Limbic Abnormalities in Affective Processing by Criminal Psychopaths as Revealed by Functional Magnetic Resonance Imaging

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Where are we going?
- Introduction
- Methods and Materials
- Results
- Discussion
- Critique
- Future Studies
- Questions??

First, what exactly is a Psychopath?
Psychopathy is a complex personality disorder of unknown origin. But, what does this mean?
- Affects 1% of the general population
- Disproportionate amount of repetitive and violent, criminal acts (murder, rape, mutilation)
- Glib and superficial; lack empathy, guilt, or remorse
- Difficulty processing affective (emotional) material

What Previous researchers have found...
Findings:
- Criminal psychopaths fail to experience or appreciate emotional significance of stimuli
- Fail to show normal ERP differentiation between neutral and emotional words
- They require more cognitive resources to process and evaluate affective stimuli
- Lack of spatial resolution and consistency has led to few findings that are neurologically based in evidence

What the researchers predict...
Hypothesis:
- Psychopaths will show less activation than healthy controls and criminal non psychopaths when processing affective words compared with neutral words at cerebral sites where healthy controls had exhibited significant activation for affective words as compared to neutral words.

Some of our favourites...
Method

Subjects:
- Criminal psychopaths (n=8) and criminal non-psychopaths (n=8)
- Healthy controls (n=8)

Procedure:
- Eight trials: three phases in each trial
  1. Encoding: memorize a list of 12 words, presented one at a time (500 ms each)
  2. Rehearsal: mentally rehearse list of words
  3. Recognition: 12 words presented and asked if word was present in previous list of words

***Accuracy was Stressed***

Using an fMRI (1.5 T) a mean functional image was constructed for each from the images in the trials.

Results!!!

- No group differences in affective processing relative to neutral processing in subjects
- Psychopaths trend for more accurate recall of affective material as compared to neutral.
- Also showed less affect-related activity compared to the neutral baseline in the caudal anterior cingulate, posterior cingulate, left inferior frontal gyrus, right amygdala, ventral striatum, left amygdala, and the bilateral anterior superior temporal gyrus.
- Exhibited greater activation than controls in regions outside the limbic system: left anterior superior temporal gyrus and the right inferior frontal gyrus.

Results...

Controls: More Activation of posterior cingulate, caudal and rostral anterior cingulate

Psychopaths: Less Activation of posterior cingulate, caudal and rostral anterior cingulate

Psychopaths: Greater activation in the bilateral inferior frontal gyrus (outside the limbic system)

Controls: Less activation in the bilateral inferior frontal gyrus (outside the limbic system)

Discussion

The results support the hypothesis that criminal psychopathy is associated with frontal cortex and limbic abnormalities.

- Anterior and posterior cingulate ➔ attentional & affective processes
- Amygdala, Ventral striatum, hippocampal formation ➔ emotion and memory
- Bilateral inferior lateral frontal cortex ➔ semantic and decision making processes

~ Currently, the origin of these abnormalities is unknown~

Critique...

- Limitations:
  - Sample sizes were too small (sample specific)
  - Can’t be confidently generalized
  - Verbal material used: abnormalities may be limited to affective linguistic stimuli
  - Can’t rule out substance abuse because this was by self-report

In the Future...

- Future Studies/Improvements:
  - Use pictures or faces for stimuli (not verbal material)
  - Drug testing in order to rule out substance abuse
  - Larger sample sizes
  - Test psychopaths with stimuli relating to their particular crime ➔ see if they show even less activation to these stimuli
Questions are guaranteed in life; Answers aren’t.