clin Psych, 66,* 348–362.

Differences Betw. Laboratories

Circumferencial vs. volumetric measures
Visual vs. auditory stimuli
Video clips vs. still pictures
Numbers and duration of pictures shown
One vs. many of each stimulus shown
Validation of interpretation methods

Differences Betw. Laboratories
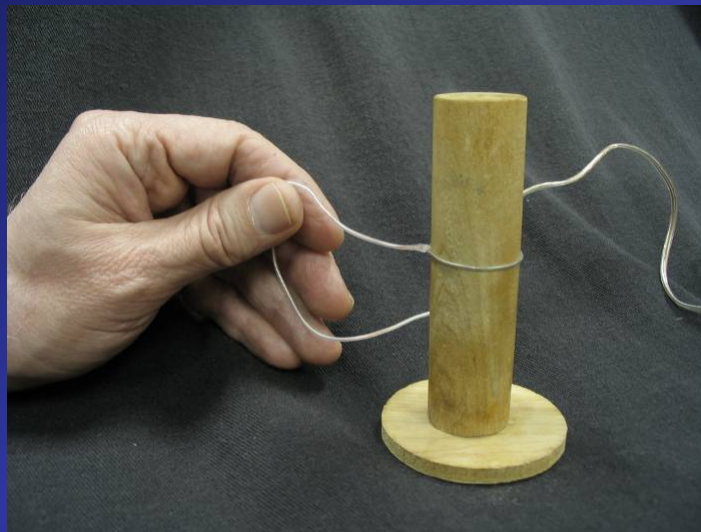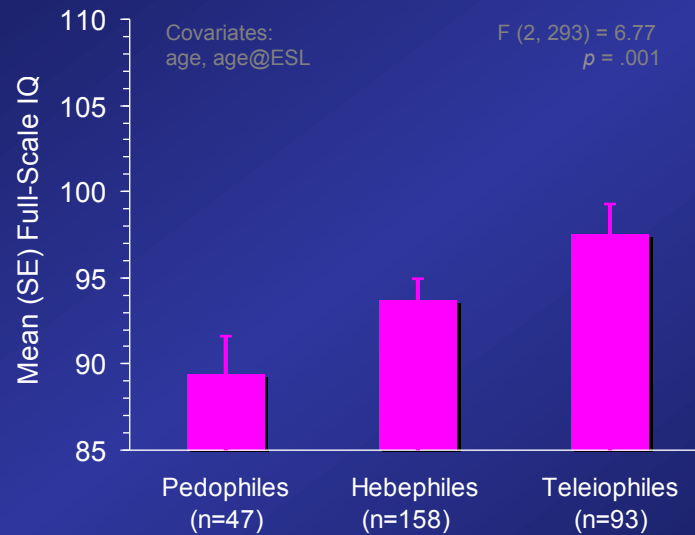
Differences Betw. Laboratories
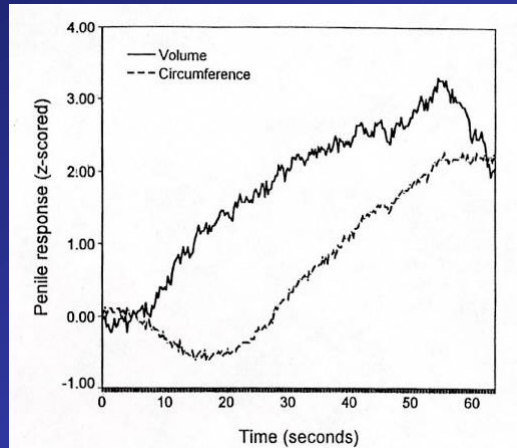
—Kuban, Barbaree, & Blanchard (1999). *Archives of Sexual Behavior, 28*, 245–359.

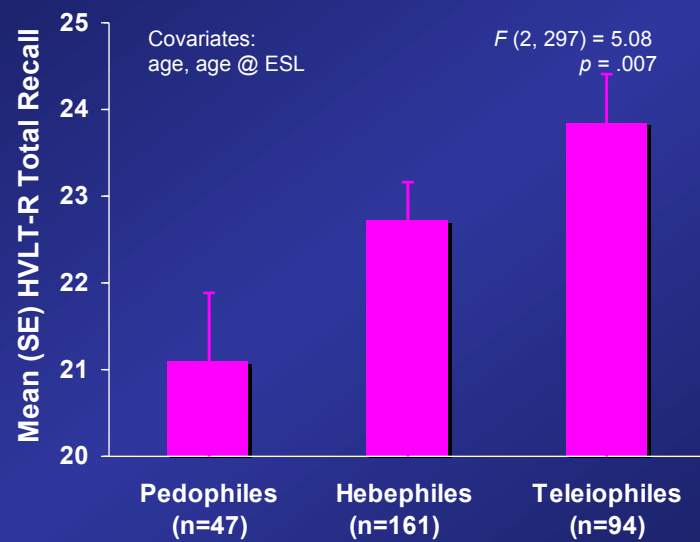## Contemporary neuropsychology and biometrics

Needs fixing!:

Very small samples.

Heterogeneous offender types.

Poorly validated (or not-validated) instruments.

Excessive "data-mining."

Lack of control samples.

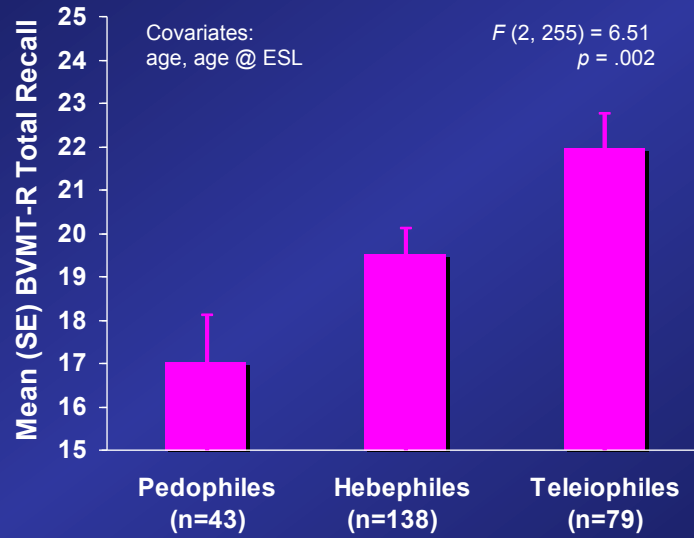Very selective citation of findings.

Intelligence Quotient (IQ)

Covariates:
age, age@ESL

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

Mean (SE) Full-Scale IQ

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

From: Cantor, Blanchard, Christensen, Dickey, et al. (2004). *Neuropsychology, 18,* 3–14.

Verbal memory by phallometric group

Covariates:
age, age @ ESL

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

Mean (SE) HVLT-R Total Recall

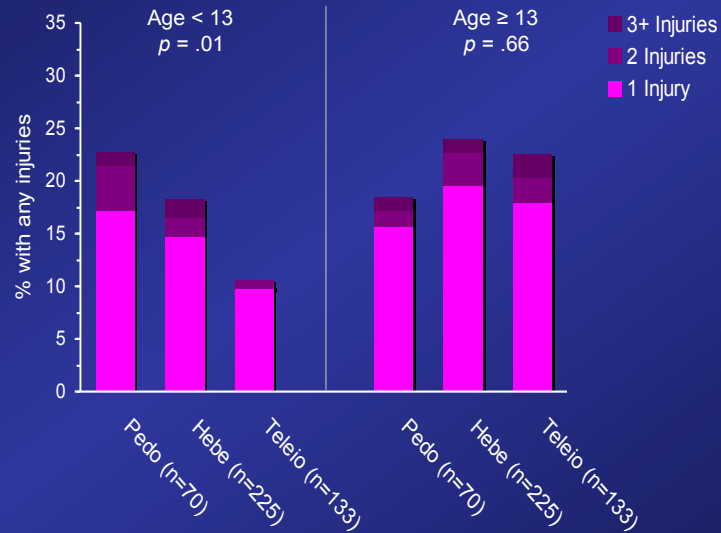|		
Pedophiles (n=47)	Hebephiles (n=161)	Teleiophiles (n=94)

—Cantor, Blanchard, Christensen, Dickey, et al. (2004). *Neuropsychology, 18,* 3–14.

Visuospatial memory by phallometric group

Covariates:
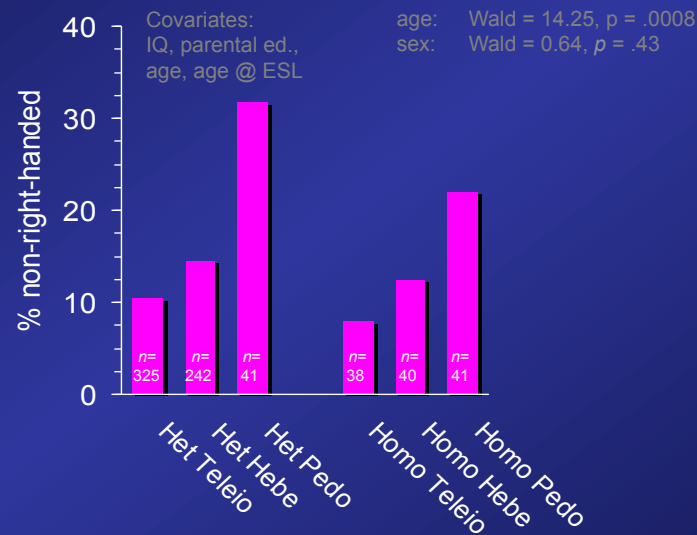age, age @ ESL

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

Mean (SE) BVMT-R Total Recall

Pedophiles (n=43)
Hebephiles (n=138)
Teleiophiles (n=79)

—Cantor, Blanchard, Christensen, Dickey, et al. (2004). *Neuropsychology, 18,* 3–14.

Accidents causing unconsciousness

Age < 13
$p = .01$

Age ≥ 13
$p = .66$

■ 3+ Injuries
■ 2 Injuries
■ 1 Injury

% with any injuries

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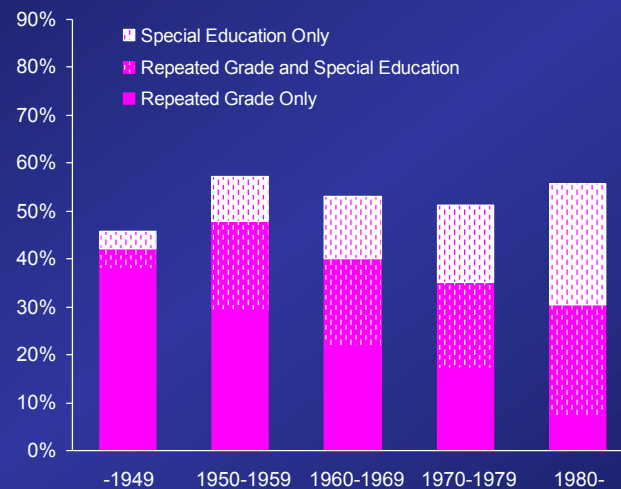Teleio (n=133)
Pedo (n=70)
Hebe (n=225)
Teleio (n=133)

—Blanchard, Kuban, Klassen, Dickey, Christensen, Cantor, & Blak. (2003). *Archives of Sexual Behavior, 32*, 573–581.

Handedness in Pedophilia and Hebephilia

% non-right-handed

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

age: Wald = 14.25, p = .0008
sex: Wald = 0.64, *p* = .43

40

30

20

10

0

n=
325

n=
242

n=
41

n=
38

n=
40

n=
41

Het Teleio
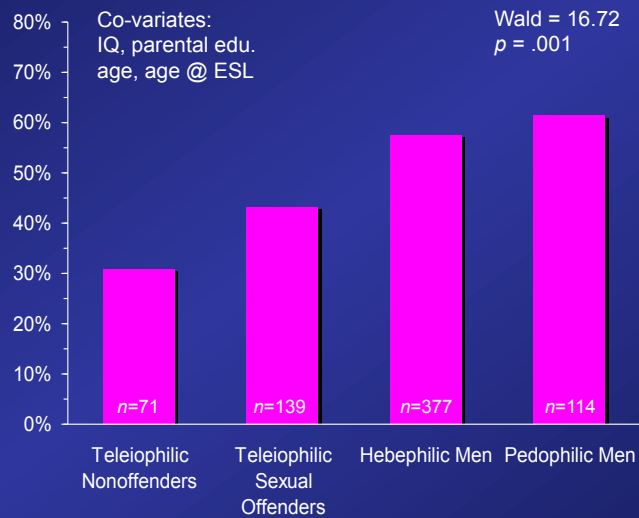
Het Hebe

Het Pedo

Homo Teleio

Homo Hebe

Homo Pedo

—Cantor, Klassen, Dickey, Christensen, Kuban, Blak, et al. (2005). *Archives of Sexual Behavior, 34,* 447–459.

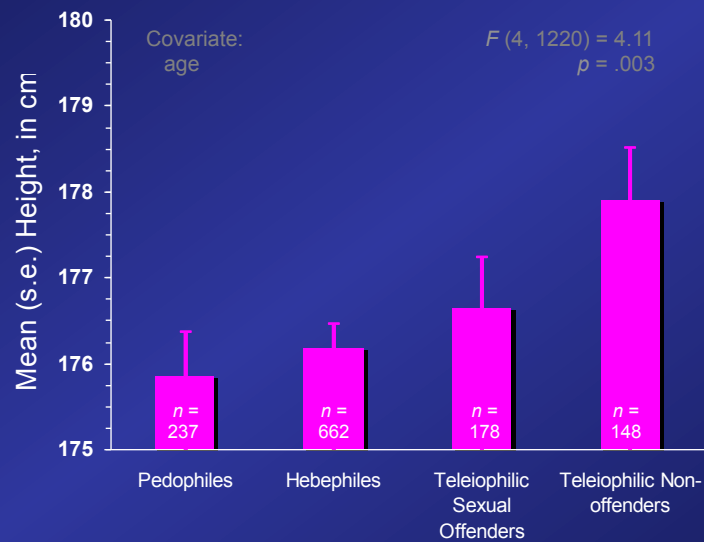# Proportions failing or in spl. ed. by birth decade

90%

80%

70%

60%

50%

40%

30%

20%

10%

0%

■ Special Education Only
■ Repeated Grade and Special Education
■ Repeated Grade Only

-1949   1950-1959   1960-1969   1970-1979   1980-

—Cantor, Kuban, Blak, Klassen, Dickey, & Blanchard. (in press). *Archives of Sexual Behavior.*

Proportions failing or in spl. ed. by group

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

Wald = 16.72
p = .001

n=71 n=139 n=377 n=114

Teleiophilic Nonoffenders | Teleiophilic Sexual Offenders | Hebephilic Men | Pedophilic Men

—Cantor, Kuban, Blak, Klassen, Dickey, & Blanchard. (in press). *Archives of Sexual Behavior.*

Physical Height

Covariate:
age

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

Mean (s.e.) Height, in cm

n = 237 n = 662 n = 178 n = 148

Pedophiles | Hebephiles | Teleiophilic Sexual Offenders | Teleiophilic Non-offenders

From: Cantor, Kuban, Blak, Klassen, Dickey, & Blanchard. (2007). *Sexual Abuse, 19,* 395–407.

Are Brain Differences Observable *Directly?*

Magnetic Resonance Imaging (MRI)

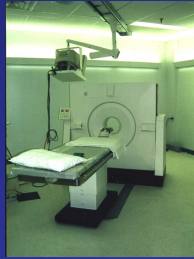How we are going to attack this. In English.

- Little math or physics, some fancy slides
- Vocabulary that you really can use
- Clearing up some common confusions

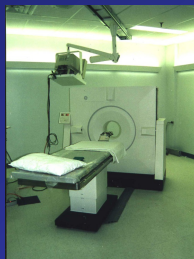Current brain imaging technologies

CT   PET   MRI   *f*MRI

Also: MEG, SPECT, DTI

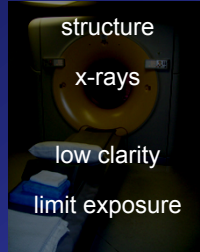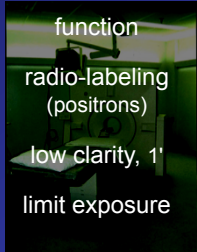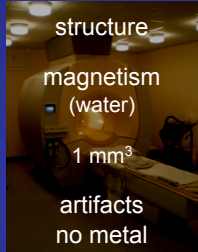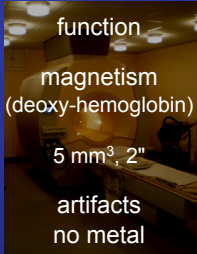Current brain imaging technologies

CT   PET

"Open MRI"

Also: MEG, SPECT, DTI

Current brain imaging technologies

CT	PET	MRI	fMRI
structure	function	structure	function
x-rays	radio-labeling (positrons)	magnetism (water)	magnetism (deoxy-hemoglobin)
low clarity	low clarity, 1'	1 mm^3	5 mm^3, 2"
limit exposure	limit exposure	artifacts no metal	artifacts no metal

Also: MEG, SPECT, DTI

MRI Physics

Hydrogen protons
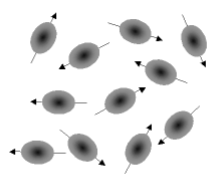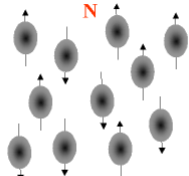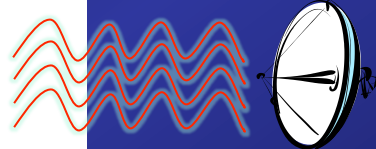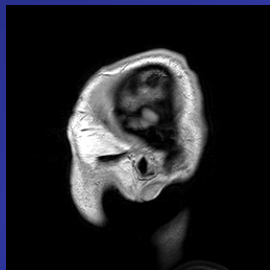
Magnet off   Magnet on (RF transmit)   Magnet on (RF receive)

http://cal.man.ac.uk/student_projects/2000/mmmr7gjw/technique3.htm

Structural MRI studies of pedophilia

Study	Theory	Prediction	Subjects	VBM Analysis
Schiltz et al. (2007)				
Schiffer et al. (2007)				
Cantor et al. (2008)				

Schiltz et al. (2007)

Study	Theory	Prediction	Subjects	VBM Analysis
Schiltz et al. (2007)	limbic	"temporal"	15 pedophiles 15 community controls	small volume corrected
Schiffer et al. (2007)	OCD/ impulsivity	frontal		
Cantor et al. (2008)				

Schiltz et al. (2007)

Study	Theory	Prediction
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Cantor et al. (2008)		

Schiffer et al. (2007)

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Cantor et al. (2008)				

Schiffer et al. (2007)

Study	Theory	Prediction
Schiltz et al. (2007)	limbic	"temporal"
Schiffer et al. (2007)	OCD/ impulsivity	frontal
Cantor et al. (2008)		

Junk data or blind monks?

Structural MRI studies of pedophilia

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Schiltz et al. (2007)	limbic	"temporal"
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Cantor et al. (2008)		
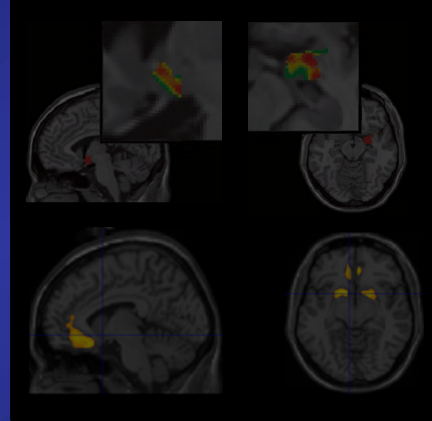
Cantor et al. (2008)

Study	Theory	Prediction	Subjects	VBM Analysis
Schiltz et al. (2007)	limbic	"temporal"	15 pedophiles 15 community controls	small volume corrected
Schiffer et al. (2007)	OCD/ impulsivity	frontal	18 pedophiles 24 community controls	small volume corrected
Cantor et al. (2008)	atheoretical	unbiased	65 pedophiles 62 nonsexual offenders	whole brain volume corrected

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

Subjects

Characteristic	Patients	Controls	Comparison	*p*
Age	36.4 (13.5)	36.9 (9.4)	$t(125) = -0.23$	.82
Full-Scale IQ	96.2 (15.3)	96.3 (11.5)	$t(125) = -0.03$	.98
Education	12.2 (3.0)	12.1 (2.8)	$t(125) = 0.20$	.84
CAGE alcohol screen	1.1 (1.4)	2.1 (1.6)	$t(125) = -3.8$	.0003
% non-right-handed	23.1%	14.5%	$\chi^2(1) = 1.52$	.22

Procedures

Sexological Measures
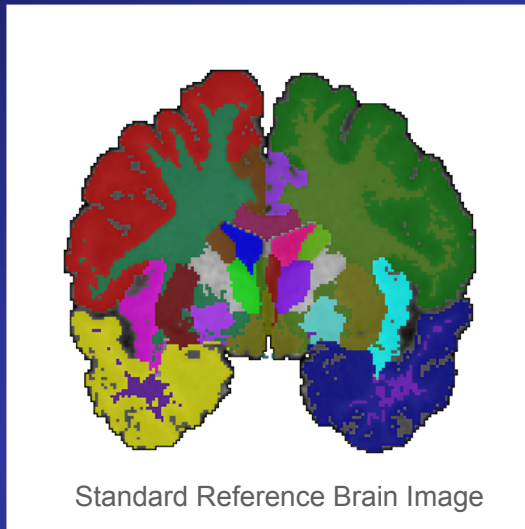
Self-report,
offense history

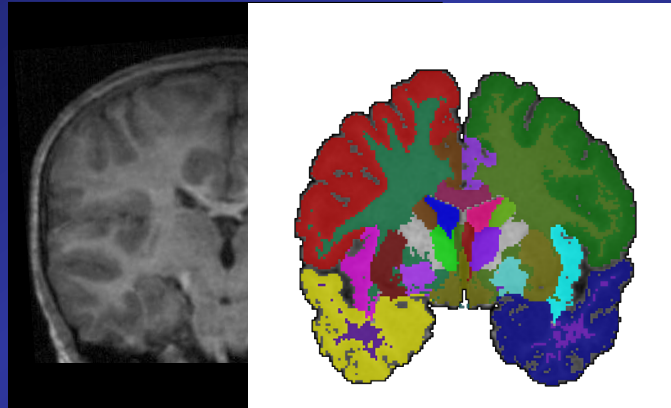Phallometry

MRI Measures

Automated parcellation

Voxel-based morphometry
(VBM)

Automated Parcellation

Standard Reference Brain Image

Automated Parcellation

Standard Reference
Brain Image

Image Acquisition & Processing

124 images/subject were acquired in the coronal plane using a 3-dimensional, inversion-prepped, radio-frequency fast spoiled-gradient recalled-echo sequence on a 1.5-Telsa MRI system.

Time to inversion:	300 ms
Time to repetition:	12 ms
Time to echo:	5 ms
Flip angle:	20°
Field of view:	20 cm
Matrix resolution:	256 × 256 pixels

Correct intensity non-uniformity:	Sled & Pike (1998)
Normalization:	MNI-Talairach space
Resampling:	1.0mm isotropic voxels
Tissue classification:	GM, WM, or CSF
Non-brain tissue removal:	Automated, manual check

Phallometric Pedophilia Index

Stimulus categories:

| prepubescent girls | pubescent girls | ▬ | adult women |
| prepubescent boys | pubescent boys | | adult men |

neutral stimuli

Parcellated Volumes with Pedophilia Index

Brain Region Families	Multiple Regression	p-value
Cortical Grey Matter (12 regions)	R = .260, F (12,95) = 0.58	.86
Subcortical Grey Matter (11 regions)	R = .263, F (11,96) = .65	.79
White Matter (11 regions)	R = .473, F (11,96) = 2.51	.008
Cerebrospinal Fluid (5 regions)	R = .274, F (5,102) = 1.66	.15

Mean (*SD*) White Matter Volumes by Group

Region	Volume (cc^3)	Correlation with Pedophilia Index	*p*
R. Frontal	89.0 (10.4)	− .16	.10
L. Frontal	93.8 (10.3)	− .17	.07
R. Temporal	52.3 (5.6)	− .31	.001
L. Temporal	50.2 (5.5)	− .25	.008
R. Parietal	49.2 (6.8)	− .32	.0008
L. Parietal	46.3 (6.4)	− .33	.0005
R. Occipital	19.2 (4.0)	− .08	.42
L. Occipital	15.8 (4.0)	.02	.84
R. Fornix	0.9 (0.2)	− .06	.56
L. Fornix	0.9 (0.2)	.04	.72
Corpus callosum	16.4 (2.8)	− .19	.05

What's a *Voxel?*
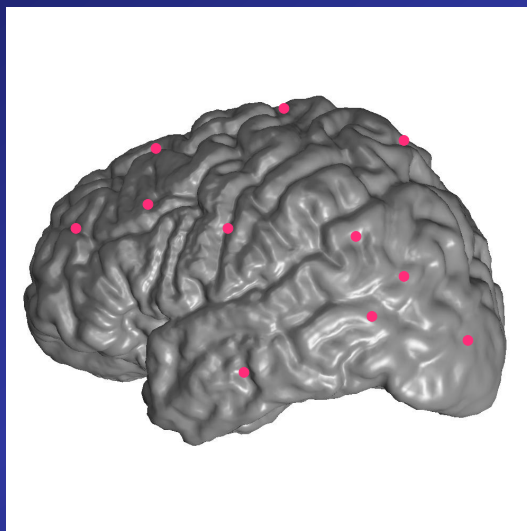
Voxel-Based Morphometry (VBM)

SPM2
Nonlinear registration: Ashburner & Friston (1999)
Custom templates: All-subject averages
Modulation
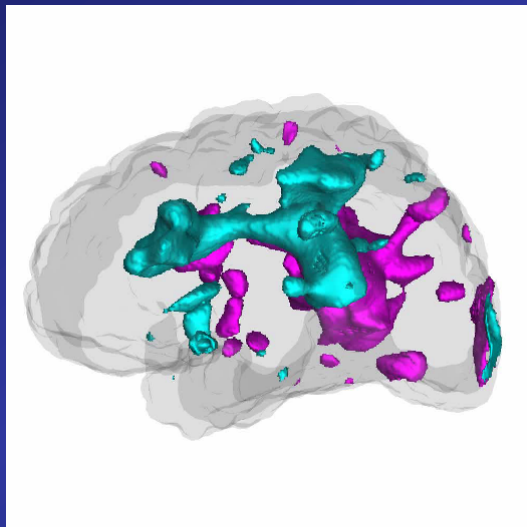Smoothing: 10mm full-width-half-maximum,
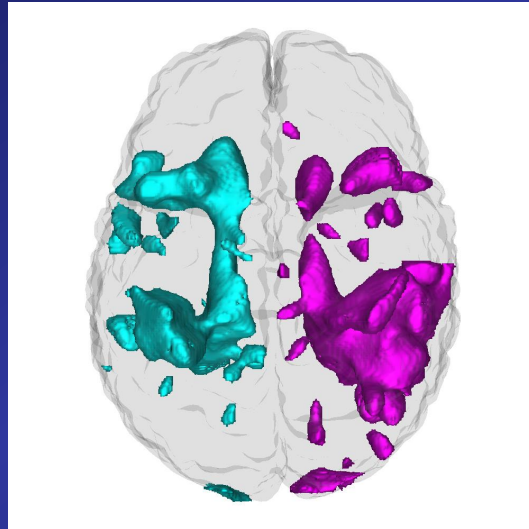   Gaussian blurring kernel

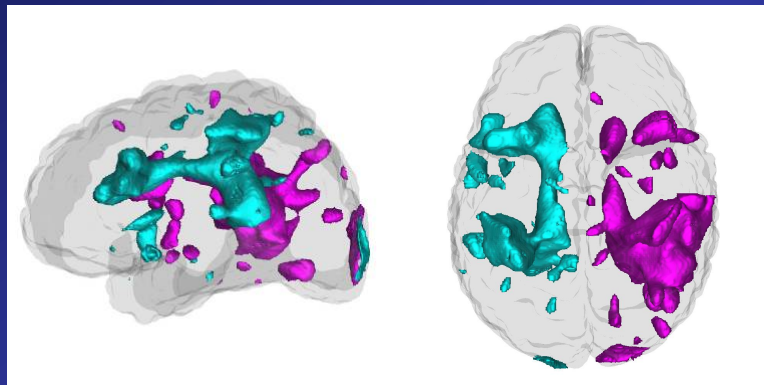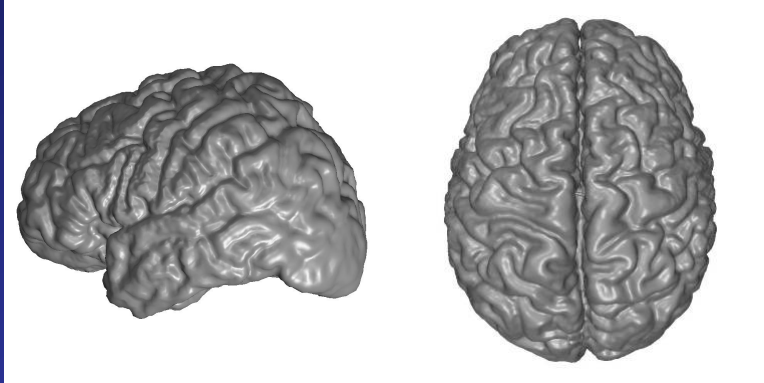Voxel-wise analyses (GLMs):   Indep t s, correlations

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VBM of Pedophilic vs. Nonsexual Offender Men

VBM of Pedophilic vs. Nonsexual Offender Men

VBM of Pedophilic vs. Nonsexual Offender Men

VBM of Pedophilic vs. Nonsexual Offender Men

Superior Occipitofrontal Fasciculus
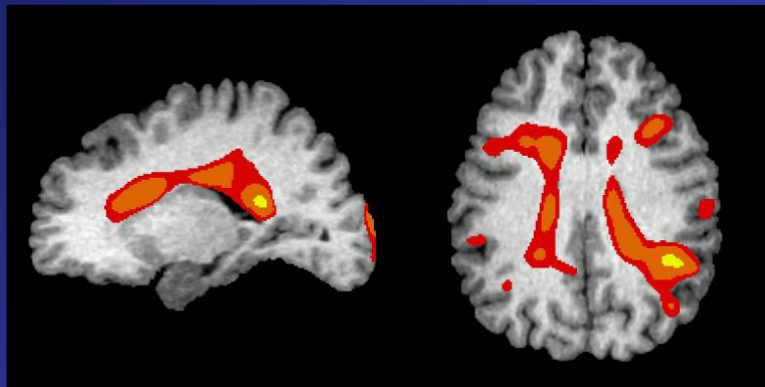
(right) Arcuate Fasciculus
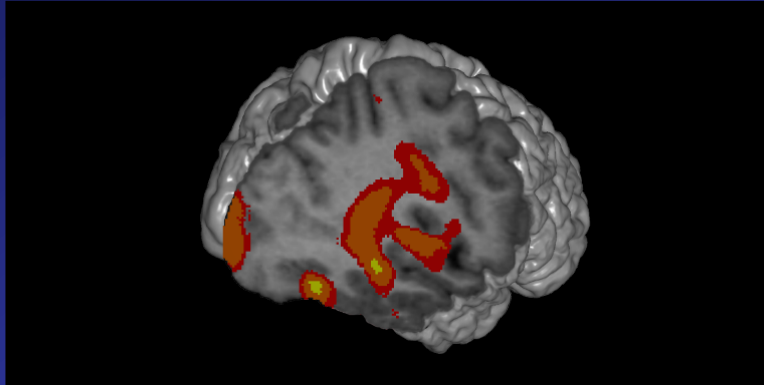
fMRI Studies of Sexual Arousal
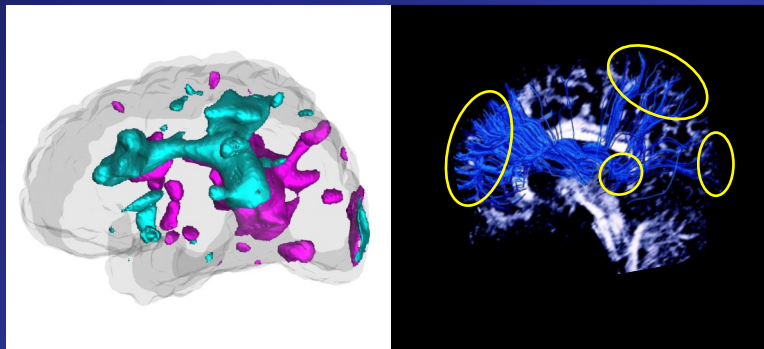
Middle Frontal Gyrus	(Ferretti et al., 2005; Garavan et al., 2000; Gizewski et al., 2006; Karama et al., 2002; Montosori et al., 2003; Rauch et al., 2000)
Insula and Opercula	(Garavan et al., 2000; Gizewski et al., 2006; Karama et al., 2002; Park et al., 2001; Stoléru et al., 1999)
Sup./Inf. Parietal Lobules	(Beauregard et al., 2001; Bocher et al., 2001; Ferretti et al., 2005; Mouras et al., 2003; Stoléru et al., 2003)
Occipital Cortex	(Beauregard et al., 2001; Bocher et al., 2001; Ferreti et al., 2005; Garavan et al., 2000; Mouras et al., 2003; Park et al., 2001)

But, what does this *mean?*

1. In healthy men, the cortical grey matter regions identified by fMRI studies may actually operate as a single network that serves to "recognize" stimuli as potentially sexual.

2. In pedophilic men, the white matter tissue is insufficient for that network to function accurately.

3. Because no deficit in grey matter volume was detected, the white matter volume may reflect poor myelination rather than low neuronal population.

Junk data or blind monks?
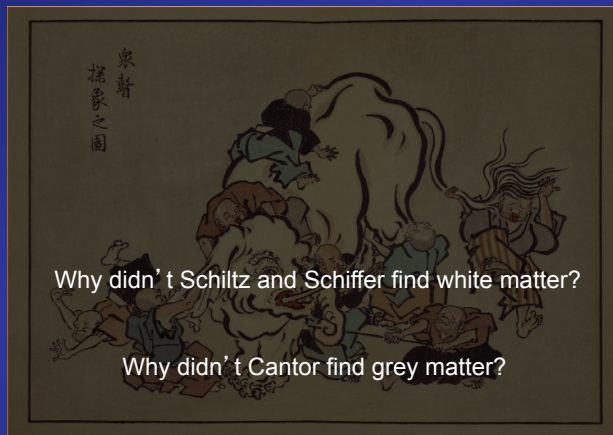
Study	Theory	Prediction	Subjects	VBM Analysis

Schiltz et al. (2007)

Schiffer et al. (2007)

Why didn't Schiltz and Schiffer find white matter?

Why didn't Cantor find grey matter?

Cantor et al. (2008)

Structural MRI studies of pedophilia

Study	Theory	Prediction	Subjects	VBM Analysis
Schiltz et al. (2007)	limbic	"temporal"	15 pedophiles 15 community controls	small volume corrected
Schiffer et al. (2007)	OCD/ impulsivity	frontal	18 pedophiles 24 community controls	small volume corrected
Cantor et al. (2008)	atheoretical	unbiased	65 pedophiles 62 nonsexual offenders	whole brain volume corrected

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Structural MRI studies of pedophilia

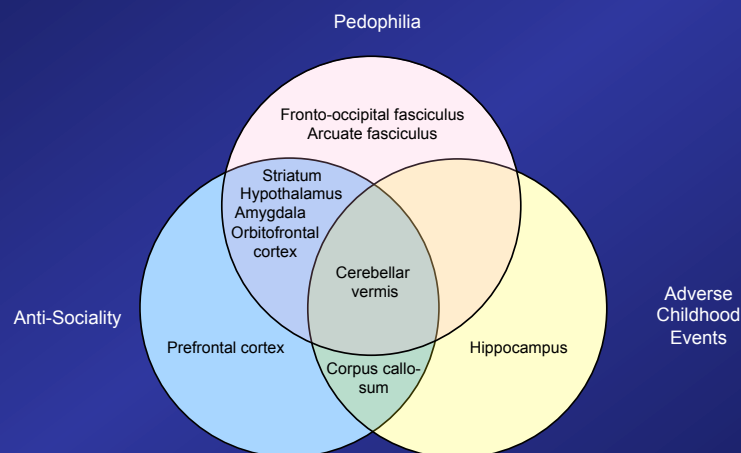| Study	Theory	Prediction	Subjects	VBM Analysis
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Junk data or blind monks?

Pedophilia

Fronto-occipital fasciculus
Arcuate fasciculus

Striatum
Hypothalamus
Amygdala
Orbitofrontal
cortex

Cerebellar
vermis

Anti-Sociality

Prefrontal cortex

Corpus callo-
sum

Hippocampus

Adverse
Childhood
Events

functional MRI (fMRI)
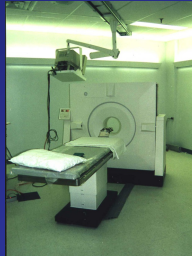
CT   PET   MRI   *f*MRI

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functional MRI (fMRI)

*f*MRI

function

magnetism
(deoxy-hemoglobin)

5 mm^3, 2"

artifacts
no metal
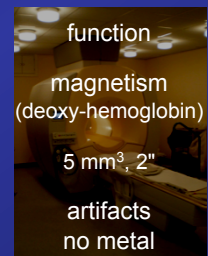
functional MRI (*f*MRI)

Hydrogen protons
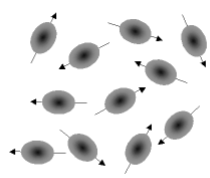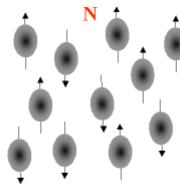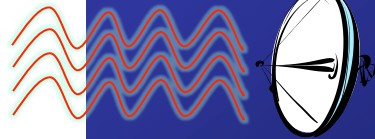
Magnet off Magnet on (RF transmit) Magnet on (RF receive)

N

S
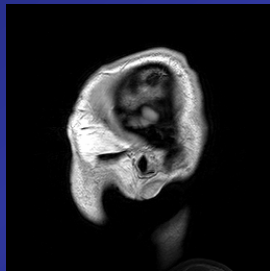
functional MRI (*f*MRI)

Perform two (or more) tasks including a control task.
Use statistics to subtract active tasks from control tasks.

Higher bloodflow = higher activity

Resting Activated
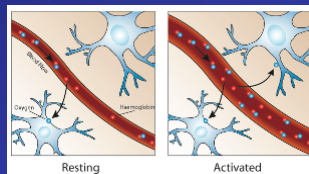
Stuart Clare, FMRIB

functional MRI (*f*MRI)

Subject perform two+ tasks, including a control task.
Use "subtractive" statistics to compare activity between tasks.
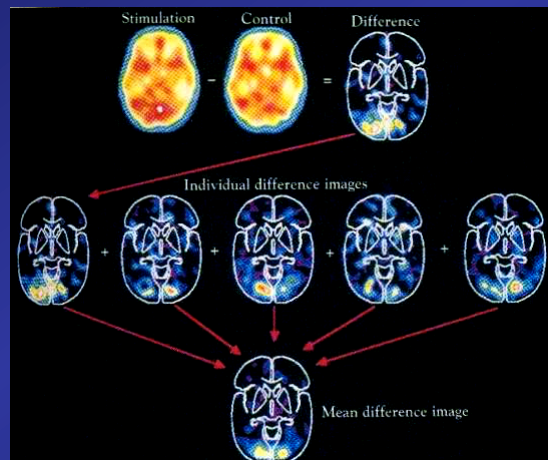
Posner & Raichle, *Images of Mind*

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functional MRI (*f*MRI)

Subject performs two+ tasks, including a control task.
Use "subtractive" statistics to compare activity between tasks.

Study	Anatomy	Subjects	Results
Walter et al. (2007)			
Schiffer et al. (2008a)			
Schiffer et al. (2008b)			
Poeppl et al. (2011)			
Sartorius et al. (2008)			
Ponseti et al. (2012)			

functional MRI (*f*MRI)

Subject performs two+ tasks, including a control task.
Use "subtractive" statistics to compare activity between tasks.

Study	Anatomy	Subjects	Results
Walter et al. (2007)	whole brain	pedophiles, healthy controls	pedophiles respond analogously to controls
Schiffer et al. (2008a)	whole brain	homosexual pedophiles, healthy gay men	pedophiles respond analogously to controls
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Poeppl et al. (2011)	whole brain	pedophiles, nonsexual offenders	pedophiles respond analogously, but > controls
Sartorius et al. (2008)			
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Ponseti et al. (2012)	empirical subset of brain	diverse pedophiles, diverse controls	88% sensitivity and 100% specificity

This just in!

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What are the ethical issues?

Neuroethics

Bioethics

Neurolaw

Legal neuroscience

What are the ethical issues?

Does our ability to detect pedophilia have implications?
What if juries buy it too much?
What if it is used to jail/commit people for their intentions?
Privacy? "mental privacy"
Basic issue: consent to assessment (like polygraph?)
Used as employment criterion?

What does this say about nature/nurture?

The Big Questions

Is it in the brain?

Can we treat it?

Is it in the genes?

Were they born with it?

Does it run in families?

Can it change?

Are they responsible for it?

Can we prevent it?

What if...?

The Public's Fears

My fears:

My fears:

MRI always right	MRI always wrong
Society's needs always comes first	Individual rights always come first
Brain tells us everything	Brain tells us nothing
Public overly trusts science	Public doesn't trust science
"Experts" with defense bias	"Experts" with prosecution bias
Unvalidated techniques	Unvalidated techniques

My fears:

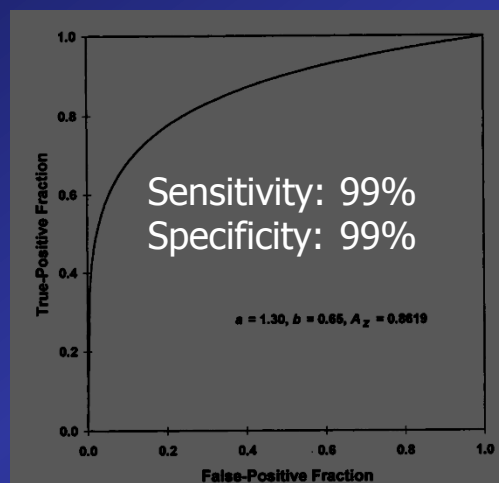| MRI always right	MRI always wrong
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The State of the Art

Research ⇨ Clinical ⇨ Screening ⇨ Evidence

Validity of Phallometry
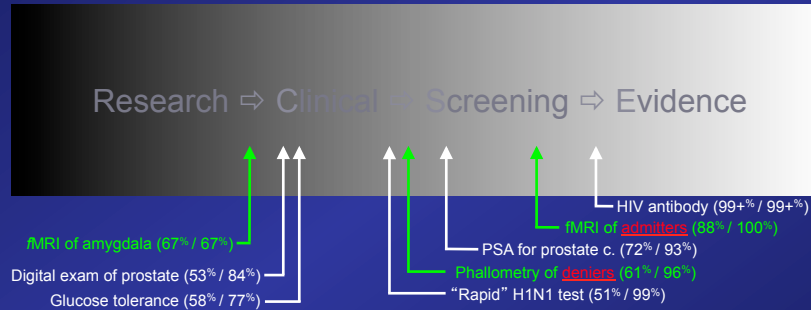

Sensitivity: 61%
Specificity: 96%

$a = 1.30, b = 0.65, A_z = 0.8619$

Hypothetical Validity

Sensitivity: 99%
Specificity: 99%

$a = 1.30, b = 0.65, A_z = 0.8619$

Hypothetical Validity

Sensitivity: 99.999%
Specificity: 99.999%

$a = 1.30, b = 0.65, A_z = 0.8619$

So, can <u>fMRI</u> detect arousal to child stimuli?

Research ⇨ Clinical ⇨ Screening ⇨ Evidence

HIV antibody (99+% / 99+%)

fMRI of admitters (88% / 100%)

fMRI of amygdala (67% / 67%)

PSA for prostate c. (72% / 93%)

Digital exam of prostate (53% / 84%)

Phallometry of deniers (61% / 96%)

Glucose tolerance (58% / 77%)

"Rapid" H1N1 test (51% / 99%)

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fMRI of amygdala (67% / 67%)
Digital exam of prostate (53% / 84%)
Glucose tolerance (58% / 77%)

Getting close.

Can we replace this:

…with this?

Future Directions

- Minor physical anomalies

- Diffusion Tensor Imaging

- Magnetization Transfer imaging

- Specificity of findings for pedophilia vs. paraphilia

- Empirical tests of childhood adversity, antisociality, vs pedophilia

- fMRI of response in abusers who *deny* pedophilia

My Hopes

What if…?

fMRI provides the next increment in accuracy of diagnosing pedophilia and is employed only within the bounds of contemporary professional ethics:

- Informed Consent
- Confidentiality

My Hopes

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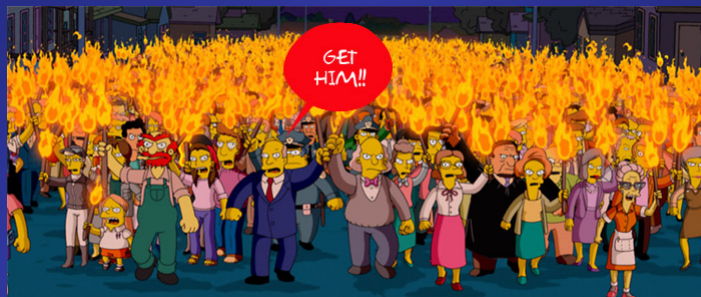- Informed Consent
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With continued research, we pinpoint the prenatal process that goes awry.

Perhaps: A *general* prenatal health factor already known to interfere with normal growth of both body and brain...

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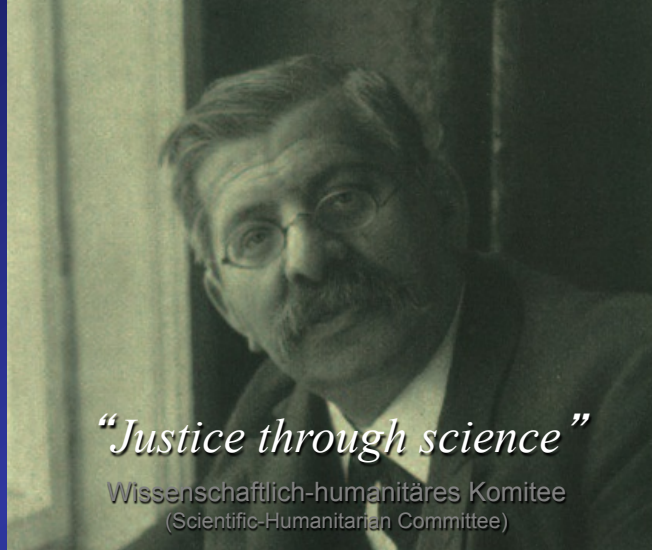
Instead of preventing a second offense,
we can prevent *the first* offense.

The stakeholders

Victim groups
Defense experts
Prosecution experts
Treatment clinics
Politically punitive
Profiteers of hysteria

Magnus Hirschfeld (1868–1935)

"Justice through science"

Wissenschaftlich-humanitäres Komitee
(Scientific-Humanitarian Committee)

Acknowledgments