The Quiet Cortex: Emotional Abuse and Blunted Prefrontal Activation

Indiana Calhoun Pellegrino

Department of Psychology, University of Hartford

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Professor Deluca

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Introduction

Emotional maltreatment is a form of child neglect and a core of all forms of abuse. This type of neglect is highly reported and categorized as psychological abuse, where a person is subjected to nonphysical acts that are detrimental to functioning and overall well-being (American Psychological Association, n.d.). When parents attend to and negatively treat their children, this reverses the positive effects of self-psychology. The self-psychology theory, developed by Heinz Kohut in 1970, emphasizes that if children are treated with emotional and physical security, stable communication, and reprofiled love, they will form a strong and realistic foundation of self-worth (Siegel, 2004). When the child faces adversity, this positive foundation will let them develop resilience, a stable sense of self, and self-esteem. However, when maltreatment occurs, children will instead create a sense of shame attached to a negative sense of self and poor navigation of the world around them.

In comparison to a Pearson Correlation of $p<.001$, bivariate correlations reveal emotional abuse to correlate positively with shame (0.51) and negatively with self-concept (-0.25) (Archuleta et al., 2023). This consequence comes from internalizing inadequate treatment and messages, leading to an increase in shame as emotional maltreatment increases. In addition, an individual will have compromised feelings of self-worth and self-perception from the initial inadequacy, along with increased shame, which will continue to decrease as emotional abuse increases. Thus, maladaptive thought patterns about the self and the world are created, paving the way to an unstable young adulthood.

People tend to have favorable self-views and achieve a stable self-concept through autobiographical memories, personal beliefs about themselves, and semantic knowledge

originating in trait relations (thoughts, emotions, etc.). Research indicates that when psychologically healthy individuals evaluate specific positive or negative traits, there was a valence of $\beta = .992$, SE = .043, CI [0.907, 1.076], $t(290) = 23.071$, $p < .0001$, sr2 = .322 (Elder et.al., 2023). When evaluating positive traits and their relationships, individuals described positive traits relating to self more descriptively than negative ones. This trend is supported by a positive outdegree centrality (r=.74) and negative outdegree centrality (r=.65) held at a 25% threshold. This strong association between trait relations and positive self-concept derives from self-referential processing, which occurs in the medial prefrontal cortex (MPFC) and helps create a stable and positive self-concept by avoiding contradictions between self-beliefs and traits (Buuren et.al., 2022). These interdependent connections reflect an individual's positive or negative self-evaluations and schemas, which are stored in the MPFC, helping the ventromedial prefrontal cortex (VMPFC) form connections parallel to one's integrated self-perception. Therefore, when an individual has a positive self-schema, it originates in a healthy formulation of positive memories, self-beliefs, and (trait) associations.

Self-schema has many contributing factors, but one crucial aspect is that individuals' personality traits or personal preferences are drawn from semantic knowledge, where they acquire information about the world or themselves through past experiences. Emotional neglect can impair the VMPFC and lead to a negative self-schema that has less emphasis on positive traits and autobiographical recall.

Originating from self-referential processing, when having judgments about oneself, brain scans showed higher activity with a higher Δ (difference) score (post Hoc Bonferroni) compared to healthy controls (1.33 vs. 0.86, $p = 0.001$) within the VMPFC (Stendari, 2023). This higher activity creates inconsistency when judging oneself, which can originate from maltreatment,

causing an unhealthy and unstable formulation of trait associations and beliefs. This higher activity can be attributed to the prefrontal cortex working twice as hard as someone with no emotional abuse, and having an increased degree in regions that provide information for processing events and emotions within the VMPFC and MPFC. The higher the activity, the lower the Oxy-b levels due to blunted activation, making the brain work twice as hard as someone with no emotional abuse.

Within the VMPFC, (trait) associations and products of self-referential processing develop when two events occur close together, creating an association and allowing future encounters with one to retrieve the memory of the other. An ANOVA revealed that the interaction of information and time of day (morning or afternoon) had an impact on recall at the time of the test later that evening; experiment 1a: $F(1,14) = 17.61$, $p < 0.05$; experiment 1b: $F(2,21) = 8.55$, $p < 0.05$ (Iordanova et al., 2011). When individuals create associations with information in close succession, that interaction plays a vital role in recalling said information. This can create confusion and poor recall within brain regions accessing the traumatic stimuli, fostering poor relations to self-processing information. Due to poor self-referential processing, an individual with trauma will have a hard time assimilating any new information into their memory. Instead, the trauma shatters their neutral or positive view of themselves from the moment the trauma began, accounting for their negative self-concept as time progresses. The maladaptive, shattered views will eclipse the adequate cognitive process that originates in the MPFC and VMPFC. Thus, when individuals have a negative self-schema, it can be highly correlated and traced back to the creation of dysfunctional patterns of thought and poor cognitive impacts originating from emotional abuse.

Individuals who experience emotional abuse and cannot assimilate and differentiate information have reduced grey matter volume in their MPFC by 19.1% (p=0.037, corrected cluster level), leaving them with only 80.9% of the original volume in comparison to individuals with no emotional abuse, having 123.7% of the volume unhealthy participants have (Tomoda et al.,2009). This reduction can lead to poor interconnectivity of paths, fostering higher activity, making it work harder yet irregularly compared to the average person, and impacting one's full self-processing abilities. This can be attributed to lower Oxy-hb levels in the brain. Growing up in a maladaptive environment with emotional abuse or neglect can diminish an individual's ability to have a positive self-referential representation/recall. This is a segue to negative beliefs about oneself and the creation of a negative self-schema. When an individual internalizes others' negative words and behaviors, it conveys implicit messages that one does not deserve care and attention, leading to not only a poor self-schema but those with emotional abuse have an implicit lead toward depression with an association and effect of 0.04, SE = 0.03, 95% CI [0.001, 0.10] (Jopling & LeMoult, 2019). In addition, a follow-up study concluded there is a 9% total effect between emotional maltreatment and later symptoms of depression in adolescents and adulthood, with a trend level of $\beta = 0.24$, SE = 0.13, $t(149) = 1.80$, $p = 0.073$. (Pm = 0.092) (Jopling & Lemoult, 2020). This can create a long-lasting, deep-rooted sense of shame from childhood to young adulthood. In turn, it contributes to the manifestation of a negative self-schema from an ingrained negative self-esteem and self-concept, affecting the individual long-term.

Self-identity is how individuals perceive themselves in their societal roles and attribute meaning to these roles. Young adults' self-concept is part of their self-identity derived from their self-esteem. When encountering trauma or disruption, an individual will rupture their cognitive process of adopting a healthy narrative identity, which is their conclusion of themselves based on

autobiographical reasoning and associations from retrieval. When individuals experience emotional maltreatment, there is a linear decrease (b = -.02, SE = .004, p < .001) in mental connections over time derived from one's personal beliefs (Mclean et al., 2022). Therefore, as one undergoes emotional abuse and experiences negative affect, mirroring and internalization of feelings and emotions toward self, it increasingly gets more challenging to unmesh past and present memories, leaving them with unstable, inconsistent, and hostile belief systems about themselves. In addition, the individual's negative holistic identity functioning is continuously impairing their healthy development of the MPFC and corresponding regions, so they are constantly stuck in a loop of a negative self-schema until they get out of that environment and/or heal their perspective. Thus, their self-schema is polluted with negative stories and emotions attached to traumatic experiences, eradicating an individual's ability to develop a broader life context and relate themselves to situations outside their past internalizations.

This cycle impacts one's ability to have healthy self-continuity and diachronic unity, the foundation of identity, where one connects past and present self-related contexts/information through autobiographical memory and reason to create a stable sense of self despite changes around you. This self concept clarity is imperative for having a positive and constant self-schema throughout life and its changes, yet unfortunately, those with emotional abuse have a lower self-concept clarity (M 3.60, SD 1.30) in comparison to those with high self-concept clarity (M 5.38 SD 1.45) with no emotional abuse: $F(1, 105)$ 43.99, p .001, p^2 .295, 90% CI [.1778, .3989] (Jiang & Sedikides, 2020). Individuals with emotional abuse have a heavier emphasis on negative autobiographical memory, creating disunity due to improper encoding and brain function of new changes, events, and feelings.

Due to emotional neglect in childhood, a young adult can have damaged cognitive functions, impacting their higher-level skills relating to the self (Wilson, 2020). This suggests that there is a gradual and prolonged impact of childhood abuse on an individual's psychological makeup and brain function, leading to poor self-schemas. There is limited research with cross-sectional studies that focus precisely on FNIRS activity through a self-referential task activation. The literature has addressed these impairments, but did not address the causation through conceptual organization. Emotional abuse and neglect are utterly complex and deserve a holistic breakdown of how they can impact a self-view long term. Deficits in existing research fail to directly examine individuals' emotional abuse in a way that focuses on all underlying aspects and their correlated causes: self-concept, self-esteem, roles of the parents, life experiences, internalized emotions, damaged brain regions, etc. The gap in the literature led to this research study.

The current cross-sectional, quasi-experimental study will examine the ventromedial prefrontal cortex (VMPFC) and the medial prefrontal cortex (MPFC). I will select 50 individuals who are 18 years old and have different ethnic backgrounds who meet the requirements to participate. I will be assessing these individuals' past emotional abuse and how it correlates to low self-esteem and self-schema, and how maladaptive views can stay stagnant throughout young adulthood and affect their day-to-day lives. Participants will be recruited from the Childhood Trauma Questionnaire and complete a self-referential encoding task while hooked to a functional near-infrared spectroscopy. I predict a significant relationship between altered activation of the VMPFC/MPFC with lower Oxygenated hemoglobin responses within individuals who have low self-worth and a low self-schema from past emotional maltreatment. The following research questions will be explored:

1. Do individuals with emotional trauma show lower Oxy-Hb levels, contributing to lower activation in the VMPFC and MPFC, indicating damage?
2. How do young adults' self-esteem and self-identity contribute to their positive or negative self-schema?

Method

Participants

The current study will recruit 50 participants through the Childhood Trauma Questionnaire short form (CTQ) (See Appendix A) through purposive sampling within Central, West, and South parts of Connecticut: West Hartford, Hartford, New Haven, Simsbury, Bridgeport, Wilton, Danbury, Ansonia, Madison, Orange, and Windsor Locks. Flyers with a brief study description and QR code for the questionnaire will be hung up in multiple locations: counseling centers, universities, gyms, college mental health centers, support groups, churches, coffee shops, and high schools. These places and towns create a variety where individuals with a wide demographic are reached. To be eligible, one must be eighteen years old, right-handed, fluent in English, and not possess any neurological disorders, current psychiatric diagnosis, or head injury.

Participants will be diverse in gender and race (collected with recruitment), with 25 demonstrating experience with emotional abuse and self-image disruptions, and another 25 will have no emotional abuse or self-image disruptions. This collection will be done through quota sampling; once participants complete the Qualtrics CTQ questionnaire, individuals who meet the qualifications of either group will be automatically selected as participants according to their CTQ scores. Data collection will stop once the capacity for each group is met. Demographics

will be confidentially reported on all participants by labeling individuals as “participants 1-50.” Each person will be compensated $2,000 at the end of the study for their dedication.

Population Breakdown

Figure 1: Approximate Sample Demographics

Approximate Sample Demographics	Total by race
white	32
Hispanic	9
Black	5
American Indian/Alaska Native	0
Asian/Pacific Islander	4
total	50

Design and Procedure

Before completing the recruitment screener, individuals must provide informed consent (Appendix A), and upon acceptance, participants will complete an additional informed consent (See Appendix B) with a finalized participation agreement. Once consent is obtained, the 25 participants in the experimental group (who present emotional abuse) will engage in a five-minute baseline recording of neural activity in the VMPFC and MPFC through functional near-infrared spectroscopy (FNIRS). This will get the resting rate of oxygenated Hemoglobin (Oxy-HB) while the participant sits quietly with eyes closed. While still connected to the FNIRS, these 25 participants will engage in a modified Self-Referential Encoding Task (SRET) (See Appendix C) that only focuses on positive phrases. Participants will be shown a positive phrase (30 statements) for five seconds (spaced with 10-second intervals), one at a time, and are asked if it describes them. Researchers will record the Oxy-Hb levels in the VMPFC and MPFC in real time. This protocol is then repeated for the control group. The study will conclude with

participants being thanked for their time and receiving their $2,000 check. The risk of participation in this study is presumed to be minimal, other than potential discomfort when engaging in the SRET. However, if participants experience any pivoting psychological stress, they will not be required to finish the study and will be referred to appropriate care.

Measures

Childhood Trauma Questionnaire (Short form)

The Childhood Trauma Questionnaire will engage participants in the retrospective screening of five sections: Emotional Abuse, Physical Abuse, Sexual Abuse, Emotional Neglect, and Physical Neglect (Bernstein, 1994). There are five questions in each section, and responses are based on a 1-5 rating Likert scale: never accurate (1), rarely true (2), sometimes (3), often true (4), very often true (5). Even though this study does not focus on physical or sexual neglect/abuse, individuals who respond with a rating of 2-5 will be asked to elaborate and describe the negative emotional tax that these situations created. This will be done to create a holistic picture of the person's trauma and further future research expansion concerning how emotional abuse is the center of all abuse, driving maladaptive development that must be explored. However, the direct scoring will only be based on a total calculation of emotional abuse and emotional neglect based on four categories: none to minimal, low to moderate, moderate to severe trauma, and severe to extreme trauma exposure for each scale. Participants for the experimental group must have a CTQ score of emotional abuse as a moderate (13) or higher and emotional neglect as moderate (15) or higher. For physical and sexual abuse, researchers will examine the open response, but regardless, they must fall within the threshold scores for emotional abuse and neglect to be considered.

Functional Near-Infrared Spectroscopy

Functional near-infrared spectroscopy is a non-invasive neuroimaging technique that measures participants' changes in oxygenated (Oxy-Hb) Hemoglobin, which are indicators of cortical activity (Karim et al., 2012). The NIRSport2 system and NIRStar software will be used, and light emitters and detectors, called optodes, will be placed on the scalp, targeting the area corresponding to VMPFC and MPFC, with equal spacing around each one. The Near-Infrared light reaches the cortical surface and can measure hemodynamic changes in the cortex (Lai et al., 2017). This is done by absorbing oxygenated hemoglobin (Oxy-Hb) in neurovascular coupling (Ho et al., 2016). Oxy-Hb are hemoglobin molecules in the blood that carry oxygen to the brain and other body parts when active, marking cortical activity (Ferreri et al., 2014). Therefore, when a stimulus is presented, Oxy-hb should increase because this brain region demands more oxygen to support the neurons firing. Confirm all channels are active and the software signal is strong with minimal to no background noise. Participants will engage in a baseline and experimental recording during the SRET. In the software, ensure task event markers are integrated concerning activity tracking (Nirx, n.d.). This study focuses strictly on Oxy-Hb signals due to their known ability to be more robust and exhibit greater changes within neural activity (Ferrari & Quaresima, 2012). This provides a more reliable post-test measure when implementing track changes, focusing on self-referential processing activation from the self-schema task.

Self-Referential Encoding Task (modified)

The Self-Referential Encoding Task is a computer-based and verbal task that measures how individuals encode information about themselves and provides information about their self-schema processing (Craik et.al, 1972). The modified version will only focus on positive phrases,

where an individual is presented with a phrase (e.g., “I am a capable person”) on the computer. Participants will be asked to read these phrases out loud and respond yes or no if they describe them. Twenty statements are used with 10-second intervals for each. Scoring for this is not applicable because it is purely an activation task, whereas the scoring will rely on the FNIRS results during this activity.

Proposed Analysis

This study aims to investigate whether individuals with a history of emotional trauma have lower Oxy-Hb levels within their VMPFC and MPFC, indicating lower activation. In addition, this study examines how negative self-esteem and self-identity contribute to a negative self-schema, creating lower activation within the prefrontal regions. It is hypothesized that participants with a history of emotional abuse will exhibit blunted activation in the VMPFC and MPFC, reflected by lower oxygenated hemoglobin levels, triggered through the positive self-schema task. Compared to healthy controls, these individuals reflect a disrupted internalization of positive self-concepts due to emotional abuse in childhood.

This study will analyze the percentage of Oxy-Hb levels within the VMPFC and MPFC at pretest and posttest levels. First, an analysis of participants’ gender and race will be presented through a matched comparison of the state of CT demographics. A table with observed demographics and expectations will be presented, along with a chi-square to examine differences. In addition, there will be an analysis of data for each region separately for those in the experimental group (emotional abuse) and for those in the control group (no emotional abuse). The baseline percentage of Oxy-hb will be compared to the post-test percentage once the individual is engaging in the self-schema task. This will be done by looking at the distribution of activation areas by an independent t-test, laying out the percentage of Oxy-Hb in the VMPFC,

and a separate t-test for the MPFC and its Oxy-Hb levels. There will be two cross tabs (Chi squared) that examine gender x trauma and race x trauma to look at the categorical factors that can mesh and create differences within trauma and the creation of negative self-schemas. At the post-test level, there will be a paired t-test examining pre-test and post-test overall with percentage of Oxy-Hb through the activation task: pretest trauma vs. posttest trauma and pretest no trauma vs. posttest no trauma. To examine the post-test results of individuals with no trauma vs. trauma for the VMPFC and MPFC, a two-way ANOVA will be performed to assess the interaction between trauma and gender. Lastly, an average of CTQ scores by gender and race will be done through an independent t-test (for both experimental and control), along with a cross tab (chi squared) examining the CTQ by gender and race (for both experimental and control).

References

American Psychological Association. (2018, April 19). *APA Dictionary of Psychology*. Dictionary.apa.org. https://dictionary.apa.org/emotional-abuse

Archuleta, W. P., Kaminski, P. L., & Ross, N. D. (2023). The roles of shame and poor self-Concept in explaining Low social connection among adult survivors of childhood emotional maltreatment. *Psychological Trauma: Theory, Research, Practice, and Policy*. https://doi-org.hartford.idm.oclc.org/10.1037/tra0001559

Bernstein, D. P., Fink, L., Handelsman, L., & Foote, J. (1994). *Childhood Trauma Questionnaire (CTQ)* [Database record]. APA PsycTests. https://doi.org/10.1037/t02080-000

Bombari, D., Schmid Mast, M., Brosch, T., & Sander, D. (2013). How interpersonal power affects empathic accuracy: differential roles of mentalizing vs. mirroring? *Frontiers in Human Neuroscience*, *7*. https://doi.org/10.3389/fnhum.2013.00375

Cai, J., Li, J., Liu, D., Gao, S., Zhao, Y., Zhang, J., & Liu, Q. (2023). Long-term effects Of childhood trauma subtypes on adult brain function. *Brain and Behavior, 13*(5) https://doi.org/10.1002/brb3.2981

Cook, D. (2012). *Internalized Shame Scale*. https://doi.org/10.1037/t04998-000

Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior*, *11*(6), 671–684. https://doi.org/10.1016/s0022-5371(72)80001-x

Elder, J., Cheung, B., Davis, T., & Hughes, B. (2023). Mapping the self: A network approach for

Understanding Psychological and neural representations of self-concept structure. *Journal of Personality and Social Psychology*, *124*(2), 237–263. https://doi-org.hartford.idm.oclc.org/10.1037/pspa0000315.supp

Ferrari, M., & Quaresima, V. (2012). A brief review on the history of human functional near-Infrared spectroscopy (fNIRS) development and fields of application. *NeuroImage, 63*(2), 921 935. https://doi.org/10.1016/j.neuroimage.2012.03.049

Ferreri L, Bigand E, Perrey S, et al. (2014). The promise of near-infrared spectroscopy (NIRS) for psychological research: A brief review. *Lannee Psychologique* 114: 537–569.

Gerhardt, S. (2006). Why love matters: How affection shapes a baby's brain. *Infant Observation*, *9*(3), 305–309. https://doi.org/10.1080/13698030601074476

Ho CS, Zhang MW, and Ho RC (2016). Optical topography in psychiatry: A chip off the old block or a new look beyond the mind-brain frontiers? *Frontiers in Psychiatry* 7: 74.

Howe, D. (2017). *Child abuse and neglect: attachment, development, and intervention*. Bloomsbury Academic.

Iordanova, M. D., Good, M., & Honey, R. C. (2011). Retrieval-Mediated Learning Involving Episodes Require Synaptic Plasticity in the Hippocampus. *Journal of Neuroscience*, *31*(19), 7156–7162. https://doi.org/10.1523/jneurosci.0295-11.2011

Jiang, T., Chen, Z., & Sedikides, C. (2020). Self-concept clarity lays the foundation for self-Continuity: The Restorative function of autobiographical memory. *Journal of Personality and Social Psychology*, *119*(4), 945–959. https://doi.org/10.1037/pspp0000259

Jopling, E., Tracy, A., & LeMoult, J. (2020). Childhood Maltreatment,

Negative Self-Referential Processing and Depressive Symptoms During Stress. *Psychology Research and Behavior Management*, *Volume 13*, 79–87. https://doi.org/10.2147/prbm.s231505

Karim, H., Schmidt, B., Dart, D., Beluk, N., & Huppert, T. (2012). Functional Near-Infrared Spectroscopy (fNIRS) of Brain Function During Active Balancing Using a Video Game System. *Gait & Posture*, *35*(3), 367–372. https://doi.org/10.1016/j.gaitpost.2011.10.007

Lai CY, Ho CS, Lim CR, et al. (2017). Functional near-infrared spectroscopy in psychiatry. *Bjpsych Advances* 23: 324–330.

Liebschutz, J. M., Buchanan-Howland, K., Chen, C. A., Frank, D. A., Richardson, M. A., Heeren, T. C., Cabral, H. J., & Rose-Jacobs, R. (2018). Childhood Trauma Questionnaire (CTQ) correlations with prospective violence assessment in a longitudinal cohort. *Psychological Assessment*, *30*(6), 841–845. https://doi.org/10.1037/pas0000549

McLean, K. C., Dunlap, D., Jennings, S. C., Litvitskiy, N. S., & Lilgendahl, J. P. (2022). Stability and change in autobiographical reasoning: A 4-year longitudinal study of narrative identity development. *Journal of Personality*, *90*(3), 343–356. https://doi.org/10.1111/jopy.12669

Montecinos-Wilson, C. (2020). *Understanding the Impact of Childhood Emotional Neglect on The Academic Grades of Early Elementary School-Aged Children* (Order No. 28153021). Available from ProQuest Dissertations & Theses Global: The Humanities and Social Sciences Collection. (2459435361).

https://hartford.idm.oclc.org/login?url=https://www.proquest.com/dissertations-theses/understanding-impact-childhood-emotional-neglect/docview/2459435361/se-2

Narimani, M., Mahmoodi-Aghdam, M., & Abolghasemi, A. (2012). The Role of Child Abuse and Neglect in Predicting the Early Maladaptive Schemas Domain Article information Abstract. In *Zahedan Journal of Research in Medical Sciences Journal homepage*. https://academics.uma.ac.ir/Files/Publication/12164/12164.pdf

NIRSport2 | fNIRS Systems | NIRS Devices | NIRx. (n.d.). NIRx Medical Technologies. https://nirx.net/nirsport

Prefrontal cortical activation measured using fNIRS. (n.d.). Artinis Medical Systems | (F)NIRS Devices. https://www.artinis.com/fnirs-prefrontal#:~:text=Prefrontal%20cortex%20(PFC)%20is%20an

Rosenberg, M. (1979). *Conceiving the Self.* New York: Basic Books.

Siegel, A. M. (2004). *Heinz Kohut and the psychology of the self*. Brunner-Routledge.

Stendardi, D., Giordani, L. G., Gambino, S., Kaplan, R., & Ciaramelli, E. (2023). Who am I really? The impermanence of the self-schema following vmPFC damage. *Neuropsychologia*, *188*, 1–8. https://doi-org.hartford.idm.oclc.org/10.1016/j.neuropsychologia.2023.108651

Susan Bluck & Nicole Alea (2011). Crafting the TALE: Construction of a measure to assess the functions of autobiographical remembering, Memory, 19:5, 470-486

Tezel, F. K., Kislak, S. T., & Boysan, M. (2015). Relationships between Childhood Traumatic Experiences, Early Maladaptive Schemas and Interpersonal Styles. *Nöro Psikiyatri Arşivi*, *52*(3), 226–232. https://doi.org/10.5152/npa.2015.7118

Tomoda, A., Suzuki, H., Rabi, K., Sheu, Y.-S., Polcari, A., & Teicher, M. H. (2009). Reduced prefrontal cortical gray matter volume in young adults exposed to harsh corporal punishment. *NeuroImage*, *47*, T66–T71. https://doi.org/10.1016/j.neuroimage.2009.03.005

Total population by race/ethnicity: Connecticut, 2021. (n.d.). March of Dimes | PeriStats. https://www.marchofdimes.org/peristats/data?reg=99&top=14&stop=131&slev=4&obj=3&sreg=09

Van Buuren, M., Sijtsma, H., Lute, N., van Rijn, R., Hollarek, M., Walsh, R. J., Lee, N. C., & Krabbendam, L. (2022). Development of the neural correlates of self- and other-referential processing across adolescence. *NeuroImage*, *252*, 119032. https://doi.org/10.1016/j.neuroimage.2022.119032

World Health Organization. (2023). *Adolescent health*. World Health Organization.https://www.who.int/health-topics/adolescent-health#tab=tab_1

Young, J., Klosko, J., & Weishaar, M. (2003). Schema therapy - A practitioner's guide. New York: The Guilford Press

Young, J. E. (1998). *Young Schema Questionnaire--Short Form (YSQ-SF, YSQ-S, YSQ)* [Database record]. APA PsycTests. https://doi.org/10.1037/t12644-000

Zaki, J., Weber, J., Bolger, N., & Ochsner, K. (2009). The neural bases of empathic accuracy. *Proceedings of the National Academy of Sciences*, *106*(27), 11382–11387. https://doi.org/10.1073/pnas.0902666106

Appendix A

Recruitment and Consent

Title: The Quiet Cortex: Emotional Abuse and Blunted Prefrontal Activation

Description: This study aims to investigate how emotional abuse during childhood and adolescence impacts regions of the prefrontal cortex (ventromedial and medial), which disrupts an individual's self-schema in young adulthood (development). These regions are responsible for self-schema development and self-identity; thus, this study will examine how these regions react to ideas of the self. The main goal is to obtain a baseline of information at the beginning of participation and to see if and how it changes compared to the very end, and compare it to those with no past emotional abuse. If you meet the qualifications and agree to participate in this study, you will be asked to use functional near-infrared spectroscopy (FNIRS). This is a non-invasive and harmless way to measure brain activity within the prefrontal cortex. This will be done at the beginning and end while you engage in a self-schema activation task that examines self-esteem, identity, and self-concept. At the end of the study, you will receive a $2,000 compensation via check. This study has been reviewed and approved by the University of Hartford's research ethics committee. Your participation is voluntary, and your information and identity will remain confidential. This research is essential for a more in-depth understanding of emotional abuse and how it affects the developing brain with the development of the self. Results will guide the field in a proper direction to understand how to treat individuals within this age range struggling with their self-concept concerning their past experiences. If you have questions about the survey or procedure before commitment, please contact me at Ipellegri@hartford.edu.

Qualifications Required: To be eligible, you must be 18 years of age, right-handed, fluent in English, and not possess any neurological disorders, current psychiatric diagnosis, or head injury

You are being asked to participate in a research study about early life experiences. This survey includes questions about potentially sensitive topics such as emotional and physical experiences during childhood. Participation is entirely voluntary. You may choose to stop at any time. Your responses will be kept confidential and used only for research purposes. The survey will take approximately 5–10 minutes to complete.

By selecting **"I agree"** below, you consent to complete this initial survey. If your responses meet the eligibility criteria for the study, you may be **considered for continued participation**. Before continuing, you will be asked to **review and sign a second, full consent form**. You may decline to continue at that time with **no penalty**.

If you select **"I do not agree,"** you will not proceed, and no information will be collected.

Do you consent to participate in this study?

- o I agree
- o I disagree

Childhood Trauma Questionnaire Short Form

Please respond to the following questions as honestly as possible, and upon completion, a researcher will contact you regarding eligibility.

What is your race? _____

What is your gender? _____

Emotional abuse:

1. People in my family called me things like ‘‘stupid,’’ ‘‘lazy,’’ or ‘‘ugly.’’
2. I thought that my parents wished I had never been born.
3. I felt that someone in my family hated me.
4. People in my family said hurtful or insulting things to me.
5. I believe I was emotionally abused.

Physical abuse:

6. Someone in my family struck me, so I had to see a doctor or go to the hospital.
7. People in my family struck me, leaving me with bruises or marks.
8. I was punished with a belt, a board, a cord, or other hard object.
9. I believe that I was physically abused.
10. I got hit or beaten so severely that someone like a teacher, neighbor, or doctor noticed it.

Sexual abuse:

11. Someone tried to touch me sexually or tried to make me touch them.
12. Someone threatened to hurt me or tell lies about me unless I did something sexual with them.
13. Someone tried to make me do sexual things or watch sexual things.
14. Someone molested me.
15. I believe that I was sexually abused.

Emotional neglect:

16. There was someone in my family who helped me feel that I was essential or unique.
17. I felt loved.

18. People in my family looked out for each other.
19. People in my family felt close to each other.
20. My family was a source of strength and support.

Physical neglect:

21. I did not have enough to eat.
22. I knew that there was someone to take care of me and protect me.
23. My parents were too drunk or high to take care of the family.
24. I had to wear dirty clothes.
25. Someone could take me to the doctor if I needed it.
26. There was nothing I wanted to change about my family.
27. I had the perfect childhood.
28. I had the best family in the world.

Response Options:
never true - 1
rarely true - 2
sometimes true - 3
often true- 4
very often true - 5

Appendix B

Informed Consent



Title of Study: The Quiet Cortex: Emotional Abuse and Blunted Prefrontal Activation

Primary Investigator: Indiana Pellegrino

Research Supervisor: Domenic Deluca

The purpose of the study is to investigate the impact that emotional maltreatment and abuse during childhood and early adolescence have on the prefrontal cortex and on obtaining and developing a proper self-schema in young adulthood. You will be asked to engage in functional near-infrared spectroscopy (FNIRS) upon acceptance. This is a non-invasive and harmless way to measure brain activity within the prefrontal cortex. This will be done at the beginning and end, while you engage in a self-schema activation task that examines self-esteem, identity, and self-concept.

I understand that:

- I must be 18 years of age.
- I must be right-handed.
- I must not possess any neurological disorders, current psychiatric diagnosis, or head injury.
- I must be fluent in English.
- Participation in the study involves completing the self-schema activation task and participating in the brain scans. I will receive $2,000 for full participation, but this reward will not be administered if I opt out of the study at any time.

My participation is voluntary. However, if I agree to participate in the study but later change my mind, I may drop out at any time. I will only receive compensation for the time I dedicate, and no other negative consequences will occur. There are no physical risks in participating in this study. A few questions may make me feel uncomfortable. Should I find any part of the study distressing, I understand that I should notify the investigator as soon as possible. Should I experience any distress during or following the study, I will be provided with the CT crisis hotline phone number to process any concerns. If any of my responses or behaviors indicate a concern for my safety or the safety of others, I understand that the researcher will take appropriate actions to ensure safety.

The investigator of this study understands that the information obtained may be personal and is committed to protecting the participants' privacy. All the information I provide for this study will be kept confidential and stored in a password-protected computer file that only the researchers of this study will have access to. Identification numbers will be used in place of names so that identifying information will not be associated with my data in any way. None of my identifying information will be entered for data analysis. All data will be analyzed and presented in aggregate. The study results may be used in papers submitted for publication or presented at professional conferences, but under no circumstances will my name or other identifying characteristics be included. The data will be kept for a minimum of five years following the publication of the research project.

Suppose I have any questions and would like more information about the study or a summary of the results. In that case, I understand that I am free to contact the following investigators:

Indiana Pellegrino

Primary Investigator

860.929.6876

Ipellegri@hartford.edu

Domenic Deluca

Research Supervisor

860.768.4100

deluca@hartford.edu

If you have questions about your rights as a research subject, please contact the University of Hartford Human Subjects Committee (HSC) at (860) 768-5371 or hsc@hartford.edu. The HSC reviews research studies and protects the rights of people involved.

I, _____, have read the above information and at this moment agree to (Please sign name) participate in this research study.

Appendix C

Self-Referential Encoding Task Modified to Positive Only Traits (SRET)

You will see a series of statements describing personal qualities or traits. For each statement, please decide whether it describes you. Respond 'Yes' if the statement feels true about you, and 'No' if it does not. Try to respond as quickly and honestly as possible.

- Each statement appears on the screen for 5 seconds.
- Participants respond "Yes" or "No" verbally
- 10-second inter-stimulus interval between each statement to allow the brain to return to baseline.

1. I am a capable person.
2. I am a good friend.
3. I am confident in my abilities.
4. I am a kind person.
5. I am important to others.
6. I have a lot to offer.
7. I am resilient.
8. I am worthy of love and respect.
9. I am a trustworthy individual.
10. I am proud of who I am.
11. I am a positive influence on others.
12. I am a creative thinker.
13. I am good at solving problems.
14. I am compassionate toward others.
15. I am strong even in challenging situations.
16. I am an honest person.
17. I am someone people can rely on.
18. I am successful in my own way.
19. I am deserving of happiness.
20. I am a hard worker.
21. I am able to achieve my goals.
22. I am thoughtful and considerate.
23. I am growing and improving every day.
24. I am intelligent and capable of learning.
25. I am proud of my efforts.
26. I am an empathetic listener.
27. I am an interesting person.
28. I am creative and imaginative.
29. I am grateful for my strengths.
30. I am a valuable member of my community