Psychophysiology of Adolescent Peer Relations: Current Progress and Future Directions

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Physiological Indices in Peer Research

Common Physiological Systems in Adolescent Peer Research

- Autonomic Nervous System
- Neuroendocrine System
- Electroencephalography (EEG)
- Startle

Physiological Stress Systems

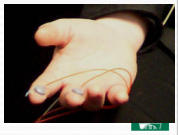
Autonomic Nervous System

Sympathetic Nervous System (SNS)
- Skin conductance
- Salivary alpha-amylase

Parasympathetic Nervous System (PNS)
- Respiratory sinus arrhythmia (RSA)

SNS and PNS
- Heart rate
- Blood pressure

Hypothalamic-pituitary-adrenal (HPA) axis
- Cortisol



Androgens and Sex Hormones

- Sex Steroids
  - Testosterone
  - Androstenedione
  - DHEA
  - DHEAS

Electroencephalography (EEG)

- Cortical arousal
  - Alpha: relaxed wakefulness, cortical inactivity
- EEG asymmetry
  - Alpha power in each hemisphere

Pizzagalli (2007)

Mechanisms Underlying Subtypes of Peer Behavior

Subtypes of Peer Behavior

- Distinct physiological processes may accompany different subtypes of peer-based behavior
  - Aggression
    - Proactive versus reactive aggression
    - Physical versus relational aggression
  - Withdrawal
    - Socially reticent versus preference for solitude

Proactive versus Reactive Aggression: Stress Systems

- Exaggerated reactivity to stress → aggression
  - Heart rate reactivity, skin conductance reactivity, RSA withdrawal (ANS)
  - Reactive aggression
- Underactivation of stress systems (baseline and/or reactivity) → aggression
  - Low heart rate, skin conductance, cortisol (SNS & HPA axis)
  - Proactive aggression

e.g., Hubbard et al. (2002); Murray-Close & Rellini (2012)

EEG and Social Withdrawal

- Heightened frontal cortical activation → social withdrawal in infants
  - Greater social monitoring and vigilance to novel stimuli
- Right frontal asymmetry → social withdrawal in infancy, preschool

Henderson et al. (2004)

Social Withdrawal

- Participants
  - 247 preschoolers
- Resting EEG
- Lab interactions with 3 same-age, same-gender peers
  - Reticence
  - Solitary-passive behavior

Henderson et al. (2004)

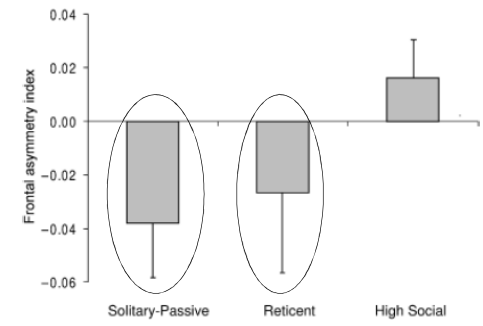


Figure 1. Mean frontal EEG asymmetry index (+/− 1 *SE*) by social play group.

Henderson et al. (2004)

Low scores reflect relative right frontal activation

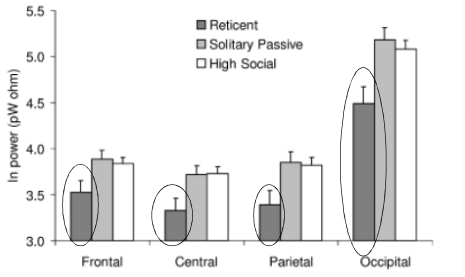


Figure 2. EEG alpha power (6 – 9 Hz) across scalp regions by social play group.

Henderson et al. (2004)

Lower scores reflect higher cortical activation

Social Withdrawal: Applications to Adolescence?

- Adolescent social withdrawal may reflect distinct social processes
  - Social avoidance due to fear of social challenge (analogous to reticence)
    - May be related to activation of stress systems and heightened cortical arousal (indicators of vigilance)
  - Preference for solitary activities (analogous to solitary passive behavior)
    - May be related to EEG asymmetry

Subtypes of Behavior: Implications

- May help clarify mechanisms underlying distinct subtypes of behavior
  - E.g., forms and functions of aggression
- May help researchers distinguish between behaviors that appear similar but reflect unique processes
  - E.g., social withdrawal

Biosocial Interactions

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- The correlates of physiological processes may differ depending on the peer context
- Levels of peer influence may depend on physiological processes

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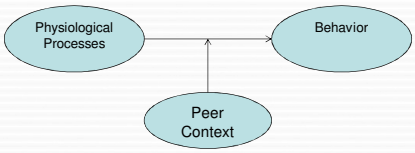


- Levels of peer influence may depend on physiological processes

Testosterone and Peer Status

- Heightened testosterone → aggression
  - Positive but low correlation between testosterone levels and aggressive behaviors in adolescent samples (Archer, 2005)
- Aggression or dominance?
  - Several studies have reported that testosterone is related to dominance but not aggression in early adolescence (see Mazur & Booth, 1998)

Dominance and Testosterone

- Do the dominance behaviors linked to testosterone depend on the peer group?
- Sample: 9, 11, & 13 year old boys
- Measures
  - Baseline plasma testosterone
  - Parent- and self-reported
    - Aggressive & nonaggressive conduct disorder symptoms
    - Leadership
    - Peer deviance

Rowe et al. (2004)

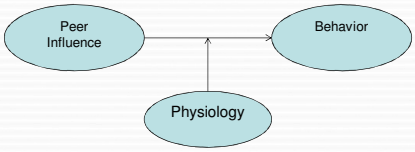
Findings

- Testosterone was not associated with aggressive behaviors
- Testosterone → dominance behaviors
  - Among boys with deviant peers, testosterone was positively related to nonaggressive CD symptoms
  - Among boys with non-deviant peers, testosterone was positively associated with leadership

Rowe et al. (2004)

Biosocial Interactions

- The correlates of physiological processes may differ depending on the peer context
- Levels of peer influence may depend on physiological processes



Peer Influence: Physiology as a Moderator

- Biological sensitivity to context theory (e.g., Ellis et al., 2011)
  - Heightened physiological reactivity may reflect receptivity to contextual influences
- ANS and HPA axis arousal may moderate the association between peer influence and adolescents' behavior

Biological Sensitivity to Context and Peer Influence

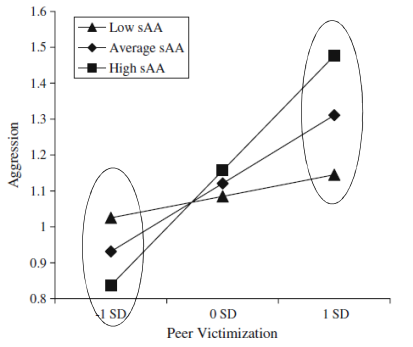
- Victimization → aggression
  - However, not all victimized youth become aggressive
- Physiological stress reactivity may moderate the link between victimization and aggression against peers

Rudolph et al. (2010)

Biological Sensitivity to Context and Peer Influence

- Participants
  - 132 pre-adolescents (~9 years)
- Measures
  - Self-reported victimization
  - Teacher-reported overt aggression
- Stress arousal
  - Salivary alpha-amylase in anticipation of social challenge

Rudolph et al. (2010)



Rudolph et al. (2010)

Biological Sensitivity to Context: Implications

- May help explain individual differences in peer influence processes, such as:
  - Why some youth who associate with deviant peers do not engage in such conduct themselves
  - Why negative peer treatment may lead to problems in some youth but not others
  - Why positive peer role models may be more effective at changing some adolescents' behavior

How Peer Relations affect Adolescents

Peer Experiences → Development Outcomes

- How do experiences with peers influence developmental outcomes, such as:
  - Psychological well-being
  - Physical health

Peer Victimization and Stress Physiology

- Peer victimization may serve as a potent stressor, and lead to alterations in stress system functioning
  - Several studies have documented elevated arousal of stress systems in victimized adolescents (e.g., Kliewer, 2006; Wilson et al., 2002)
  - However, others have found that victimization is associated with lower stress activation (e.g., Knack et al., 2011; Vaillancourt et al., 2008)
- Results may depend on the chronicity and severity of victimization

Popularity and Dominance

- Low dominance → stress system activation (Sapolsky, 2005)
  - May depend on the structure of the dominance hierarchy
    - Use of aggression against low dominant individuals
    - Stability of hierarchy
- Adolescent researchers should attend to:
  - Contextual differences in the use of aggression by popular and dominant peers
  - Transitions that disrupt dominance hierarchies

The Outcomes of Peer Relations: Implications

- Negative outcomes associated poor adolescent peer relations may in part reflect alterations in physiological stress system functioning
  - Victimization
  - Dominance and popularity

Where do we go from here?

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- Longitudinal designs and tests of direction of effects
- Gender differences
- Examining interactions between systems
- Measuring states versus traits
- Choosing types of stressors
- Other physiological measures
  - E.g., fMRI

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