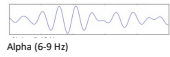


Background

Context

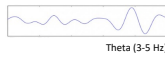
- Theory:** Experience-dependent neural mechanisms facilitate learning by forming new synaptic connections in response to unique information from the child's environment¹.
- Reality:** In Canada, the poverty rate for children aged 0 to 17 is projected to have increased by almost 40% in 2022². Over half of these families report feeling stress most days due to financial issues³.

Baseline EEG Trajectories



Alpha (6-9 Hz)

Mid-High SES Infants⁴
display
higher relative alpha
lower relative theta



Theta (3-5 Hz)

Low SES Infants⁵
display
lower relative alpha
higher relative theta

- When coupled with **low** power in the higher-frequency bands (e.g., alpha), **high** theta power has been linked to ADHD, and poorer top-down control⁶.

How might parental stress influence infant neural development?

- Joint attention (JA):** engagement in shared attention between an infant and their caregiver over a common object or event⁷.
Engaging in JA enables children to gain important linguistic and social cues to scaffold their socioemotional development.
- Variations in the **3-5 Hz (theta)** and **6-9 Hz (alpha)** frequency ranges in infants have been previously associated with **neural activation during JA interactions**⁸.
- Previous explorations of JA focus on responding and initiating behaviours. By exploring **5 dimensions of JA**⁹, we may tease apart what makes a high-quality interaction during play
 - Duration / Frequency
 - Initiation: Mother directs, Mother follows, Infant initiates
 - Termination: Mother vs infant terminated
 - Coordinated vs Passive

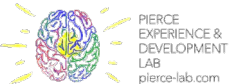
Purpose

We aim to test whether **SE-stress** predicts the quantity and quality of JA interactions and EEG power in alpha and theta bands, and whether the **nature of JA interactions** mediates or moderates associations between **SE-stress** and neurodevelopment underlying JA.

This study's goal is to understand how stress influences infant neural development via research protocols which serve families from diverse backgrounds. The goal is to expose the misunderstood variabilities present across affluent and nonaffluent communities.

Participants

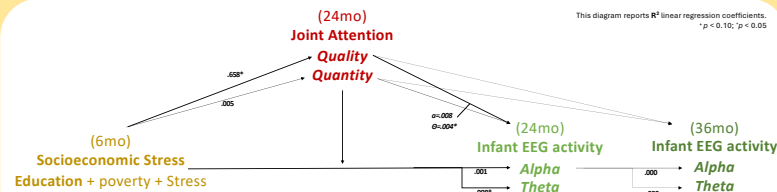
- 157 mother-infant dyads
- Recruited from 2 primary care clinics in Boston, and Los Angeles, which serve families from low-income backgrounds.



Associations Between Socioeconomic Stress, Engagement in Joint Attention, and Infant Neurodevelopment in 24- to 36-Month-Old Infants

Ana Badal^a, Leen Asaada, Charles A. Nelson^b Pat Levitt^c & Lara Pierce^a

Proposed Models



Aim 2 & 3: Mediation & Moderation Results

Table 1 - Summary of mediation analysis for theta at 24 months.

EEG Outcome	N	R ²	F	p	B	SE	p
Theta (24mo)	53	.052	2.781	.102			
Model							
Mediating variable: JA					.004	.003	.079*
Quality							
Material Education					-.010	.004	.011*

*Reported are model values for N = sample size, R² = R coefficient squared, F = variance, and p = significance indicator, and variable values for B = B coefficients, SE = standard error, and p = p < 0.10; **p < 0.05; ***p < 0.001.

Table 2 - Summary of moderation analyses.

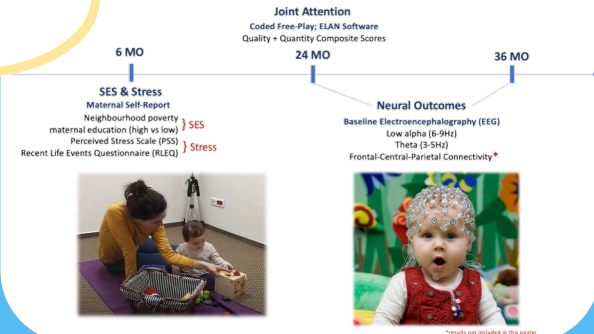
EEG Outcome	Alpha (24mo)				Alpha (36mo)			
	N	R ²	F	p	N	R ²	F	p
	43	.068	.544	.742	24	.281	1.406	.269
	B SE p				B SE p			
Mediating variable: JA	.003	.004	.872		.006	.005	.282	
Quality								
PSS	.001	.001	.182		.001	.001	.050*	
Neighborhood Poverty	-.012	.037	.748		-.018	.040	.651	
Material Education	.002	.008	.783		-.011	.011	.272	
JA Quality x PSS	.000	.001	.805		.000	.001	.939	
	Theta (24mo)				Theta (36mo)			
	N	R ²	F	p	N	R ²	F	p
	43	.273	2.781	.011*	24	.237	1.118	.386
	B SE p				B SE p			
Mediating variable: JA	.006	.002	.009*		.002	.004	.721	
Quality								
PSS	.000	.000	.939		.000	.001	.704	
Neighborhood Poverty	.022	.019	.257		.055	.033	.114	
Material Education	-.009	.004	.035*		-.012	.009	.190	
JA Quality x PSS	.000	.000	.922		-.001	.001	.500	
	EEG Outcome				Alpha (36mo)			
	N	R ²	F	p	N	R ²	F	p
	43	.058	.452	.809	24	.226	1.052	.419
	B SE p				B SE p			
Mediating variable: JA	-.002	.004	.586		-.001	.006	.853	
Quality								
PSS	.001	.001	.297		.001	.001	.103	
Neighborhood Poverty	-.012	.038	.758		-.009	.039	.824	
Material Education	.002	.008	.823		-.007	.010	.479	
JA Quality x PSS	.000	.001	.724		.000	.001	.863	
	Theta (24mo)				Theta (36mo)			
	N	R ²	F	p	N	R ²	F	p
	43	.129	1.101	.377	24	.234	1.101	.394
	B SE p				B SE p			
Mediating variable: JA	.001	.002	.577		-.001	.005	.817	
Quality								
PSS	.000	.000	.814		.000	.001	.896	
Neighborhood Poverty	.015	.021	.469		.053	.032	.114	
Material Education	-.008	.005	.106		-.008	.008	.237	
JA Quality x PSS	.000	.000	.965		-.001	.001	.356	

*Reported are model values for N = sample size, R² = R coefficient squared, F = variance, and p = significance indicator, and variable values for B = B coefficients, SE = standard error, and p = p < 0.10; **p < 0.05; ***p < 0.001.

- JA did not mediate or moderate links between maternal socioeconomic stress and infant brain activity. This may reflect limitations in how joint attention was measured across a culturally diverse sample.

- These findings underscore the need to consider cultural variations in play when studying early brain development, particularly in families facing socioeconomic adversity.

Measures



Results

- Aim 1:** Compute hierarchical linear regressions to test whether: SE-stress (6 months) → relative alpha and theta (24 and 36 months) SE-stress (6 months) → JA quantity and quality (24 months)

- Maternal education was significantly associated with both JA quality (b=.658; p=.013) and relative theta at 24 months (b=-.008; p=.035).
- JA quality was also a significant predictor of relative theta at 24 months (b=.004; p=.035).
- See Table 1 and plots A and B in the middle column.

- Aim 2:** Perform mediation analyses to test whether: JA quantity and/or JA quality mediate associations between SE-stress and EEG outcomes at 24 months.

- The mediation model supports maternal education (b=-.010; p=.011) and JA quality (b=.004, p=.079) as predictors of theta at 24 months (Table 1).
- JA quality did not mediate the association between education and theta.
- Maternal education → JA quality was driven by JA coordination (r=.256; p<0.05); infants of mothers with more years of education engaged in more coordinated JA (plot C).
- JA quality → theta was driven by infant termination (r=.264; p<0.05); while infant termination is considered a marker for high quality mother-infant interactions⁹, infants who terminated more JA episodes were more likely to display higher theta activity. This may be explained by previous works which have identified higher theta activity as a marker of inattention in infants⁵ (plot D).

- Aim 3:** Perform moderation analyses to test whether: JA quantity and/or JA quality moderate associations between perceived stress and EEG outcomes at 24 and 36 months.

- 8 models computed for JA quality and quantity as respective moderators for the relationships between perceived maternal stress (PSS) and infant EEG outcomes at 24 and 36 months (Table 2).

Conclusion

Significant associations emerged between SES and infant neurodevelopment, with maternal education linked to both joint attention (JA) quality and theta activity at 24 months. While JA quality showed potential as a mediator between maternal education and theta activity at 24 months, further research is needed to unpack the complex relationships between socioeconomic stress, joint attention, and neural activity during infancy. Considering how cultural differences in caregiving and play influence JA behaviours is critical to understand the diverse ways in which JA shapes early brain development.

Posters and more...

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