Neurocognitive mechanisms implicated in increasing the risk for violence

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Talk plan

• Distinguishing forms of violence: Reactive and Instrumental

• A system mediating reactive aggression: acute threat response

• Neuro-cognitive mechanism that, when dysfunctional, increases the risk for instrumental aggression: Empathic responsiveness

• Neuro-cognitive mechanism that, when dysfunctional, increases the risk for reactive and instrumental aggression: Reward-Punishment based decision making.

• Conclusions
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The distinction between reactive and instrumental aggression (Blair, TiCS, 2007)

- **Reactive**
  - Frustration/threat induced

- **Associated disorders**
  - Borderline Personality Disorder
  - Anxiety
  - Depression
  - Intermittent Explosive Disorder
  - Childhood bipolar disorder
  - Psychopathy (elevated CU traits).

- **Instrumental**
  - Goal directed

- **Associated disorders**
  - Psychopathy
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Automatic reactive aggression
(Blair, *Nature Neuroscience Reviews*, 2014)
Armony et al (2005): PTSD and masked fearful expressions
Neural correlates of emotion processing in borderline personality disorder

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Increased responsiveness to threat images in patients with BPD
Similar data seen in other groups at risk for increased levels of reactive aggression: PTSD, IED, Borderline PD, 5HT transporter. Individuals with the met (COMT) allele.

Viding et al. AJP (2012)

FIGURE 1. Right Amygdala Response to Fearful and Calm Faces in Boys With Conduct Problems and High or Low Callous-Unemotional Traits and in Typically Developing Comparison Boys. —

Right amygdala: peak, x=20, y=-2, z=-22
Note:

• The impact of stress, trauma, neglect
  – Increases the responsiveness of this circuitry.

• Emotion regulation
  – Problems with emotional regulation will lead to longer periods of increased responsiveness of this basic threat circuitry.

• Frustration
  – Is also thought to activate this circuitry.
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Callous-Unemotional (CU) traits

– Meets full criteria for Conduct Disorder.
– Shows 2 or more of the following characteristics persistently over at least 12 months and in more than one relationship or setting:
  
  • **Lack of Remorse or Guilt:** Does not feel bad or guilty when he/she does something wrong.
  
  • **Callous-Lack of Empathy:** Disregards and is unconcerned about the feelings of others.
  
  • **Unconcerned about Performance:** Does not show concern about poor/problematic performance at school, work, or other activities.
  
  • **Shallow or Deficient Affect:** Does not express feelings or show emotions to others, except in ways that seem shallow or superficial (e.g., emotions are not consistent with actions; can turn emotions “on” or “off” quickly) or when they are used for gain (e.g., to manipulate or intimidate others).
Empathic responsiveness
(Blair, *Nature Neuroscience Reviews*, 2014)
Healthy comparison children, children with DBDs and CU traits and children with ADHD (N = 12 in each group) matched for gender, age, ethnicity and IQ: MARSH et al (AJP; 2008)
Responsiveness to another’s pain
(Marsh et al., JCPP, in press)
Similar data seen in other groups at risk for increased levels of reactive aggression: PTSD, IED, Borderline PD, 5HT transporter.

Individuals with the met (COMT) allele.

Viding et al. AJP (2012)

FIGURE 1. Right Amygdala Response to Fearful and Calm Faces in Boys With Conduct Problems and High or Low Callous-Unemotional Traits and in Typically Developing Comparison Boys

Contrast Estimate for Fear > Calm

Conduct problems/low callous-unemotional traits (N=15)
Comparison subjects (N=16)
Conduct problems/high callous-unemotional traits (N=15)

Right amygdala: peak, x=20, y=-2, z=-22


**META-ANALYSES OF THE EXPRESSION RECOGNITION LITERATURE** (Blair & Marsh, 2008; Dawel et al., 2012):

- Fear/ Sadness impaired
- Anger/ Disgust intact
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Reward-punishment based decision making (Blair, *Nature Neuroscience Reviews*, 2014)
Passive avoidance learning (White et al, AJP, in press: 20 CD+CU, 24 HC)


Critical though to distinguish BOLD responses to cue from those to feedback.

Regressors for Chosen, Non-Chosen and Reward, Punishment were weighted according to learning theory: Rescorla-Wagner:

Prediction error for the current trial \( (t) \) equaled the feedback value for the current trial minus the expected value for the current trial.

\[
PE_{(t)} = F_{(t)} - EV_{(t)}
\]

EV was calculated via the following formula:

\[
EV_{(t)} = EV_{(t-1)} + (\alpha * PE_{(t-1)})
\]
During Feedback: Failure to respond to PE within striatum
During choice: Failure to use EV information
Reduced response to reward within vmPFC/caudate


Conclusions

• Three important neuro-cognitive systems implicated in violence:
  – Acute threat response; reactive aggression
  – Empathic responding (instrumental)
  – Reward-punishment based decision making (both)

• Understanding these systems allows greater clarity with respect to other factors:
  – The role of stress, trauma, neglect.
  – The role of poverty, diet
  – Genetics.
  – Alcohol.
Alcohol

Reduced responsiveness to fearful expressions (Sripada et al., 2012)

Reduced responsiveness to reward outcomes (Gilman et al., 2011)

Reduced responsiveness to punishment outcomes (Gilman et al., 2011)
Organizing the aggressive response (King et al., 2006)

Fig. 1. Screenshot from each trial type showing the two types of appropriate and inappropriate behavior within the context of a video game: (a) appropriate compassion, bandaging a wounded human; (b) appropriate violence, shooting a nonhuman assailant; (c) inappropriate violence, shooting a wounded human; (d) inappropriate compassion, bandaging a nonhuman assailant.
Organizing the aggressive response (King et al., 2006)