

Juvenile Justice & The Brain Research Studies

Instructions: For your Jigsaw topic, explore the studies below. As you do, consider how each contributes to our essential question. Work as a group to provide critical thinking for each study.

Topic 1: Localization of Function

Dimasio et al (1994): Phineas Gage Case Study

Aim: To determine what areas of Phineas Gage's brain was damaged in the accident.

Method: Used MRI technology to create a model of the accident and determine what areas were damaged.

Findings: The frontal lobe, and only the frontal lobe was damaged in the accident.

Conclusions: The frontal lobe is responsible for behaviors such as planning, emotional control, and social interactions.

Critical Thinking:

Cohen et al (2006)

Aim: To investigate brain activity in young people when under emotional states.

Method:

Participants: 100 13 to 25 year olds from L.A. and NY City.

Task: While placed in an fMRI machine, participants were asked to press a button when they saw a bored or scared face. However, if they saw a happy face, they would not press the button.

Treatment 1: Positive Arousal...They could be awarded \$100 for their performance

Treatment 2: Negative Arousal...They could hear a loud noise at any time.

Control Group: No arousal.

The researchers then compared the results and neural activity of participants in different groups and of different ages.

Findings:

- There was no difference between ages in the positive arousal and control group.
- In the negative arousal group the 18- to 21-year-olds performed worse on the task relative to adults over 21. This reduction in performance was associated by decreased activity in fronto-parietal circuitry, implicated in cognitive control, and increased sustained activity in the ventromedial prefrontal cortex, involved in emotional processes.

Conclusions: Different parts of the frontal lobe are responsible for different behaviors. When under stress, younger individuals with less developed frontal lobes struggle to perform. This shows that the fronto-ventromedial prefrontal cortex is involved with emotional control and the fronto-parietal circuitry is involved in cognitive control.

Critical Thinking:

Kaplan et al (2016)

Aim: To investigate brain activity in people when faced with contradictory evidence to long held beliefs.

Method:

Participants: 40 healthy adults from the L.A. areas who held strong political beliefs (avg. age: 24.3).

Task: While inside a fMRI scanner, participants saw a series of statements they previously indicated strongly believing, followed by several challenging counterarguments. After participants read all five counterarguments, the original statement was shown again and they reported their post-challenge belief strength. The difference between pre-scan and post-challenge ratings was used as a measure of belief change.

Findings:

- When faced with evidence against their strongly held beliefs, participants showed increased activity in their dorsomedial prefrontal cortex.

- Those who showed the largest willingness to change their mind about important issues showed less activity in this area along with the amygdala.

Conclusions: The dorsomedial prefrontal cortex is used to maintain beliefs through emotions and processes information through an emotional lens.

Critical Thinking:

Baird et al (2005)

Aim: To investigate brain activity in young people while making risky decisions.

Method:

Participants: 20 adolescents(10 males, 10 female, avg. age: 13.4); 20 adults(10 males, 10 female, avg age: 21.7)

Task: While laying in an fMRI machine, participants were asked to make judgments of whether an idea was a good or bad idea. Examples included “jumping off a roof,” “swimming with sharks,” and “going for a walk.”

Measurements: Researchers examined response times and brain activity.

Findings:

- There was no difference between ages when responding to clearly “good ideas.”
- When faced with a “bad idea,” adolescents took longer to respond than adults and showed increased activity in the Dorsolateral Prefrontal Cortex (responsible for planning, abstract thinking, and

Conclusions: When confronted with a dangerous scenarios, adolescents rely more on areas associated with emotional processing rather than logical thinking.

Critical Thinking:

Qin et al (2013)

Aim: To investigate the size of the amygdala in teens and their likelihood of experiencing anxiety in life.

Method:

Participants: 76 children aged 7-9.

All participants received a MRI brain scan and took an anxiety test.

Findings:

- The children with the larger amygdalas were more likely to experience anxious behavior.
- None of the children in the research experienced enough anxiety to be considered clinically diagnosable.

Conclusions: An enlarged amygdala is associated with higher rates of anxiety among children.

Critical Thinking:

Whittle et al (2008)

Aim: To investigate the size of the amygdala in teens and their likelihood of demonstrating aggressive behavior.

Method:

Participants: 137 children between the ages of 11-13. All were from Australia.

-All participants received a MRI brain scan and were observed having high stress conversations with their parents.

Findings:

· The children with the larger amygdalas were more likely to show hostile and moody behavior towards their parents.

Conclusions: An enlarged amygdala is associated with higher rates of emotional and antisocial behavior.

Critical Thinking:

Jung et al (2018)

Aim: To investigate the role of the amygdala in risk taking.

Method:

Participants: 108 young adults.

Participants were placed in a MRI machine and asked to perform gambling tasks. Reseachers measured the size of the amygdala and its connectivity with the frontal lobe.

Findings:

· Participants who had larger amygdalas were more likely to take risks in the gambling task. They also had stronger connections between the amygdala and the frontal lobe.

Conclusions: An enlarged and highly connected amygdala is associated with higher rates of risk taking in young adults.

Critical Thinking:

Topic 2: Brain Plasticity

Study: Rosenzweig (1972)

Aim: *To determine how the environment can impact the neurological development of rats.*

Method: Randomly assigned lab rats to one of three conditions.

-**Control:** *Typical Laboratory Cage (other rats, adequate room and food/water.)*

-**Impoverished:** *Small cage, isolated, adequate food/water.*

-**Enriched:** *Large space, Multiple Toys, Companions, adequate food/water.*

-*After living 4-10 weeks, they were killed and autopsies were performed on their brains (randomly assigned numbers to eliminate researcher bias).*

Findings: *The enriched rats had...*

1. Thicker and heavier cerebral cortexes
2. Larger neurons

Conclusion:

An enriched environment produced more developed and bigger brains. A stressed Environment produced less developed brains.

Critical Thinking:

Study Name: McEwan et al (2006)

Aim: *To determine the impact of chronic stress on neural structure*

Method:

-**Control:** *Rats in cages with two other rats.*

-**Treatment:** *Rats who were placed in highly stressful restraints for 6 hour each day for 21 days.*

-**On the 22nd day, all rats were euthanized and their brains dissected.**

Findings: *The treatment rats had weakened dendrites in their frontal lobes and hippocampus. They also had stronger neural connections in their amygdala.*

Conclusion:

Chronic stress brought about by isolation weakens the frontal lobe and hippocampus, while strengthening the amygdala.

Critical Thinking:

Bremner et al (2003)

Aim: *To investigate whether prolonged stress (PTSD) reduces the volume of the hippocampus.*

Method: *Participants: War veterans and female adults who were sexually abused as children. (Some had PTSD, but not all)*

Took MRI scans of brains and had participants take a memory test.

Findings: *Veterans with the most memory problems had the smallest hippocampus.*

The Hippocampus of PTSD sufferers was smaller than a control group.

Conclusions:

Chronic stress reduces the volume of the hippocampus and impairs memory.

Critical Thinking:

Study 4: Find Your Own.

Use online research to find an additional study about how a positive behavior and cause the brain to grow in healthy ways.

Topic 3: Neurotransmission

Dolan et al (2010):

<https://www.sciencedaily.com/releases/2010/06/100629170922.htm>

Aim: To investigate the impact that dopamine plays on impulsivity.

Method:

Participants: 14 healthy participants

- Repeat Measures were used to test participants in two conditions.
- Participants were given a tablet with a 150mg dose of dopamine in one trial and a placebo in another. They were faced with a number of options that questioned their impulsivity. For example, they were asked if they would choose a 'smaller, sooner' option, for example receiving £15 in two weeks, or a 'larger, later' option, such as receiving £57 in six months.

Findings:

- When given extra dopamine, all participants demonstrated a greater likelihood to choose the “smaller, sooner” option.

Conclusions

- High amounts of dopamine leads individuals to favor instant gratification in goal oriented behavior.

Critical Thinking:

Rutledge et al (2015): <https://www.sciencedaily.com/releases/2015/07/150707213245.htm>

Aim: To investigate the relationship between dopamine levels and risk taking.

Method:

- Participants: 30 healthy adult males (ages 13-17), 19 adults (ages 25-30)
- This repeated measures experiment had participants in both the treatment and control group.
- Treatment group: Given an extra dose of dopamine and participated in a gambling game.
- Control Group: Given a placebo and participated in a gambling game.
- Situation #1 in game: Accept a small monetary gain or gamble for a larger gain/nothing.
- Situation #2 in Game: Accept a small loss or gamble for no loss/large loss.
- Throughout the research, participants were asked how happy they were.

Findings:

- When given extra doses of dopamine, participants were more likely to take risks to get large gains.
- No difference was noted between the groups in the no loss/large loss situation.
- When given extra dopamine, participants reported being happier after small gains.

Conclusions

- High levels of dopamine correlate with risky behaviors when faced with potential gains.

Critical Thinking:

Galvan et al (2014)

Aim: To investigate the relationships between dopamine activity in the brain and reward seeking behavior in teens.

Method:

- Participants: 22 teens (ages 13-17), 19 adults (ages 25-30)
- Participants were placed in an fMRI and asked to perform a gambling task in which they had a 50-50 shot of winning.

Findings:

- Teenage participants showed increased activity in the ventral striatum (which is the center of dopamine in the brain) in comparison with adults when making similar bets.
- Teenage participants took greater risks than adults.

Conclusions

- Teens use their reward center of their brain that is driven by their high amounts of dopamine to drive their behavior. Increased dopamine levels led to increased risk taking and over valuing potential rewards.

Critical Thinking:

Chein et al (2011):

Aim: To investigate the relationship between peer pressure and decision making in the teenage brain.

Method:

Participants: 40 subjects (14 adolescents (age: 14-18), 14 young adults (ages 19–22) 12 adults (ages 24–29)

- Participants were placed in a fMRI machine and drove in a driving simulation in two conditions.
- Condition #1: Driving alone where they were not watched.
- Condition #2: Driving with peers watching.

Findings:

- When teens drove in front of their peers, they demonstrated greater risk taking and higher activity in areas associated with dopamine (ventral striatum and orbitofrontal cortex)

Conclusions

- Peer influence led teens to take more risks due to their heightened activity in dopamine rich areas of the brain.

Critical Thinking:

Sherman et al (2016): <http://newsroom.ucla.edu/releases/the-teenage-brain-on-social-media>

Aim: To investigate the impact that “likes” on social media had on teenage biology.

Method:

Participants: 32 teens (age 13-18)

- Participants were placed in a fMRI and viewed images on a simulated social media app similar to Instagram.
- Over 12 minutes, the participants saw 148 pictures, including 40 submitted by themselves, and measured brain activity. Each photo had a number of “likes” that participants believed came from other teens (when in reality they were assigned by the researchers).
- Teens also had the ability to “like” photos.

Findings:

- When teens saw pictures of theirs with many “likes” they displayed large amounts of activity in the nucleus accumbens (an area associated with pleasure).
- Teens were more likely to “Like” other photos that had many other “likes”

Conclusions

- Teens found peer approval on social media highly rewarding.

Critical Thinking:

Topic 4: Hormones

Suor et al (2015): Stress of Children in Poverty and Cognitive Functioning

Aim: To investigate how levels of cortisol impact the cognitive development of children.

Method:

- Performed a longitudinal study on 201 low-income children in the United States.
- Measured the cortisol levels in children at ages of 2, 3, & 4.
- Watched children interact with parents and measure family stability and trauma at age 2.
- Measured cognitive ability (language, motor functioning, & problem solving) at age 4.

Findings

- Exposure to violence and Elevated levels of stress were associated with higher and lower levels of cortisol.
- 30% High, 40% Low, 30% Moderate.
- Children with both high and low cortisol levels had lowered cognitive functioning.
- Children with moderate cortisol levels had average cognitive functioning.

Conclusions

Children with high and low cortisol levels had delayed cognitive functioning.

Explanation

High levels: High levels of cortisol are associated with decreased strength in areas of the brain such as the frontal lobe and hippocampus.

Low Levels: Ongoing stress leads to a state of *hypocortisol (depletion of cortisol)*. Children lacked motivation to engage in tasks.

Critical Thinking:

Kobak et al (2014)

Aim: To investigate the relationships between cortisol levels and anti-social behavior in teens.

Method:

- Participants: 116 disadvantaged youth (Male-56, Female-60; Ages 12-14)
- Measured the base cortisol levels of teens when entering the lab.
- Asked participants to have a high stress conversation with their care givers.
- Measured the cortisol level after the conversation and compared this with the behavior while in the conversation.

Findings

- Participants who had low base cortisol levels were more likely to show antisocial behavior towards their caretakers.
- The participants who showed the most anti-social behavior demonstrated a large increase in cortisol during the conversation.
- Girls with low cortisol levels were particularly at risk of antisocial behavior.

Conclusions

- Children with low levels of cortisol (especially girls) were more prone to demonstrating antisocial behavior when in a social situation.

Critical Thinking:

Shirtcliff et al (2005)

Aim: To investigate the relationships between cortisol levels and anti-social behavior in children

Method:

- Participants: 724 youth (Avg. Age: 13.5)
- Participants were given saliva samples and were measured for base cortisol rates.
- Their behavior was tracked over a three year period.

Findings:

- Male students who had low cortisol rates were more likely to demonstrate antisocial behavior over the three year study.

Conclusions

- Children with low levels of cortisol (especially boys) were more prone to demonstrating antisocial in real world settings.

Critical Thinking:

Testosterone

Pepper et al (2013)

Aim: To investigate the relationships between cortisol levels and anti-social behavior in children

Method:

- Participants: 268 participants between 6 and 25 years old.
- Participants were given a baseline test for testosterone level.
- Participants engaged in an activity where they used a pump to blow up a balloon with the goal of making it as large as possible. The larger it was, the more money they earned for themselves.

Findings:

- Male participants with the highest base levels of testosterone were more likely to take more risks and explode the balloon.
- Female participants with the highest base levels of testosterone were more likely to take more risks and earned more money.

Conclusions

- In both males and females, higher rates of testosterone were associated with risk taking. While males were generally unsuccessful in their attempts, females were more successful.

Critical Thinking:

Dabs et al (1995)

Aim: To investigate the relationships between testosterone levels and violent behavior in adult male prison populations.

Method:

- Participants: 692 incarcerated adult males were tested for testosterone levels.
- Participants' past behavior were examined.

Findings:

- Participants with higher rates of testosterone were more likely to have committed violent crimes and broke more rules, especially in regards to confrontation with authority figures, while incarcerated.

Conclusions

- High rates of testosterone are associated with violent and antisocial behavior among adult male prisoners.

Critical Thinking:

