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The Co-regulatory Effects of Emotionally Focused Therapy

Julia Conroy
University of Arkansas, Fayetteville

The Co-regulatory Effects of Emotionally Focused Therapy

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by

Julia Conroy
Baylor University
Bachelor of Arts in Psychology, 2015
University of Arkansas
Master of Science in Counseling, 2018

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University of Arkansas

This dissertation is approved for recommendation by the Graduate Council.

____
Kristi Perryman, Ph.D.
Dissertation Director

____
Paul Blisard, Ed.D
Committee Member

____
Ro DiBrezzo, Ph.D.
Committee Member

____
Michelle Gray, Ph.D.
Committee Member

____
Samantha Robinson, Ph.D.
Committee Member

ABSTRACT

Mental health literature emphasizes the necessity of expanding emotional regulation to improve symptomology of a variety of mental health disorders. Coregulatory experiences have been shown to expand individual emotional regulation and are more likely in relationships with secure attachment. Emotionally Focused Therapy (EFT) is focused on developing secure attachment between partners. This study examined the coregulatory effects of EFT with a single couple over the course of couples' counseling. The participating couple received eight couples' counseling sessions from a clinician who is a certified EFT trainer, supervisor, and therapist while having their heart rate, electrodermal activity, and skin temperature taken during the sessions. Surrogate synchrony analysis (SUSY) was used to assess physiological synchrony between the couple over their sessions. Heart rate variability was also calculated. The degree of relationship between the heart rate variabilities of the couple was measured using linear regression. While the results of the study did not show significant increases in physiological synchrony between the couple, the results emphasize the presents of in and out of synchrony pendulation occurring between the couple as well as the presence of lagged synchrony as the couple responds according to the partner's experience. Implications for future research are also included.

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DEDICATION

To my Granny, the leader of my original girl gang, who started this process with me but was unable to finish it alongside me. All this work and effort is a testament to all you believed me to be capable of and all of the words of encouragement you spoke over me.

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CHAPTER 1

INTRODUCTION TO THE STUDY

This chapter introduces the study and explains its purpose. The problem statement provides the broader context for necessity of the study. The research question guides this study, determining the most appropriate research design and proposed data analyses. The chapter includes an overview of the variables in the study and how they are measured. This chapter concludes with an overview of relevant terminology to provide a framework of the relevant factors in the present study.

Problem Statement

The interest in the construct of emotional regulation has been growing substantially in the mental health field over the past decades (Gross, 2013). Emotional regulation is defined as the detection, assessment, and resultant change of emotional reactivity (Thompson, 1994). Decreased emotional regulation is correlated with several mental health disorders, including attention deficit hyperactivity disorder (ADHD; Moukhtarian et al., 2018), bipolar disorder (Moukhtarian et al., 2018), disordered eating (Lavender et al., 2015), borderline personality disorder (BPD; Schore, 2003), anxiety (Schäfer et al., 2017), and depression (Schäfer et al., 2017). Due to the strong influence of emotional regulation on mental health, it is imperative for mental health professionals to be familiar with methods of expanding regulation capacities to maximize healthy emotional processing of clients.

Recent literature indicates that coregulatory experiences are helpful in the development of emotional self-regulation (Koole & Tschacher, 2016; Hirschler-Guttenberg et al., 2015; Silkenbeumer et al., 2018). Coregulation refers to the bidirectional connection of emotional channels between partners, which provides emotional stability (Butler & Randall, 2013).

Coregulatory experiences promote the synchronization and stabilization of responses between people in close relationships as they become more attuned to and engaged with the other's emotional experience (Butler & Randall, 2013). Research indicates increased coregulation capacity between a dyad results in increased individual regulation outside of the relationship (Butler & Randall, 2013). Coregulatory experiences are more common in securely attached relationships (Waters et al., 2018; Guo et al., 2015). As a safe and nurturing relationship is found in secure attachment, emotionally engaged and attuned responsiveness is more likely to occur between a dyad, which enables them to monitor and adjust their own emotions more readily. Individuals in securely attached relationships demonstrate more individual emotional regulation in stressful situations even when they are alone (Roth et al., 2013).

Secure attachments offer more opportunities for coregulatory experiences, which increase individuals' capacity for emotional self-regulation. Attachment security is a malleable construct (Wiebe & Johnson, 2016). By increasing attachment security in close relationships, emotional regulation capacities can be expanded to lead to more healthy and adaptive functioning. Due to the aforementioned correlation between emotional dysregulation and several mental health disorders, mental health professionals can offer sustained change and relief for many of their clients through access to coregulatory experiences in secure attachment. Clients who are able to regulate their emotions are better able to respond to pain and challenges in their lives with resiliency as opposed to hopelessness and dysregulation.

It is important to understand the neurobiology of why coregulatory experiences are so effective. Developing a neurobiological understanding deepens the clinician's awareness of the process of change taking place within the client as a result of counseling (Luke et al., 2019). In recent years, counselors increasingly reference neuroscientific literature that legitimizes and

supports the counseling process (Luke et al., 2019). This awareness allows the neuroscience-informed counselor to apply interventions and techniques with more precision and awareness as they understand the full body response to the counseling process (Beeson & Field, 2017). The neuro-informed counselor can also share this level of understanding with clients, which clarifies the change taking place for clients and has been shown to improve client outcome (Miller, 2016). Mental health literature highlights both a need for interventions to expand emotional regulation capacities and a need for a neurobiological understanding of how these successful interventions work. This study offers a response to both of those needs by measuring selected physiological responses to coregulatory experiences in counseling.

Purpose of the Study

The purpose of this study was to detect potential changes in emotional coregulation between couples in Emotionally Focused Therapy (EFT) as measured through physiological synchrony. EFT is a framework for couples' therapy that is founded on attachment science and seeks to develop more secure attachments (Johnson, 2004). Physiological measurements have been established as reliable and valid measurements of emotional processing (Gottman, 1988). Measures of heart rate, electrodermal activity, and skin temperature offer a more reliable sense of the body's reactivity as they measure automatic response rather than a self-evaluative measure of reactivity and regulation that makes it difficult to detect change over time (Gottman, 1988). Additionally, the awareness required within self-report measures limits the reporting to the effects of reactivity that can be consciously processed and observed. EFT is an effective therapeutic model in securing attachment styles between couples (Wiebe & Johnson, 2016). Based on the aforementioned literature, it can be assumed the securing of attachment between couples could produce more coregulatory experiences (Waters et al., 2018; Guo et al., 2015).

The research provides insight into how mental health professionals can increase emotional regulation in a sustained way for clients through facilitating coregulatory experiences during EFT. This study also offers evidence of the physical impact of secure attachment on the body, specifically with regard to the synchrony of couples' physiology. According to Palumbo et al. (2017), "Interpersonal autonomic physiology is defined as the relationship between people's physiological dynamics, as indexed by continuous measures of the autonomic nervous system" (p. 99). This synchrony provides insight into the level of coregulation taking place between the couple. Additionally, the researcher offers a psychophysiological explanation as to why EFT is so effective with couples. Grounded in the effectiveness of EFT and the impact of secure attachment established in the literature, the following research questions shaped the study:

1) What impact does Emotionally Focused Therapy have on couple's coregulation as measured through physiological synchrony within a counseling session?
2) What impact does Emotionally Focused Therapy have on couple's coregulation as measured through physiological synchrony over eight counseling sessions?
3) What impact does Emotionally Focused Therapy have on the couple's regulatory capacities as measured through heart rate variability over eight sessions?

Summary of Research Design

In investigation of these research questions, this dissertation utilized a nonexperimental, cross correlational, time series design. The researcher took physiological measurements of heart rate, skin temperature, electrodermal activity, and heart rate variability during the couple's therapy sessions with a certified EFT therapist using a monitoring wristband described in more detail in the methodological section. The time series design provides insight into the process of therapy *as* it is occurring as opposed to a cross-sectional measurement of the effect that has taken

place after the therapeutic process is over. A look into the current processing measures the therapeutic change that is taking place in EFT rather than the end product. Surrogate synchrony data analysis allows for trends in physiological measurements to be compared between both members of the couple. This analysis detects synchronized patterns of emotional regulation between the couple and the effect sizes of the change in synchrony over time. This research design sheds light upon the effect of EFT on couples' coregulatory experiences as measured through physiological synchrony.

Limitations

Potential limitations are important considerations for researchers and the intended audience. It is important to consider factors aside from the bonding process of EFT that could contribute to changes in heart rate, skin temperature, electrodermal activity, and heart rate variability, such as increased exercise, improved diet, and increased comfort with the therapeutic process over time. All of these factors have the potential to contribute to changes measured in the participants' physiological reactivity. With this understanding, one must be cautious in attributing any trends in the data exclusively to the EFT process. Additionally, this study was a limited case study design, which prevents generalizations from being made to the larger public.

Operational Definitions of Variables

The predictor variable is participation in couple's time in EFT counseling. The four dependent variables that were measured are the continuous constructs of heart rate, skin temperature, electrodermal activity, and heart rate variability. All of the outcome variables were measured by the same instrument, which will be described in further detail in the methodological section. All measurements were taken on the dominant wrist of both participants.

Heart rate. A photoplethysmogram (PPG) optical sensor in the monitoring wristband that detects blood volume changes. By emitting light signals upon the skin, the sensor detects the current strength of blood flow through the translucency of the skin at 1Hz.

Skin temperature. An infrared thermopile read the peripheral skin temperature at the wrist in degrees Celsius at 5Hz.

Electrodermal activity. A galvanic skin response sensor that detects changes in electrical activity upon the skin's surface according to the sweat gland activity measured electrodermal activity at 5Hz.

Heart rate variability. A photoplethysmogram (PPG) optical sensor in the monitoring wristband that detects blood volume changes measured heart rate variability. By emitting light signals upon the skin, the sensor detects the current strength of blood flow through the translucency of the skin to determine the inter-beat intervals and the heart rate.

Definition of Terms

Because this study pertains to several fields of study, it is especially important to be familiar with the following terms:

1. **Emotional regulation**: The intrinsic and extrinsic processes that allow emotional reactions to be recognized, monitored, evaluated, and modified (Thompson, 1994).
2. **Coregulation**: The bidirectional connection of emotional channels between partners, which provides emotional stability (Butler & Randall, 2013).
3. **Attachment:** An emotional connection to another due to the ability to offer protection, comfort, and support when needed (Bowlby, 1988).

4. **Anxious attachment:** An insecure form of attachment in which individuals display extreme distress in separation or stress, demonstrating clinging behaviors and tendencies (Bowlby, 1988).
5. **Avoidant attachment:** An insecure form of attachment in which individuals display indifference in response to separation or stress, often ignoring stimuli (Bowlby, 1988).
6. **Secure attachment:** A form of attachment that is consistently safe and responsive, promoting independent exploration and adaptive functioning (Bowlby, 1988).
7. **Autonomic nervous system**: The system in the body that regulates automatic or non-voluntary processes, such as the heart beating, intestines moving, glands secreting, etc. (Cardinali, 2018).
8. **Sympathetic nervous system**: The part of the autonomic nervous system that facilitates the body's reaction to stress or urgency by increasing heart rate, contracting muscles, and slowing other processes deemed unnecessary (i.e. digestion) to focus the body's response on the perceived threat (Cardinali, 2018).
9. **Parasympathetic nervous system**: The part of the autonomic nervous system that restores equilibrium to the body after response to a threatening situation to conserve energy and return the body to typical operation (Cardinali, 2018).
10. **Limbic system**: The part of the brain that facilitates lower order emotional processing. It serves as a bridge between the more primitive subcortical structures and the more advanced cerebral cortex. It evaluates present risk to ensure the body's current arousal matches that risk (Cardinali, 2018; Porges, 2011).
11. **Hypothalamus-pituitary-adrenal axis**: This axis refers to the interaction of feedback between the hypothalamus, pituitary gland, and adrenal glands, which regulate the body's

response to stress as well as digestion, immunity, emotions, sexuality, and energy usage (Porges, 2011).

12. **Polyvagal theory**: Theory that claims three regulatory circuits that connect the human brain to the rest of the body, including the dorsal motor nucleus (most primitive), sympathetic nervous system, and social engagement system (Porges, 2011).
13. **Social engagement system**: The branch of the vagus nerve that calms behavior by reducing the sympathetic nervous system on the heart (Porges, 2011).
14. **Ventral vagal complex (VVC)**: The circuit in the vagus nerve of the autonomic nervous system that inhibits the activation of the sympathetic activation through the safety perceived through connection with others (Porges, 2011).
15. **Anterior cingulate cortex**: The part of the brain between the prefrontal cortex and limbic system that facilitates autonomic processes, such as heart rate and blood pressure, and facilitates higher-order processes, such as impulse control, empathy, and emotional regulation (Porges, 2011).
16. **Psychophysiology**: The study of emotional or mental processes by measuring involuntary physiological responses (Andreassi, 2013).
17. **Heart rate**: The pace of the heart's rhythm. The average human heart rate is between 50-76 beats per minute. Heart rate indicates the level of stress from perceived threat the body is currently under (Leschka et al., 2006)
18. **Heart rate synchrony**: Degree to which two individuals' heart rates change together over time.

19. **Electrodermal activity response**: A measurement of the electrical current on the skin's surface in response to stress (Wood et al., 2014). The average EDA reading is 1-20 microsiemens.
20. **Electrodermal activity synchrony**: Degree to which two individuals' electrodermal activity levels change together over time.
21. **Skin temperature**: A manifestation of the thermal energy of the skin's surface, which reflects the autonomic reactivity of the body (Merla & Romani, 2007). The average temperature taken at the wrist is 34.16 ^{o}C.
22. **Skin temperature synchrony**: Degree to which two individuals' skin temperatures change together over time.
23. **Heart rate variability**: The naturally occurring variation between consecutive heartbeats. The average heart rate variability is 3.2 beats per minute. Heart rate variability indicates the regulatory abilities of the body (Leschka et al., 2006).
24. **Emotionally Focused Therapy**: A framework for couples' therapy that is founded on attachment science and seeks to facilitate corrective emotional experiences between partners to develop more secure attachments (Johnson, 2004).

Brief Dissertation Overview

This study is separated into five chapters, including the introduction, literature review, methodology, results, and discussion. Chapter 1 introduces the study's purpose and presents the research question. Chapter 2 discusses relevant literature to the study and grounds the study in an established theory. Chapter 3 describes the selected methodology to answer the research questions and procedures used to analyze the results. Chapter 4 reviews the results from the statistical analyses. Chapter 5 summarizes the results of the study, making note of significant

implications for Emotionally Focused Therapy, clinicians, and counselor education as well as for future research.

CHAPTER 2

REVIEW OF THE LITERATURE

This chapter begins with a review of the literature of the existing research into coregulation and its impact upon self-regulation. It also explores the role of attachment in coregulation and attachment's impact on neurobiological and physiological functioning, especially as understood through the polyvagal theory. The chapter describes the mediating role of secure attachment on threat detection and its resultant physiological arousal. Emotionally Focused Therapy (EFT) emerged as a practical application of attachment theory as a means of developing more secure attachments between couples. Therefore, it can be assumed EFT increases coregulatory experiences between partners and reduce emotional dysregulation and physiological reactivity as it produces more secure attachment.

Necessity of the Study

Mental health literature focuses on the role of emotional regulation within various mental health disorders (Gross, 2013). Emotional regulation is defined as the detection, assessment, and resultant change of emotional reactivity (Thompson, 1994). Decreased emotional regulation capacities are correlated with several mental health disorders, including attention deficit hyperactivity disorder (ADHD; Moukhtarian et al., 2018), bipolar disorder (Moukhtarian et al., 2018), disordered eating (Lavender et al., 2015), borderline personality disorder (BPD; Schore, 2003), anxiety (Schäfer et al., 2017), and depression (Schäfer et al., 2017). While there is not necessarily a causal relationship, viewing mental health disorders "from an emotion regulation perspective highlights potential mechanisms underlying psychosocial interventions" (Gross, 2013, p. 362). This role of emotional regulation provides a clear and focused approach for clinicians in helping clients to function with a mental health disorder. Expanding emotional

regulation within clients who have mental health disorders improves client outcome (Berking et al., 2013; Bacon et al., 2018).

Recent literature indicates that coregulatory experiences help individuals regulate themselves (Koole & Tschacher, 2016; Hirschler-Guttenberg et al., 2015; Silkenbeumer et al., 2018). Coregulatory experiences allow the synchronization and stabilization of responses between people in close relationships as they become more attuned to and engaged with the other's emotional experience (Butler & Randall, 2013). Therefore, clinicians can facilitate coregulatory experiences within the context of counseling to develop more emotional regulation within clients.

Developing a deep understanding of the changes taking place during counseling offers clarity for the clinicians facilitating these experiences. This depth includes an emotional, psychological, social, and physical application (Myers et al., 2000). The more that is understood about the actual process of change; the more effectively therapeutic interventions can be applied (Prochaska, 1999). This deeper understanding of change aligns with the push in literature to develop an approach to wellness "in which body, mind, and spirit are integrated by the individual to live life more fully" (Myers et al., 2000, p. 252). The neurobiologically-informed approach to counseling encourages an understanding of how the body and mind interact within the process of counseling (Luke et al., 2019). It takes into account the neurobiological functions and structures involved in the counseling process to offer a more complete understanding of the change that is taking place (Luke et al., 2019; Beeson & Field, 2017; Cozolino, 2017). Neuro-informed counseling equips clinicians with a deeper understanding of why their approaches to counseling are effective, allowing them to execute their theories and interventions with more precision as they gain more insight into what is happening beneath the surface (Beeson & Field, 2017).

Awareness of the neurobiological considerations of counseling allows counselors to normalize the psychological and physiological distress they may be experiencing (Beeson & Field, 2017). This normalizing helps clients to feel more clear and understood in the counseling process. Neuro-informed counseling has also been shown to provide more clarity for clients in their counseling process as their counselors can offer them a clearer picture of the goals of the counseling process (Miller, 2016). This movement toward neuro-informed counseling highlights the field's emphasis on understanding the holistic approach to the counseling process.

Another form of this holistic approach to wellness (Myers, 2000) is found in psychophysiology. Psychophysiology offers valid and reliable measures of these processes beneath the surface by understanding the brain-body connection (Ax, 1964). Without relying on self-report or subjective instrumentation, physiological assessment provides an objective assessment of the human experience, especially with regard to arousal and reactivity (Ax, 1964). For decades, these physiological measurements have been used to make psychological assumptions. Detecting physiological changes, such as heart rate, skin temperature, electrodermal activity, and heart rate variability, during a counseling session provides objective and accurate insight into how the brain and body are responding beneath the surface.

This study seeks to answer the calls in literature for strategies to expand emotional regulation and for a holistic approach to wellness by examining the physiological impact of coregulatory experiences in couples' counseling. The study offers physiological insight into the regulatory mechanisms at work within the body, which also sheds light into the emotional regulation capacities of the body (Porges, 2007). This understanding expands clinicians' potential to increase the quality of life for their clients and their awareness of why this change takes place during the therapeutic process.

Coregulation

Coregulation expands one's emotional self-regulation (Butler & Randall, 2013). Coregulation is the bidirectional connection of emotional channels between partners, which provides emotional stability (Butler & Randall, 2013). Literature indicates that coregulatory experiences between caretakers and children offer the foundation of self-regulation capacities that last a lifetime (Lobo & Lunkenheimer, 2020; Lunkenheimer et al., 2017). The caretaker calms the child during emotional stress through relational connection and safety (Lunkenheimer et al., 2017). This process continues through intimate relationships into adulthood as partners serve as emotional and biological regulators for one another (Sbarra & Hazan, 2008). According to the social baseline theory, humans rely on support and safety from close relationships to reduce threat responding and promote emotional stability through limiting cognitive or metabolic cost (Coan, 2008). As the threat response is less necessary in the presence of a safe other, more stability is achieved.

The stability offered by a safe and trusted "other" reduces the amount of threat upon the individual. Coregulation has been linked to the release of oxytocin into the bloodstream and high parasympathetic tone (Butler & Randall, 2013). Oxytocin is a hormone released during social bonding and has a calming effect on the body (Taylor et al., 2000). These rewards of social bonding reinforce coregulatory behavior (Sbarra & Hazan, 2008). Additionally, parasympathetic tone is a soothing vocal tone that promotes regulation in the body (Porges, 2007). When this tone is detected during coregulatory experiences, it too has a soothing impact that promotes emotional flexibility and connectedness (Porges, 2007). The physiological aspects of coregulation between adults are linked to secure attachment. According to Sbarra and Hazan (2008), the coregulatory model of attachment is "defined as a pattern of interwoven physiology between romantic

partners that results from the conditioning of biological reward systems and the emergence of felt security within adult pair bonds” (p. 141). The safety associated with secure attachment facilitates the coregulatory processes necessary to promote self-regulation.

The Role of Attachment

Coregulatory experiences that promote more individual emotional regulation are more likely within the context of relationships that are securely attached (Roth et al., 2013). Therefore, securing attachment during the counseling process would lead to more emotional regulation of individuals (Roth et al., 2013). Individuals with secure attachments “seek support from significant others and have confidence in their own skills and thus develop more successful and constructive coping plans” (Simmons et al., 2009, p. 235). As individuals in secure relationships seek support from one another, they are more likely to engage in coregulatory processes that expand individual emotional regulation. Secure attachment promotes independence as individuals know they have a safe base in which to rest when needed rather than a desperate co-dependence (Bowlby, 1988).

John Bowlby initially developed the theory of attachment (1969, 1988) as a way to describe the bond that occurs between infants and caregivers. Attachment is the degree to which “an emotional connection to another individual that develops between an individual who is seen as able to provide protection, comfort, and support in times of need” (Roth-Hanania & Davidov, 2004). The strength of the attachment depends on the level of perceived responsiveness to the infant’s needs. If the infant perceives needs as being met in a consistent and sensitive manner, a secure attachment forms.

Insecure attachments will form if the infant perceives the caregiver’s responsiveness as inconsistent or insufficient (Bowlby, 1969). Anxious attachment styles are a form of insecure

attachment that develops with inconsistent engagement in moments of distress. Infants with these attachment styles tend to exhibit severe distress in separation and demonstrate more clinging behaviors to caregivers (Bowlby, 1988). Avoidant attachment styles result from a lack of engagement with the infant (Bowlby, 1988). Infants who display this attachment style tend to show minimal symptoms of distress when separated from caregivers, often avoiding physical contact and eye contact as the caregiver returns from an absence (Ainsworth, 1978). Disorganized attachments are the least common form of insecure attachment that develop as a result of manipulative or complete deprivation of responsiveness to a child (Bowlby, 1988). In moments of distress, infants with this attachment style demonstrate behavior that lacks a clear purpose or intent (Ainsworth, 1978). Due to the rarity of disorganized attachments and the complexity of the treatment required for healing, the scope of this paper will focus on the more common anxious and avoidant insecure attachments.

The level of responsiveness that caregivers or attachment figures provide instill either a sense of safety and security that promote adaptive functioning or a sense of insecurity and threat that promote more limited responses to distress (Bowlby, 1988). When an infant experiences distress, the body generates a signal for the infant to reach out to an attachment figure (Bowlby, 1988). These signals of reaching out can consist of crying, physically raising arms, or movement to get closer but are all intended to capture the attention of the caregiver during moments the infant finds distressing (Bowlby, 1988). However, the nature of these signals depends on the established security and responsiveness the infant has come to expect from the caregiver. If the infant repeatedly displays these signals but is unsatisfied with the level of responsiveness, the infant will adapt by either elevating the signals (anxious attachment) or discontinuing them (avoidant attachment) (Bowlby, 1988). The perceived responsiveness of attachment figures

forms an infant's response to distressing moments and the resultant strategies to regulate the emotional response.

Internal Working Models

Studying infant behavior in times of distress reveals that infants develop experience-informed expectations of the response to their displayed signals of distress (Ainsworth, 1978). The response to these calls also influences the development their self-perception, even at an early age, as they internalize messages about their own worthiness of being attended to in times of distress (Bowlby, 1969). Internal working models are blueprints that are developed to organize and predict social experiences (Bowlby, 1980). Infants early attachment experiences are carried into future relationships. "Infants construct internal working models of that attachment figure in the form of expectations about the attachment figure's availability, responsiveness, and likely behavior in novel situations" (Sherman et al., 2015, p. 113). Initial attachment figures partially supply the infant's first messages of self-understanding as well as general assumptions regarding their later social interactions.

These expectations first learned with caregivers extend to non-parental relationships as infants experience new interactions with more people (Bretherton & Munholland 2008; Bowlby, 1969). The consistency of these soothing or regulatory behaviors in initial attachment relationships creates a lasting reflex for the child later in life (Widom et al., 2017; Schneider-Hassloff, 2016). Infants who are responded to consistently are more likely to believe others will do the same for them. Infants who are not responded to consistently are more likely to doubt others' capacity for responsiveness and display clinging or avoidant strategies. Hazan and Shafer (1987) expanded the application of attachment security to adult relationships, finding the same patterns of security, avoidance, anxiety, and disorganization. Research initially implied the fixed

stability of initial attachment styles, or the attachments with the primary caregivers, that carry into adult relationships as well (Ainsworth, 1978). However, more recent research shows that attachment is malleable as new ways of connecting and functioning can result as people apply different strategies to meet their attachment needs for security in different settings (Konrath, 2014). The ability for change in attachment style provides hope for individuals who have not had access to securely attached relationships or coregulatory experiences.

Despite this potential for change, "identifying connectedness between early experience and later development points to the important role of attachment in development" (Hamilton, 2000, p. 694). This development includes one's capacity for emotional regulation. Securely attached individuals are more likely to implement effective coping strategies, displaying less catastrophizing and more control exhibited over pain (Schmidt et al., 2012; Meredith et al., 2006). Insecure attachment styles are correlated with maladaptive coping strategies (Craparo et al., 2014). Attachment styles influence emotional regulation capacities because of the impact the attachment bond in downregulating the brain and body during moments of stress.

The Unregulated Brain and Body

Individuals who lack secure attachments are more likely to display increased levels of emotional dysregulation when faced with stressors and less likely to engage in coregulatory experiences (Roth et al., 2013). When the body is presented with a stressful situation, the body's sensory messenger neurons report the potential for threat to the amygdala, where the threat is assessed for emotional salience (Morrow et al., 2019). If the amygdala is triggered by the potential threat of the environment, it alerts the hypothalamus, initiating the sympatho-adrenal medullary system of the autonomic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis of the endocrine system (Ulrich-Lai & Herman, 2009).

The sympatho-adrenal-medullary system releases epinephrine and norepinephrine into the blood stream to maximize blood flow to the most essential parts of the body in responding to threat (Ulrich-Lai & Herman, 2009). The release of epinephrine and norepinephrine increases heart rate, blood pressure, and electrodermal activity levels as the body attempts to mobilize itself to maximize response to threat (Ulrich-Lai & Herman, 2009). The HPA axis sustains the immediate response of the sympatho-adrenal-medullary system by releasing a cascade of hormones, including cortisol and various catecholamines, into the bloodstream that will continue to elevate the body's alertness to respond to the potential threat (Ulrich-Lai & Herman, 2009). The threat response redistributes energy within the body to maximize its protections to potential threat.

While this redistribution promotes flexibility to respond to immediate stressors, the prolonged activation of this system significantly impacts the body and brain. A threat response system that is overactivated and underregulated constantly releases stress hormones that have deleterious consequences over time. These consequences include cardiovascular disease, excess blood glucose, reproductive dysfunction, immune dysfunction, and deficiencies in growth hormones (Golbidi et al., 2015; Tamashiro et al., 2011; Garrett & Wellman, 2009; Flügge et al., 1998; Vázquez et al., 2008; Ranabir & Reetu, 2011). The overactive threat response system of the body devastates the functions that are essential to healthy and adaptive functioning.

In addition to the harmful effects on the body, overactivation of the threat response system is correlated with decreased volume of the hippocampus and amygdala, which plays a significant role in memory and assessment of emotional salience (Gianaros et al., 2007; Rosenkranz et al., 2010). Additionally, chronic stress results in decreased volume of the frontal cortex, which facilitates complex thought (Martín-Hernández et al., 2018). Chronic stress

impairs the hippocampus, amygdala, and frontal cortex of the brain during the threat response system of the body. These areas of the brain facilitate emotional regulation (Butler & Randall, 2013). Therefore, the overactive threat response system creates a perpetual cycle of increasing emotional dysregulation as the consistency of stress further disrupts its capacity to soothe itself. The regulating capacity of secure attachment offers an escape from this vicious cycle of impairment.

Neurobiology of Secure Attachment

Attachment literature clearly indicates the regulating capacity of a secure social bond. The presence of an attachment figure reduces the perception of pain (Eisenberger, 2011), meaning the safety associated with an attachment figure provides a sense of a buffer in painful situations. The presence or even photograph of an attachment figure decreases automatic threat responses, such cortisol levels, heart rate, blood pressure, and electrodermal activity, in people experiencing distress (Sullivan, 2017; Bryant, & Chan, 2017). Established safety from an attachment figure allows the body to regulate itself during moments in which it feels threatened. This regulation is possible because the brain of an individual with secure attachments has less reactivity in the areas responsible for threat assessment (Roth et al., 2013). Secure attachments are correlated with less activity in the threat response system or the limbic system (Roth et al., 2013). The safety and stability of an attachment figure reduce the body's perceived need for a threat response.

Secure attachments result in increased gray matter volume in the anterior cingulate cortex, which creates stronger activation of the social reward network of the brain (Vrticka et al., 2008). These secure relationships also result in less distress reactions in psychological pain and social rejection reported due to less insula activation within the brain (Coan et al., 2006).

Individuals who report secure attachments exhibit more stable emotional responsiveness and a higher capacity for cognitive reappraisal due to their decreased reactivity to threats (Vrticka et al., 2012). In couples' research, securely attached partners are more likely to utilize their higher order processing skills, such as problem solving or abstract reasoning, during moments of distress with partners (Winterheld, 2015; Shaver et al., 2007), indicating their threat detection systems are less reactive and more regulated.

Additionally, positive social emotions that are produced in secure attachments result in increased release of dopamine within the ventral tegmental area, substantia nigra, striatum, and medical orbitofrontal cortex of the brain (Haber & Knutson, 2010). These parts of the brain all provide the body with information into how the body's needs are currently being met (Haber & Knutson, 2010). This release of dopamine in these areas regulates the fear response, resulting in less reactivity (Haber & Knutson, 2010). Individuals with secure attachments also show greater releases of oxytocin, a neurohormone that acts as a brain reward, when looking at an attachment figure (Strathearn et al., 2009). Oxytocin reduces cortisol, the stress hormone, levels to promote healthy growth within the brain (Heinrichs et al., 2003). The structural, functional, and chemical correlations with secure attachment clearly indicate more stable functioning to regulate the reactivity of the threat response system. The securely attached brain is less reactive to potential threats and is more likely to remain regulated during moments of stress, especially when compared to individuals with insecure attachments.

Neurobiology of Insecure Attachment

A brain that lacks the coregulatory experiences of secure attachment results in less stability of responsiveness to potential threats (Rognoni et al., 2008). HPA axis reactivity and insecure attachments are positively correlated (Diamond & Fagundes, 2010). Individuals with

avoidant attachment styles tend to be less aroused, displaying a blunted response to emotional triggers to suppress the need or desire for comfort, while individuals with anxious attachment styles tend to be more aroused, displaying a more heightened response to emotional triggers as their bodies activate to get their needs met (Vrticka et al., 2008).

Avoidant attachment styles have lower activation within the low ventral striatum and medial orbitofrontal cortex, which are areas of the brain associated with social rewards (Vrticka et al., 2008; Strathearn, 2009). The anterior insula and dorsal anterior cingulate cortex, which typically regulate feelings of social exclusion, show decreased activation (DeWall et al., 2011). While avoidant attachment styles dull the pain of the low moments, they also are unable to feel the extent of the high moments as well. Avoidant attachment style is also correlated with a decreased capacity for processing emotional faces (Zhang et al., 2008). Their suppression of their own emotional experience inhibits their ability to connect with others in their emotional experiences. Avoidant coping strategies typically involve response focused emotional regulation through suppression (Vrticka et al., 2012). Literature clearly indicates the success of individuals with avoidant attachment styles disconnecting from their own emotional experience. However, Vrticka et al. (2012) indicated that they actually display higher levels of activation to potentially threatening stimuli when they are unable to withdraw from the threat. Individuals with avoidant attachment styles actually become more reactive and dysregulated when they are unable to escape from the threatening stimuli.

This emotional reactivity is typically more obvious within individuals with anxious attachment styles. Anxious attachment styles are correlated with higher arousal to perceived negative emotions than secure attachment styles (Rognoni et al., 2008). The amygdala shows increased activity when individuals with anxious attachment styles face personal failure or social

disapproval as compared to secure attachment styles (Lemche et al., 2006). In the midst of social rejection, they experience increased activation and more emotional distress within the anterior insula and dorsal anterior cingulate cortex as compared to those with secure attachments (DeWall et al., 2011). Anxious attachment styles are also correlated with reduced gray matter volume of the hippocampus (Quirin et al., 2010). The HPA axes of individuals with anxious attachments show abnormal cortisol responses, either showing hypersecretion or hyposecretion during the stress response (Kidd et al., 2011). Individuals with anxious attachment styles experience consistent limbic reactivity, which prevents healthy regulatory behaviors to emerge. Literature clearly indicates the emotional regulation of secure attachment and the regulatory difficulties associated with insecure attachment. By developing more secure attachments within clients' lives, counselors offer more capacity for emotional regulation. While the correlations and effects are important to observe, it is additionally important to be grounded by a theory explaining why attachment has the impact it does on emotional regulation capacities.

Polyvagal Theory

The polyvagal theory explains the relationship between attachment and emotional regulation by means of coregulation of the vagus nerve (Porges, 2011). The vagus nerve extends from the brain through the heart and into the abdomen. As the name would suggest, the polyvagal theory purports there are multiple branches of the vagal nerve that facilitate differing levels of physiological arousal in response to threat (Porges, 2011).

The most primitive branch of the vagus nerve is an unmyelinated area of the brainstem called the dorsal motor nucleus. When this branch activates in response to threat, it responds through immobilization to maximize the likelihood of survival. All vertebrates share this vagal response to threat (Porges, 2011). This immobilization can look like feigning death or complete

behavioral shut down. If an individual assesses an environment as life threatening by the amygdala, the ventrolateral periaqueductal gray will freeze metabolic activity through the dorsal vagal complex (Porges, 2011). As a result, the body no longer produces energy and instead prepares to shut itself down to maximize protection and survival.

The second branch relies on the sympathetic nervous system that increases metabolic and cardiac activity. The sympathetic response mobilizes the body through the flight-or-fight behaviors. If the individual perceives danger that is not necessarily life threatening, it will activate the dorsolateral and lateral periaqueductal grey to determine if fighting or fleeing is the most effective protective strategy (Porges, 2011). Whether in fight or flight, the sympathetic nervous system activates to mobilize the body toward that action (Porges, 2011). This mobilization includes the increase of heart rate and blood pressure in the body's acute stress response. Electrodermal activity increases and body temperature decreases as the body attempts to maximize its capacity to respond to the present threat.

The third and most sophisticated system, the ventral vagal complex (VVC) or the social engagement system, activates when the limbic system assesses the environment as safe. The nucleus ambiguus houses the social engagement system in the brainstem. Facial expressions, soothing vocalization, and listening communicate a sense of safety to the VVC. The VVC inhibits the limbic defense system of reactivity and instead emphasizes social engagement behaviors. In moments of distress, this branch regulates the threat response by reaching out for social connection and comfort, limiting the reactivity of the second branch of the sympathetic nervous system (Porges 2011). According to polyvagal theory, secure attachments are correlated with active VVCs, which are better able to rely on perceived social support to regulate the body's threat response (Porges, 2011). The relationship between attachment and emotional

regulation supports polyvagal theory's understanding of the function of the VVC. All three branches are reviewed in Figure 1 (Walker, 2020).

The polyvagal theory explains the role of the vagal nerve in emotional regulation. The VVC soothes the sympathetic nervous system's response to threat, preventing an overactivated threat response system that deteriorates the brain and body. The safety of the attachment bond facilitates the connection required to calm the body's threat response. According to the polyvagal theory, activation of the social engagement system and the resultant secure attachment develop effective emotional regulation capacities.

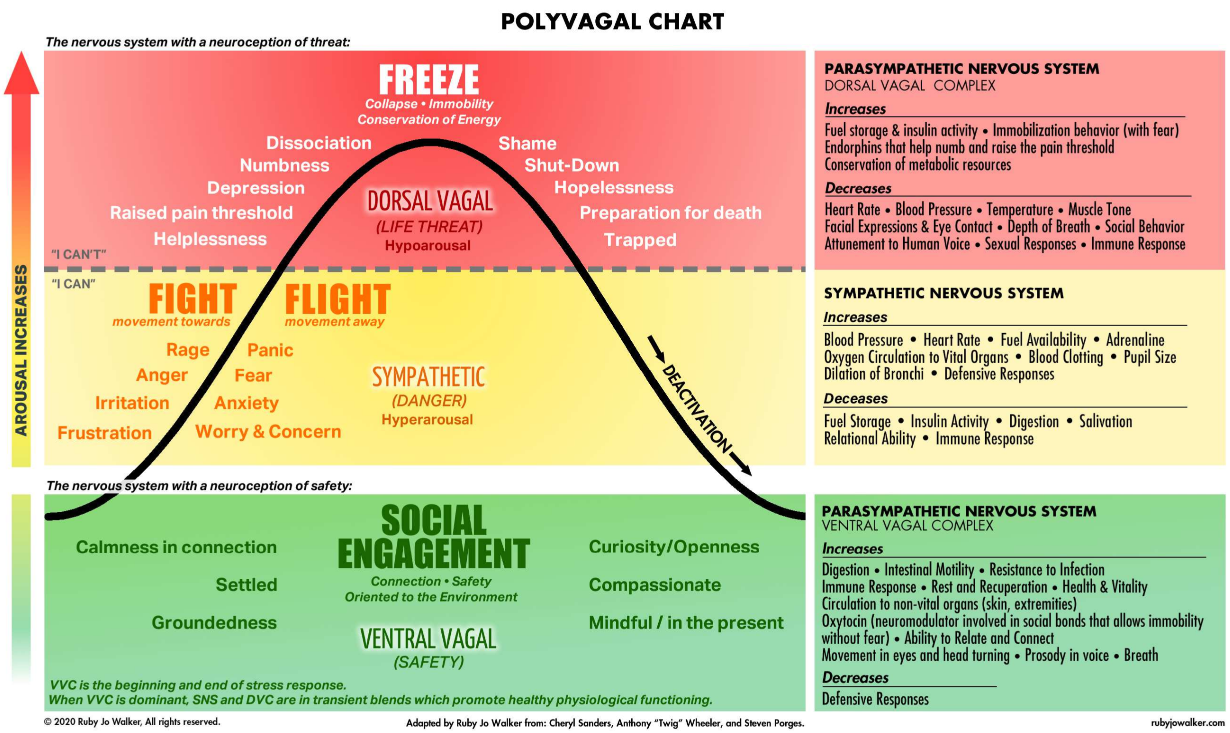

Figure 1

Three Branches of the Vagal Nerve According to Polyvagal Theory

Application of Polyvagal Theory

Polyvagal theory develops more comprehensive understandings of a variety of physical and mental health issues, including gastrointestinal disorders, fetal growth restriction, traumatic stress, and autism spectrum disorder (Kolacz & Porges, 2018; Aldrete-Cortez et al., 2019;

Kolacz et al., 2019; Bailey et al., 2020; Billeci et al., 2018). Its conceptualization of emotional regulation offers clarity into processes occurring beneath the surface and potential direction for healing and restoration through emphasizing the necessity of activation of the VVC. Additionally, its use of physiological support promotes clarity in how to measure the effectiveness and reactivity of the body's threat response system. The vagal nerve mediates heart rate variability and dopamine and glucose levels (Colzato & Steenbergen, 2017; Anselmi et al., 2017; Boychuk et al., 2019), confirming its role in regulating the body's response to threat.

Emotional Regulation of the VVC

Without an environment being perceived as safe, the VVC remains inactivated and is unable to soothe the sympathetic nervous system (Porges, 2011). Secure attachments indicate a safe environment that activates the VVC (Porges, 2011). Attachment insecurity is correlated with higher levels of emotional dysregulation (Cronin, Pepping, & O'Donovan, 2018; Read, Clark, Rock, & Coventry, 2018; Wei, Vogel, Ku, & Zakalik, 2005). This emotional dysregulation is correlated with depression, impulsive or reckless behavior, increased substance use, and hyperactivity (Kosutic, 2019; Trub & Starks, 2017; Siegel, 2015; Forslund, 2016). To develop treatments that are effective in producing more secure attachments and safety to activate the VVC, it is imperative to understand the neurodevelopment of individuals with insecure attachments. With this understanding, clinicians can facilitate environments that can be perceived as safe and activate the VVC that can calm the threat response of the body.

Neurobiology of Unmediated Threat Responses

The VVC weaves through the three primary levels into which the brain is organized (Porges, 2011). The lower brain is primarily responsible for the most primitive aspects of human functioning and includes the brainstem, which facilitates physiological responses in the body,

such as heart rate, blood pressure, and consciousness (Freeman, 2004). The midbrain facilitates more emotional functioning as it houses the limbic system. The hippocampus and amygdala are a part of the limbic system, using past memories to assess the present and future threat of stimuli (Williams et al., 2018). The limbic system facilitates threat detection. By using experiences to signal the appropriate level of response for the rest of the body, it maximizes the chances for survival (Williams et al., 2018). The results of the threat assessment impact both the lower and upper brain functioning. If the amygdala detects threat as informed by the hippocampus's recollection, it will communicate this threat to the lower brain, which will activate the physiological system to prepare for defense toward the threat (Williams et al., 2018). This activation temporarily impairs upper brain functioning, as the brain primarily focuses on its response to the threat (Pichon et al., 2012). The upper brain facilitates higher order processing, including logical evaluation and assessment, creativity, and problem solving, which the body deems as less necessary in threatening situations (Pichon et al., 2012). Therefore, when a threat is detected, as informed by past experience, the limbic system cues autonomic responses, minimizing the potential benefits that could be offered by the upper brain in regulating experiences, such as conflict resolution or problem solving.

From an attachment perspective, the lack of a nurturing response in moments of distress causes amygdalae to go unsoothed by attachment figures via the VVC and therefore remain activated (Opendak & Sullivan, 2019). Overly activated amygdalae impair emotional regulation skills. They constantly send messages to the lower brain to prepare for threat, resulting in limbic systems that are frequently sending out messages of panic (Opendak & Sullivan, 2019). The parts of the brain responsible for this communication, the insula, anterior cingulate, and orbital frontal cortex, form disjointed and inconsistent connections from the amygdala to the stress

response systems because they are unmediated by the VVC (Schore, 2001; Porges, 2011). This dysregulation leads to structural, functional, and chemical changes within the brain that is consistently distressed that have been previously explored (Rognoni et al., 2008; Vrticka et al., 2012).

Unmediated limbic activity is correlated with increased cortisol responses to distress (Smyth et al., 2015; Oskis et al., 2011). If the body has not been taught to regulate through an attachment figure, the VVC is less active and less able to regulate in moments of distress through connections with others. Therefore, the body is more likely to respond with overly reactive energy or seek to escape the stimulus altogether in isolation (Craparo et al., 2018). These anxious or avoidant tendencies put additional strain on significant relationships, which limits the VVC's soothing potential (Johnson, 2019; Porges, 2011). This lack of regulation creates a vicious cycle in which fight or flight tendencies actually prevent the soothing connection of the VVC.

In adult relationships, romantic partners are often the most available source of social support. If partners have insecure attachments with one another, they are unable to use one another to activate their VVCs to regulate themselves during distress. In their attempts to regulate in isolation, partners often perceive one another as being overly reactive or dismissive and are less likely to feel connected to one another (Johnson, 2019). The reduced capacity for emotional regulation in individuals with insecure attachments results in increased threat detection as the VVC is unable to use the available social support to soothe the system.

Physiological Response to Threat Detection

The overactivation of the limbic system in individuals with insecure attachments can be detected by measures of physiological functioning that deviate from typical baseline functioning (e.g. heart rate, blood pressure, electrodermal activity, etc.) Individuals with avoidant attachment

styles have greater heart rate variability as the body struggles to regulate itself without the VVC's mediation of the sympathetic nervous system (Bryant & Hutanamon, 2018; Porges, 2011). Avoidant attachment styles are more likely to have decreased levels of electrodermal activity in moments of distress as they even physiologically suppress their response to emotions (Taylor et al., 2018). Comparatively, anxious attachment styles show an increase in electrodermal activity as their bodies respond to stressful stimuli (Taylor et al., 2018). People with high levels of perceived social support, as seen in more secure attachments, tend to have lower blood pressure (Che et al., 2018) as compared to individuals who perceive themselves as lacking social support. These physiological measurements offer crucial insight into the body's threat detection system and therefore its emotional regulation capacities.

Emotional Regulation and Psychophysiology

Polyvagal theory emphasizes the need for emotional regulation to be experienced in relationships. According to Dana (2018), "Polyvagal theory identifies coregulation as a biological imperative: a need that must be met to sustain life. It is through reciprocal regulation of our autonomic states that we feel safe to move into connection and create trusting relationships" (p. 4). An activated VVC in coregulation calms the sympathetic nervous system's alerts to the body and resultant physiological escalation.

Measuring this physiological escalation may then offer insight into the regulatory capacity of the VVC. Psychophysiology is the science of using physiological measurements to provide insight into psychological constructs (Andreassi, 2013). The goal of psychophysiology is to measure covert behavior without interfering with the natural functioning of the organism of study (Ax, 1964). Since its inception, psychophysiological measurements have included constructs, such as respiration, blood pressure, heart rate, and galvanic responses (Darrow,

1964). Lacey and Lacey (1958) described heart rate and galvanic response as "aperiodic oscillatory changes that are uncorrelated in time with specifically imposed stimuli or with detectable specific episodes of affective response" (p. 144). For decades, physiological measurements have illuminated researchers' understanding of more covert behaviors and processes in response to stimuli.

Psychophysiological Measures

For decades, heart rate has been measured as a precise physiological construct (Docter et al., 1964) with a strong correlation to psychological stress. As the sympathetic nervous system activates under perceived threat, the heart pumps blood faster to equip the body for its fight or flight response (Porges, 2011). Increases in heart rate indicate greater stress responses and activation of the sympathetic nervous system, whereas decreases would indicate activation of the parasympathetic nervous system. Heart rate is measured in beats per minute.

Skin temperature is an established measure of emotional arousal (Merla & Romani, 2007). During the threat response of the sympathetic nervous system, the sympathetic nervous system releases sweat secretions that cool the surface of the skin (Anbar, 2002). Additionally, constrictions of the blood vessels result in decreases in temperature (Haddy et al., 1968). Decreases within the skin temperature indicate sympathetic threat response. Therefore, stable levels or slight increases of skin temperature would indicate parasympathetic nervous system arousal within the body. Skin temperature is reported in degrees Fahrenheit or Celsius.

Electrodermal activity is another physiological measurement that offers insight into psychological constructs for the past several decades (Docter et al., 1964). Electrodermal activity increases during sympathetic nervous system activation as the stress hormones of the body increase eccrine sweat gland activity (Wood et al., 2014). Amygdala activation of the limbic

system is positively correlated with threat-elicited electrodermal activity (Wood et al., 2014). Higher electrodermal activity levels could indicate a higher level of threat response within the body. High electrodermal activity levels are positively correlated with lower levels of emotional regulation, which have been shown to be mediated by high levels of trust within the context of relationship (Song et al., 2020). Gander & Buchheim (2015) established the relationship between higher electrodermal activity levels and insecure attachments. Electrodermal activity is typically reported in microsiemens, which is the amount of water per centimeter (Wood et al., 2014). Literature indicates the emotional regulation of the VVC mediates the sympathetic nervous system, decreasing its physiological activation of heart rate, skin temperature, and electrodermal activity.

According to Kim et al. (2018), heart rate variability is a valid measure of psychological health and measure of perceived stress. Heart rate variability measures the fluctuations in heart beat intervals (Malik et al., 1996). Great fluctuations indicate a greater stress response that is not as readily soothed by the parasympathetic nervous system. Emotional regulation difficulties are positively correlated with heart rate variability (Visted et al., 2017). Literature establishes this correlation with a variety of populations including individuals with disordered eating, borderline personality disorder, ADHD in children, and autism (Godfrey et al., 2019; Krause-Utz et al., 2019; Bunford et al., 2017; Dijkhuis et al., 2019). Heart rate variability has been established in psychophysiological literature as an effective measure of autonomic nervous system activity between the sympathetic and parasympathetic nervous systems.

Heart rate variability is measured by time-domain measures and frequency-domain measures (Malik et al., 1996). Time-domain measures examine segments between heartbeats in milliseconds with normal (NN) intervals. SDNN is the standard deviation of NN intervals.

RMSSD is the root mean square of differences between NN intervals (Malik et al., 1996). Frequency-domain measures analyze the power of the range, including low frequency (less than 0.15Hz) and high frequency (greater than 0.15Hz). Low frequency represents activation of the sympathetic nervous system, whereas high frequency is associated with parasympathetic activity (Malik et al., 1996). The low frequency to high frequency (LF/HF) ratio is often reported to depict the relationship between the sympathetic and parasympathetic activations (Pagani et al., 1984). Increases in LF/HF ratio correspond with a shift toward more parasympathetic activity rather than sympathetic activity (Pagani et al., 1984). Heart rate variability indicates the regulatory capacities of the body after a threat activates the sympathetic nervous system and would therefore be an appropriate psychophysiological measure of emotional regulation.

Psychophysiological Coregulation

Existing literature focuses on the link between emotional coregulation and physiological measurements, especially within couples' research in adult relationships (Campos et al., 2011; Coan & Maresh, 2014; Barthel et al., 2018). Measuring the physiological activation that occurs between couples offers insight into how individual stress responses interact with one another (Palumbo et al., 2017). Autonomic nervous system synchrony specifically focuses on the sympathetic and parasympathetic activations within the body and primarily includes cardiovascular, respiratory, and electrodermal activity measures (Palumbo et al., 2017). Synchrony offers insight into the coregulatory patterns that take place between dyads.

Physiological Synchrony

Existing literature focuses on the role of physiological synchrony in emotional regulation (Palumbo et al., 2017). The three primary areas of focus within synchrony research study the caregiver-child relationship, romantic couple relationship, and therapeutic alliance (Palumbo et

al., 2017). Caregiver-child synchrony is correlated with lower rates of depression and anxiety in children, more instances of relational repair, and higher rates of child self-regulation (Suveg et al., 2019; Woltering et al., 2015; Suveg et al., 2016). This synchrony or coregulation between caregivers and children appears to lay the foundation for regulatory capacities and behavior as the VVC soothes the limbic response. However, not all synchrony benefits the relationship, especially with regard to emotions of negative valence. Caregiver-child relationships with high conflict synchronize in their elevated and reactive states but do not report higher relational security (Liz et al., 2020).

The same is true of the couples' research. Sympathetic nervous system synchrony, or attuned physiological activity, occurs between couples, especially during moments of stress as reactivity measurements rise (Gottman & Levenson, 1988; Coutinho et al., 2019). However, Karvonen et al. (2016) found couples tend to break hostile physiological synchrony as they become more regulated initially and suggested they tend to develop a more positive or amiable physiological synchrony as they adopt a more positive affect over time. Tourunen et al. (2019) reflected this shift over time for couples in the process of counseling, claiming "a feeling of emotional disconnection is also reflected as physiological disconnection between spouses, and that couples therapy may bring spouses closer together also on a physiological level" (p. 9). Couples in counseling that emphasize body synchrony report reductions in dysregulated patterns of responses as new patterns emerge (Engelhard, 2018). As couples fall out of hostile synchrony, an adjustment period occurs as they seek to find more stable and regulated synchronous patterns with one another.

Within the therapeutic relationship, physiological synchrony is positively correlated with therapeutic bond and a positive therapeutic experience (Bar-Kalifa et al., 2019; Tschacher &

Meier, 2020). Physiological synchrony promotes a bond between clients and counselors as they have access to one another's internal states, increasing the potential for understanding and emotional coregulation (Koole & Tschacher, 2016). The physiological synchrony involves both sympathetic and parasympathetic activation within the therapeutic alliance, which illustrates the regulating and healing power of the VVC. Physiological synchrony research advocates for a balance of in synchrony and out of synchrony moments within relationships to maximize flexibility and adaptability of individuals (Mayo & Gordon, 2020). This flexibility aligns with the concept of secure attachment (Bowlby, 1988). In both balanced synchrony and secure attachment, both coregulatory and self-regulatory moments promote optimum functioning. With a safe base to return, individuals are better able to regulate themselves independently.

As secure attachment develops between partners, their threat response systems become less reactive and more stable, empathic synchrony can develop between them (Lapides, 2011). The polyvagal theory highlights the role of attachment and the functioning of the VVC in allowing partners to regulate differently promote more stable and synchronized functioning during moments of distress (Porges, 2011). The VVC soothes the body through coregulation, which can be measure through physiological synchrony. As couples seek out therapeutic intervention to move toward this connection and regulation, it is important for counseling processes to facilitate a rhythm of emotional and physiological synchrony and coregulation to generate sustained change for couples who are in distress and out of sync.

Emotionally Focused Therapy

Emotionally Focused Therapy (EFT) is a model of counseling that emphasizes this balanced synchrony as it compares love to a dance, claiming "the happier we are, the more fluid and varied the dance with our partner is" (Johnson, 2020). It seeks to develop synchrony between

partners in their dance through securing their attachments to one another. EFT develops these secure attachments in couples' therapy by emphasizing responsiveness to one's partner in moments of distress (Johnson, 2019). The model defines emotion as the integration of innate, attachment longings with past experiences, present perception, and future expectations (Frijada, 1986). Therefore, EFT seeks to focus on the past experiences that inform present and future functioning, which prevent attachment needs from being met, to promote more coregulatory experiences between couples. "The EFT therapist's focus is constantly on patterns of experiencing, especially affect regulation and expression, and patterns of responses in interactions with intimate partners" (Johnson, 2004, p. 28). By focusing on these patterns of experiencing and developing new responsive interactions, EFT therapists secure attachment and therefore promote more emotional regulation between and within the two individuals of the couple (Brubacher, 2017). EFT therapists facilitate corrective emotional experiences for their clients by creating opportunities for partners to respond to one another in their deepest moments of vulnerability (Brubacher, 2017). In session, "partners are able to share specific requests in a manner that pulls the other partner toward them and maximizes the possibility that the other will be able to respond with accessibility and comfort" (Johnson, 2004, p. 194). This responsiveness secures the attachment between partners, allowing for increased emotional coregulation.

According to EFT, the most common, out of sync pattern in which couples find themselves involves one partner with an anxious attachment style and another with an avoidant attachment style (Johnson, 2004). Anxious partners are called pursuers due to their tendency to pursue connection and intimacy with their partners during moments of stress while partners with more avoidant attachment styles are labeled as withdrawers because of their propensity for withdrawing from intimacy in the relationship during moments of stress (Johnson, 2004).

However, both develop out of a lack of response to their calls for distress in pain from previous experiences. Both pursuer and withdrawer attempt to emotionally regulate through their established strategies of pursuit or withdrawal (Johnson, 2019). These strategies are often rigid and make it difficult for couples to connect with one another. However, anxious and avoidant attachment styles are both correlated with less resilient emotional regulation strategies in isolation (Owens et al., 2018), whereas secure attachment styles tend to have more success with a higher likelihood of coregulating with an attachment figure (Pace et al., 2016).

The process of EFT requires a great deal of fluidity as the clinicians seek to attune to the clients' current experiences. Within this complexity, an established process of certification enables clinicians to receive thorough training to provide consistent administration of the model. Becoming an EFT certified therapist includes over 75 hours of training in a workshop setting, eight hours of individual supervision, a reference from the supervisor, and a case presentation that includes a written conceptualization and two video recordings of the sessions (International Centre for Emotionally Focused Therapy, 2020). The thorough certification process ensures the clinician's familiarity and fidelity to the EFT model to provide the best possible care for clients.

The EFT Change Process

The EFT model attempts to increase coregulation and secure attachment between couples by leading them through the stages of de-escalation, re-engagement and softening, and consolidation. Four steps comprise the de-escalation stage, including alliance creation, cycle identification, emotional access, and cycle reframe (Johnson, 2004). This stage first calms the elevated synchrony of the couple that is in severe dysregulation. The de-escalation process acknowledges the lack of synchrony that occurs between couples as they move from physiological elevation of conflict and seeks to reframe their interaction patterns through their

attachment needs, activating the VVC (Johnson, 2004; Porges, 2011). Re-engagement and softening involves individuals expanding their own emotional awareness of their more painful experiences in order to elicit a response from their partners (Johnson, 2004). It is through this responsiveness in their feelings of rejection or unworthiness that EFT therapists believe that more secure attachments can develop. In the second stage, the clinician seeks to initiate more synchronous interactions between the couple around each partner's vulnerability by ensuring they are accessible, responsive, and engaged in the process (Johnson, 2004). In the final stage, clients strengthen their attachment bond by having more attuned and responsive conversations around issues that formally triggered a threat response (Johnson, 2004). This final stage emphasizes the flexibility of secure attachment and balanced synchrony, as couples are able to navigate life experiences in a more constructive and connected way because of the regulation of the VVC.

Existing research demonstrates the effectiveness of EFT with couples coping with depression, PTSD, and medical illness with significant increases in forgiveness, sexual satisfaction, and change in attachment behaviors (Wiebe & Johnson, 2016). Previous studies show EFT is effective cross-culturally in terms of race, religion, gender orientation, and sexual orientation (Linhof & Allan, 2019; Cohen Davidovsky, 2019; Chapman & Caldwell, 2012; Furrow, Johnson, & Bradley, 2011). The literature establishes the success of EFT across varied populations and presenting problems. While the impact of EFT on these populations has been shown by literature, it is important for clinicians who utilize this model to increase their knowledge in why it is so effective.

Neurobiological Implications of EFT

From a polyvagal perspective, the attachment emphasis of EFT likely activates the VVC, which soothes the sympathetic nervous system and decreases threat reactivity (Porges, 2011). As couples in EFT become more confident and secure in their attachment bond with their partner, they are less likely to be triggered by the limbic response. In the presence of the safety of their partner, it is no longer necessary for the body to protect itself from danger (Porges, 2011). The safety of their partner allows for more flexibility and adaptability in the midst of difficult emotions or chaotic circumstances, leading to more emotional regulation.

Process research examines the neurobiological impact of EFT within couples that support the polyvagal perspective. The EFT process alters the threat perception while partners are present and when one partner attempts to self-regulate as shown by functional MRI scans (Johnson et al., 2013). Halchuk (2012) studied the impact of the EFT counseling process on couples' functional and structural neurobiology. Baseline for couples' salivary cortisol was established after taking four measurements throughout the day before and after performing a stressful task (Halchuk, 2012). After completing the EFT counseling process, females showed significantly lower baseline cortisol levels before and after performing a stressful task with her partner present (Halchuk, 2012). Additionally, the study also showed the EFT process produces structural changes in emotional circuitry with regard to increased amounts of white matter in the anterior cingulate cortex, which is the area of the brain that connects the limbic system to the prefrontal cortex (Halchuk, 2012). The anterior cingulate cortex connects the areas of the brain that detect and assess threat. This increased matter promotes emotional regulation, as the threat detection system is less reactive. Despite all the research into the neurobiological impact of EFT, there has yet to be a study detecting physiological changes during couples' sessions or in vivo look at the

actual counseling process. Physiological measurements can provide a non-invasive, in vivo picture of the couples' reactivity of the threat response system and potential for synchronous coregulation during the change process. Gathering this information allows clinicians trained in this model to better understand the process of change within couples seeking healing and relief.

Literature Summary

Difficulties with emotional regulation exacerbate other mental health issues and quality of life. Attachment security is positively correlated with emotional regulation capacities, indicating the impact that coregulatory experiences can have on expanding emotional regulation. This connection between attachment and emotional regulation is grounded in polyvagal theory. The activated VVC regulates the sympathetic nervous system, resulting in less reactivity to threat and more flexibility in response to emotions. Therefore, securing attachments could provide an opportunity for clinicians to increase emotional regulation capacities and decrease physiological sympathetic reactivity. EFT develops more secure attachment styles between partners (Wiebe et al., 2017) through emphasizing coregulatory experiences between a couple and therefore would increase emotional regulation capacities. Physiological measurements, such as heart rate, skin temperature, and electrodermal activity, have been established as effective methods to measure perceived threat response. Heart rate variability has been established as an effective measure of emotional regulation. Literature suggests securing attachments through the EFT process of change would result in increased emotional coregulation and less physiological reactivity as evidenced by synchronous and coregulating changes in heart rate, skin temperature, and electrodermal activity as well as increased regulation as evidenced in heart rate variability. This study sought to measure changes in emotional synchrony and regulation as evidenced by physiological constructs to determine the impact of securing attachment through Emotionally

Focused Therapy. This was the first study that seeks to establish effectiveness of a specific therapeutic intervention by using physiological evidence of coregulation through synchrony.

CHAPTER 3

METHODOLOGY

This chapter describes the methodological design of the study on the impact of Emotionally Focused Therapy (EFT) on the coregulatory experiences of couples as measured through physiological synchrony. First, this section discusses the purpose and research question of the study. Then, the quantitative research design of the study and the rationale for this selected design is explained. Next, the chapter provides information regarding the potential participants and data collection processes. In conclusion, the chapter discusses the proposed procedures for analysis and potential threats.

Purpose and Research Question

The purpose of this study is to examine the impact of EFT on couples' emotional coregulation as evidenced by physiological synchrony. The researcher intends to investigate these relationships to improve the understanding of new emotional regulation strategies and of the change process of EFT. Based on prior literature on attachment security and polyvagal theory, the research questions that structured the study were as follows:

1. What impact does Emotionally Focused Therapy have on the couple's physiological synchrony within a counseling session?
    a. H_1: Emotionally Focused Therapy will increase heart rate synchrony between couples within sessions.
    b. H_1: Emotionally Focused Therapy will increase skin temperature synchrony between couples within sessions.
    c. H_1: Emotionally Focused Therapy will increase electrodermal activity synchrony between couples within sessions.

2. What impact does Emotionally Focused Therapy have on the couple's physiological synchrony over eight counseling sessions?
    a. H_1: Emotionally Focused Therapy will establish more synchrony between couples over eight sessions.
    b. H_1: Emotionally Focused Therapy will increase heart rate synchrony between couples over eight sessions.
    c. H_1: Emotionally Focused Therapy will increase skin temperature synchrony between couples over eight sessions.
    d. H_1: Emotionally Focused Therapy will increase electrodermal activity synchrony between couples over eight sessions.
3. What impact does Emotionally Focused Therapy have on the couple's regulatory capacities as measured through heart rate variability over eight sessions?
    a. Heart rate variability will become less correlated between individuals over eight sessions of Emotionally Focused Therapy.

Research Design

In response to these research questions, this dissertation consisted of a bivariate time series design that is cross correlational within intensive longitudinal data (Walls & Schafer, 2006) and observational case studies. A time series design accounts for the consistency of therapy sessions with thousands of data points within the span of an hour long session, which is more frequent than a longitudinal design (Moulder et al., 2018). This study is nonexperimental as it seeks to investigate the natural processes taking place in EFT without experimental manipulation of treatment groups. Within the span of an hour-long session, thousands of data points were collected to provide an accurate trend line for analysis (Moulder et al., 2018). The

data are considered cross correlational because two data sets are distinctly collected and compared for similar trends and shifts in responses to stimuli (Langs, 1999). Cross-correlational, time series designs allow for associations to be detected within real-time measurements of an experience (Derrick & Thomas, 2004). The data in this study were collected via an instrument detecting heart rate, skin temperature, and electrodermal activity. The independent variable of this research question is time within an EFT counseling session, and the dependent variables are heart rate synchrony, electrodermal activity synchrony, and skin temperature synchrony.

This study also consisted of an observational case study offers information into the trends revealed in changes in couples' synchrony over eight sessions of EFT. Using descriptive statistics, the case study is the first to compare measures of synchrony over time to estimate the effectiveness of a specific clinical intervention. The independent variable is time over eight sessions of the EFT counseling process, and the dependent variables are heart rate synchrony, electrodermal activity synchrony, and skin temperature synchrony. This initial case study allows for further studies to build on the potential impact of changes in synchrony over time. Additionally, the changes in heart rate variability will be reported as a case study.

This study investigates the physiological constructs of heart rate, skin temperature, and electrodermal activity, which are objective and variable moment to moment (Stadnitski & Wild, 2019). This supports the use of a bivariate time series as measurements are taken at a high frequency (Stadnitski & Wild, 2019). This high frequency data collection, revealing individual trends and correlational associations between measurements, mirrors the complexity of the ongoing couples' counseling session. Most existing research on psychophysiological experimentation is cross-sectional (Gottman & Levenson, 1988) but is limited in its capacity to show the impact of the moment-by-moment processing because data are only collected at a

single time point or to compare before and after measurements. When interpreting physiological data from the psychotherapy process, Deits-Lebehn et al. (2020) recommends using longitudinal data and utilizing non-intrusive measurements to maintain focus on the counseling change process.

Participants

Sampling Criteria

The researcher selected a couple for the case study based on specific sampling criteria. Inclusive criteria included the receiving of in-person services from an EFT certified therapist in the Northwest Arkansas area, which was made more challenging by the social distancing restrictions recommended during the threat of COVID-19. Exclusion criteria included any medical condition that would produce heart rates too variable to determine an accurate reading, such as chronic atrial fibrillation or second degree heart block as well as the use of an implantable cardioverter defibrillator (Sahadevan et al., 2004). Additional exclusion criterion includes couples who display the primary contraindicators of EFT, including active affairs, abuse, or addiction (Johnson, 2004). These contraindications impede a couple's ability to develop secure attachments with one another and lack the safety necessary for coregulatory experiences (Johnson, 2004). One couple was identified who was willing to participate who met all of these criteria, which was fitting for the exploratory case study research. The selected counselor had over twenty years of counseling experience and is a certified EFT trainer and counselor. The counselor identified the couple as having slight levels of distress but clarified the couple would not be considered clinically distressed. The couple entered treatment with the desire to establish effective conflict resolution skills early in their marriage to build upon throughout the rest of their relationship.

The participants selected for participation were offered a verbal explanation and a written copy of informed consent, allowing them to make an informed decision with regard to their participation. Potential risks of the study included the emotional, relational, and psychological distress associated with the counseling process. The emotional, relational, and psychological intimacy between the couple that is also associated with the counseling process are potential benefits. Additionally, the clinician offered the participants a discount for their participation in the research process.

Participant Demographics

The participants both identified as white, heterosexual, and cisgender. Both participants were 23 years old at the start of data collection. Before beginning this counseling process, the couple both considered themselves to be in an exclusive and committed relationship for three years and one month, living together for the previous seven months. While neither of them had begun counseling sessions with this particular counselor used in the study before data collection, both had previously attended counseling as individuals and as a couple. Neither was currently attending individual counseling during the time of data collection. Neither participants reporting any of the exclusion criteria, reporting no conditions or medications that would produce variable heart rates, extramarital affairs, behaviors that would be considered addictive, or abuse. Both participants reported being extremely satisfied with their sex lives. Within the first session, the clinician recognized Participant 1 as an anxious pursuing attachment style and Participant 2 as an avoidant withdrawing attachment style.

Data Collection

In this section, a thorough description of the data collection is discussed. An overview of sampling procedures is given as well as the procedures to which the researcher adhered to

increase likelihood of replication. The technology used for data collection is also described. Approval from the affiliated university's Institutional Review Board was obtained before beginning data collection.

Setting

Data were collected by the researcher at a private practice located in Northwest Arkansas. One of the executive directors of the private practice is an EFT trainer, supervisor, and certified therapist who facilitated the sessions for the participants and has been practicing EFT for the past fifteen years. The clinician sent an advertising flyer to the couple who contacted the primary researcher. The clients agreed to a consistent appointment time to minimize variability of the measured constructs.

Procedures

Participants completed a demographic questionnaire before completing eight sessions (Appendix A). Eight to ten sessions of EFT have been shown to produce significant change within couples as compared to control groups (Greenberg et al., 1993). There were a two multiple week breaks between data collection in between sessions three and four and six and seven due to travel and recommended social distancing practices during COVID-19. The eight sessions were completed while participants wore an Empatica E4 wristband (Empatica, 2020). Before each session with the therapist, the primary researcher met with the couple for ten minutes before the session to fasten and activate the wristbands on the same wrists of both members of the couple to establish a synchrony baseline. Ten minutes has been established in literature as an appropriate amount of time to establish physiological baselines using wearable detection devices (Twomey, 2014). The baseline measurements were taken within the counseling room to minimize potential stress during the transition from the waiting room. The white coat

effect shows the tendency for physiological arousal during this transition (Lantelme et al., 1998). Establishing the synchrony baseline within the counseling setting attempts to minimize the potential confounding variable of the white coat effect.

The E4 wristbands recorded the physiological measurements and were uploaded to a secured network (Empatica, 2020). Data were uploaded on a password protected storage system to maximize privacy of the participants and downloaded to a password protected external hard drive. In an additional effort to maximize privacy, the researcher assigned each member of the couple a coding number to keep the data anonymous. The coding key was destroyed after data collection was completed. The researcher removed wristbands from participants after each session.

The Empatica E4 Wristband

According to the developer of the wristband, “the E4 is a medical-grade wearable device that offers real-time physiological data acquisition, enabling researchers to conduct in-depth analysis and visualization” (Empatica, 2020). Designed for the purpose of researching medical conditions, such as epilepsy and heart disease, the wristband uses four integrated sensors (an accelerometer, a plethysmograph, an electro-dermal activity sensor, and an infrared thermophile on the wrist) to provide comprehensive feedback into the body’s current functioning (Empatica, 2020). These sensors provide information into both the sympathetic and parasympathetic activation of the body to provide a thorough understanding of the body’s reactive and regulatory experiences (Garbarino et al., 2014). These four sensors provide a more thorough understanding of the body’s functioning and offers a higher frequency samples as compared to other physiological detectors, such as a traditional heart rate monitor or blood pressure cuff (Garbarino et al., 2014).

The detected heart rate is derived from the photoplethysmography of the wristband, recording the heart rate every second (Empatica, 2020). Skin temperature was taken using the E4's temperature sensor on the wrist, which was expressed in degrees on the Celsius scale (Empatica, 2020). Data were taken at 5Hz, which the researcher systematically trimmed to 1Hz to run the data analysis. Electrodermal activity was measured by the E4's electrodermal activity sensor, which was expressed as microsiemens (Empatica, 2020). Data were taken at 5Hz, which the researcher systematically trimmed to 1Hz to run the data analysis. In order to calculate heart rate variability, the researcher uploaded the interval time in seconds between heart beats and the duration in seconds of the inter-beat interval (Empatica, 2020). These data were downloaded and analyzed using Kubios HRV Standard 3.0 to the time-domain and frequency domain results of heart rate variability, which is an established software to calculate heart rate variability (Tarvainen et al., 2014).

Studies indicate the E4 produces valid and reliable measurements of heart rate, skin temperature, electrodermal activity, and heart rate variability (McCarthy et al., 2016; Schuurmans et al., 2020). In a study that compared output between the E4 and a holter portable electrocardiogram, the E4 demonstrated a validity and reliability of .85 (McCarthy et al., 2016). A comparison study between the E4 and a VU-AMS, a lightweight ambulatory device that records changes in heart beat from seven electrodes placed on the chest and back. There were no significant differences reported between the E4 and VU-AMS with regard to heart rate and heart rate variability (Schuurmans et al., 2020). The wristbands have been used to study migraine detection, seizure detection, monitoring for suicidality, stress responses, and heart rate variability to provide preventative care (Koskimaki et al., 2017; Regalia et al., 2019; Kleiman et al., 2019; Graham et al., 2019; Pfeiffer, 2019; Pijeira-Diaz et al., 2018). In addition to being used by

researchers, the E4 is also used by individuals, especially with epilepsy, to monitor their personal physiological changes as it offers a live streaming mode to a personal cellular phone or computer (Empatica, 2020). This streaming mode lasts just over 24 hours while it can record for nearly 32 hours and does require two hours of charging time for maintenance (Empatica, 2020). The E4 is simple to use as no calibration is necessary due to the integrated sensor technology (Empatica, 2020). A pilot study has been run during counseling sessions with the researcher to ensure validity and reliability of the instrument. From the pilot study, the researcher gained awareness into best practice for procedures, including established a ten minute baseline that would not be included in the analysis, taking the baseline within the counseling setting, and proper securing methodology of the device.

Data Analysis

In this section, the proposed data analysis procedures are discussed that best answered the research question. First, procedures for data cleaning are explained. The proposed analysis is explained as well as the necessary assumption checking procedures. Threats to validity are also reviewed to understand the study's potential to produce valid results.

Data Cleaning

The demographic survey was coded into categorical variables. All of the physiological data were recorded and analyzed as continuous variables. The data were visually reviewed by the researcher for any concerning outliers that may indicate errors in the E4's measurements. There were no outliers detected in the data, which was not surprising as the E4 uses an algorithm that removes incorrect measurements (Empatica, 2019). This analysis generates estimated values by randomly shuffling recordings that were detected at high frequencies (Tschacher & Haken, 2019). Using Madia's test for normality, the researcher ensured the assumption of bivariate

normality was met. Measures of electrodermal activity and skin temperature were originally taken at 5Hz, but the researcher manually thinned the data systematically to reflect these measurements taken at 1Hz. This thinning made the constructs more conducive to the synchrony analysis.

Analyses

Due to the multiple research questions, it was necessary to utilize multiple forms of data analyses in order to most effectively answer the research questions.

Research Question 1: What impact does Emotionally Focused Therapy have on couples' physiological synchrony within a counseling session?

To show the synchrony that occurs within session, the researcher used surrogate synchrony for heart rate, electrodermal activity, and skin temperature for every session. Surrogate synchrony (SUSY, cf. www.embodiment.ch) assesses the strength of the relationship between two time-dependent variables, which in this case are the physiological measurements of each partner of the couple. By averaging lagged, linear correlations between time-dependent variables, SUSY estimates the synchrony that occurs between variables with continuous data points (Tschacher & Meier, 2020). Research studies exploring the physiological synchrony of heart rate or electrodermal activity of a dyad often use SUSY analysis (Tschacher et al., 2014; Ramseyer & Tschacher, 2011; Coutinho et al., 2019).

This approach cuts the time series into a select number of segments and then calculates all cross-correlations within those segments (Tschacher & Haken, 2019). These segmented cross-correlations are also computed within a prespecified lag time (Tschacher & Haken, 2019). A 5-second lag time was selected, and therefore, a 10-second window of cross-correlations would be completed (Tschacher & Haken, 2019). All of these cross-correlations are transformed into z-

scores to standardize the data using Fisher's z (Silver & Dunlap, 1987). The assumption of bivariate normality for both datasets must be met (Tschacher & Haken, 2019). If bivariate normality is tenable, the transformed z-scores of all segment cross-correlations can then be aggregated without risk of underestimation (Silver & Dunlap, 1987). The segment z-scores were then aggregated across the entire bivariate time series to obtain the synchrony statistic (Tschacher & Meier, 2020). This observed synchrony statistic reflects the aggregated lagged, linear correlation between the two variables.

To calculate effect size, a simulated sampling distribution of the surrogate synchrony statistic is created via segment shuffling to offer a control with which to compare the observed statistic. This comparison indicates the strength of the relationship between variables that is not according to chance (Tschacher & Haken, 2019). Cross-correlations are calculated between all possible permutations of time segments. Potential combinations of a set of data containing n segments would be $n\ (n - 1)$ (Tschacher & Meier, 2020). The cross-correlations that are generated are also converted to z-scores using Fisher's z and can then be averaged to calculate the pseudo surrogate synchrony statistic and the standard deviation of this simulated sampling distribution of surrogate synchrony statistics (Tschacher & Meier, 2020). The effect sizes were calculated by finding the difference between the observed overall z score and the pseudo z score and dividing by the standard deviation of the pseudo z-score (Tschacher & Meier, 2020). The effect sizes from SUSY produces a score similar to Cohen's *d*, in which 0.20 is a small effect size, 0.50 is a medium effect size, and 0.80 is a large effect size (Cohen, 1988).

SUSY offers a method of averaging all lagged, linear cross-correlations between two time-dependent variables without skewing the data and therefore provides an accurate picture of the synchronous changes between the two variables and, thus, between bivariate time series.

SUSY is run by using an online platform that utilizes R version 3.0.2 (Tschacher, 2016). This analysis has been used to establish the physiological synchrony between dyads, especially within the counseling relationship (Tschacher et al., 2014; Ramseyer & Tschacher, 2011). It has been established as an effective assessment of the physiological synchrony that occurs between clients and clinicians within a counseling setting (Tschacher & Meier, 2020). Its calculation of the average of lagged, linear cross correlations and a measure of effect size make SUSY an appropriate statistical approach to assess this research question.

Research Question 2: What impact does Emotionally Focused Therapy have on couples' physiological synchrony over eight counseling sessions?

To answer the research questions regarding changes in couples' synchrony over time, the researcher used one-sample t-tests of the effect sizes across the eight sessions for heart rate synchrony, electrodermal activity, and skin temperature. The assumptions for one-sample t-tests were met as the dependent variables are continuous, independent, approximately normally distributed, and had all outliers removed. The null hypothesis was set to zero, which would indicate no significant synchrony. This statistical analysis has been used in previous literature measuring the physiological synchrony effect sizes over time (Coutinho et al., 2021; Coutinho et al., 2019; Roman-Juan et al., 2020).

Research Question 3: What impact does Emotionally Focused Therapy have on the couple's regulatory capacities as measured through heart rate variability over eight sessions?

The time-domain results and frequency results were calculated using Kubios 3.0 Standard software for both individuals over the eight sessions. The primary research ran a linear regression of the LF/HF ratios of Participants 1 and 2 to determine the relationship between the couple's heart rate variabilities. The researcher ensured the assumptions for the linear regression

were met, including the linear relationship between variables, multivariate normality without multicollinearity, no auto-correlation, and homoscedasticity (Salkind, 2014). Although the sample size was low, the primary researcher deemed it to be the most appropriate data analysis.

Due to the small sample size of participants of the case study, it was not possible to establish significant conclusions regarding the trend over time for couples in EFT. Due to the ethical obligations of the counselors to not delay requested treatment and the limited access to measurement tools, it is not currently feasible to establish a control measure with which to compare the treatment effect. The descriptive statistics offered in this study are the first research of its kind to compare synchrony statistics over time within a specific counseling process.

Summary

Given the three research questions that guided the study, the researcher selected a mixed design method of autonomic nervous system measures over the course of eight EFT sessions. Careful consideration was given to the inclusion and exclusion criteria to minimize confounding variables and the data collection instrument. In order to answer the research questions, the SUSY analysis, a one-sample t-test, and linear regression as the most appropriate data analyses. Assumptions for all tests were met.

CHAPTER FOUR

RESULTS

This chapter presents the results of the study. It includes the SUSY analysis for heart rate synchrony, electrodermal activity synchrony, and skin temperature synchrony across eight sessions of EFT. It also shares the results of a one-sample t-test of the average of the effect sizes that were recorded from the SUSY analyses for each session and variable. The chapter also describes the results of the time-domain and frequency-domain results of heart rate variability as well as the linear regression between the couples LF/HF ratios.

Research Question 1: What impact does Emotionally Focused Therapy have on couples' physiological synchrony within a counseling session?

In order to answer the first research question, the researcher utilized SUSY analysis to measure the degree to which physiological data points were synchronized between the couple. For each session, the researcher ran the SUSY analysis for heart rate, electrodermal activity, and skin temperature.

Session 1

Heart rate synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -0.754 (*SD*=.007), which indicates a lack of synchronous relationship between the couple with regard to heart rate in the first session. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -3, 0, and 4 second lags as shown in Figure 2.

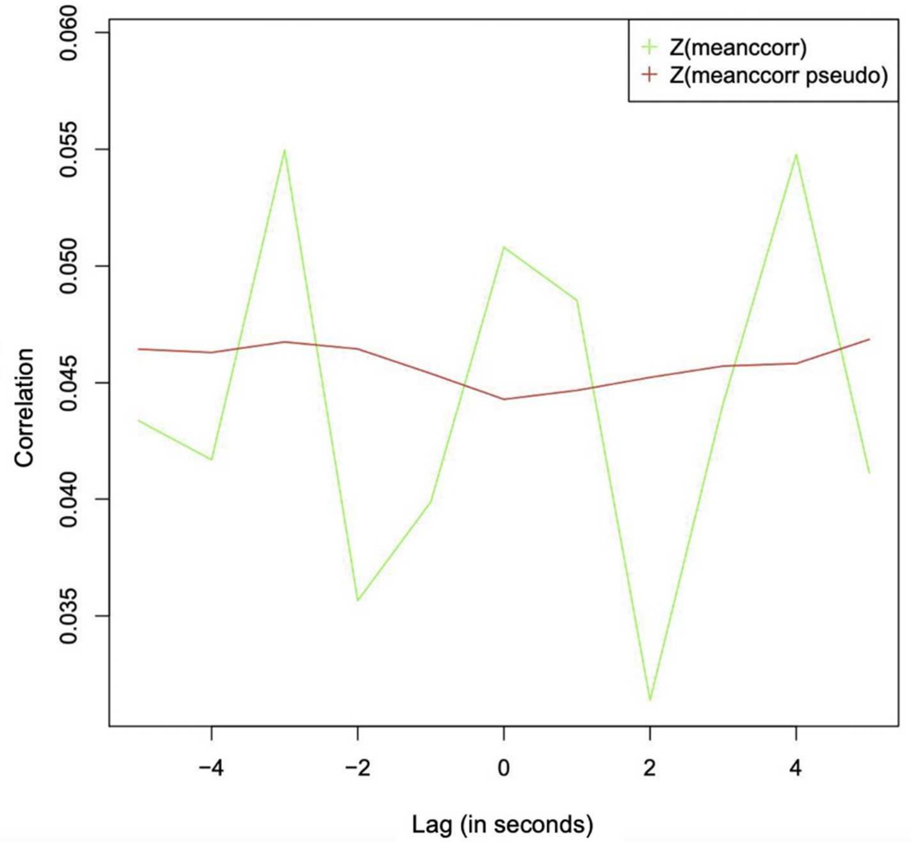

Figure 2
HR Lag Synchrony Session 1

Additionally, the heart rate synchrony measured during the first session appeared to have greater synchrony than would be expected under a null hypothesis during six phases throughout the session as shown in Figure 3, including segments 8-12 and 17-18. This segment breakdown indicates a lack of consistent synchrony occurring across the hour-long session as the couple vacillated consistently between synchronous and asynchronous heart rates.

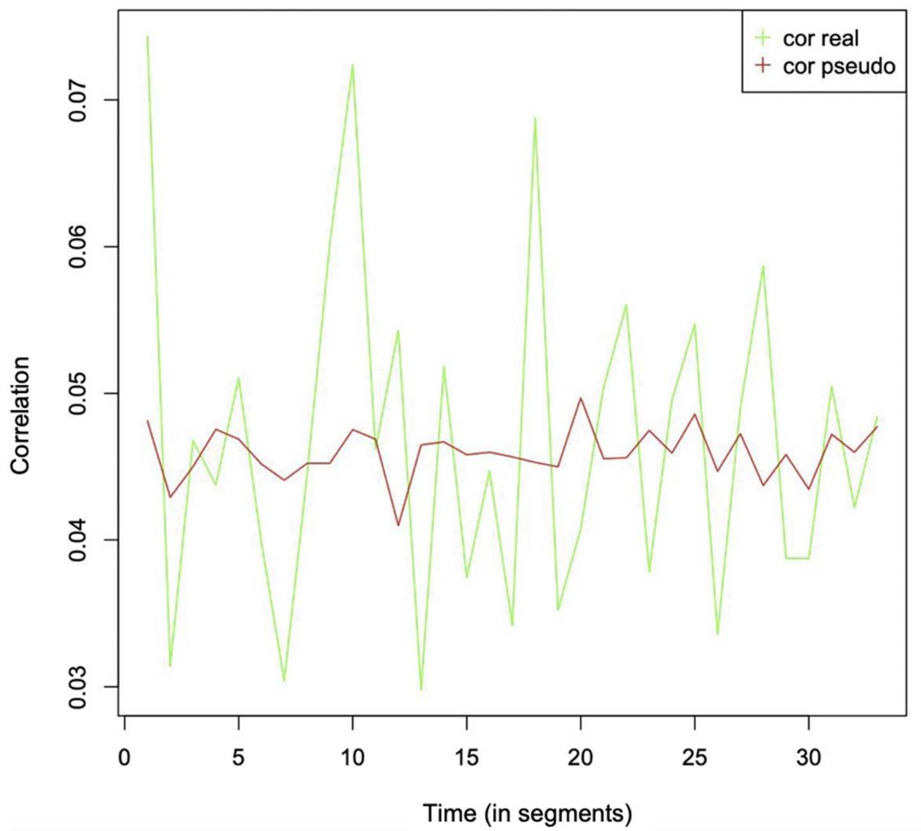

Figure 3
HR Segment Synchrony Session 1

Electrodermal activity synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}=1.073 (*SD*=0.002), which indicates a large effect size. This effect size indicates a high degree of synchrony that took place between the couple during the first session with regard to electrodermal activity. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -4, -3, and 5 second lags as shown in Figure 4.

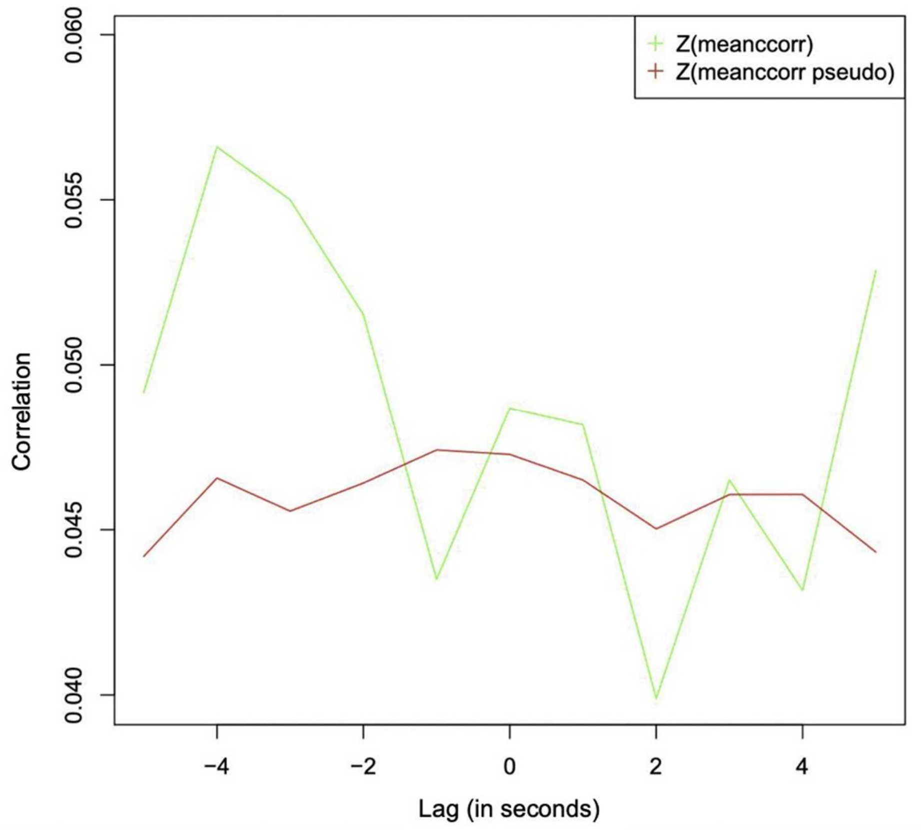

Figure 4
Electrodermal activity Lag Synchrony Session 1

Additionally, the electrodermal activity synchrony measured during the first session appeared to have greater synchrony than would be expected under a null hypothesis during four phases throughout the session as shown in Figure 5, most notably from segments 11-17.

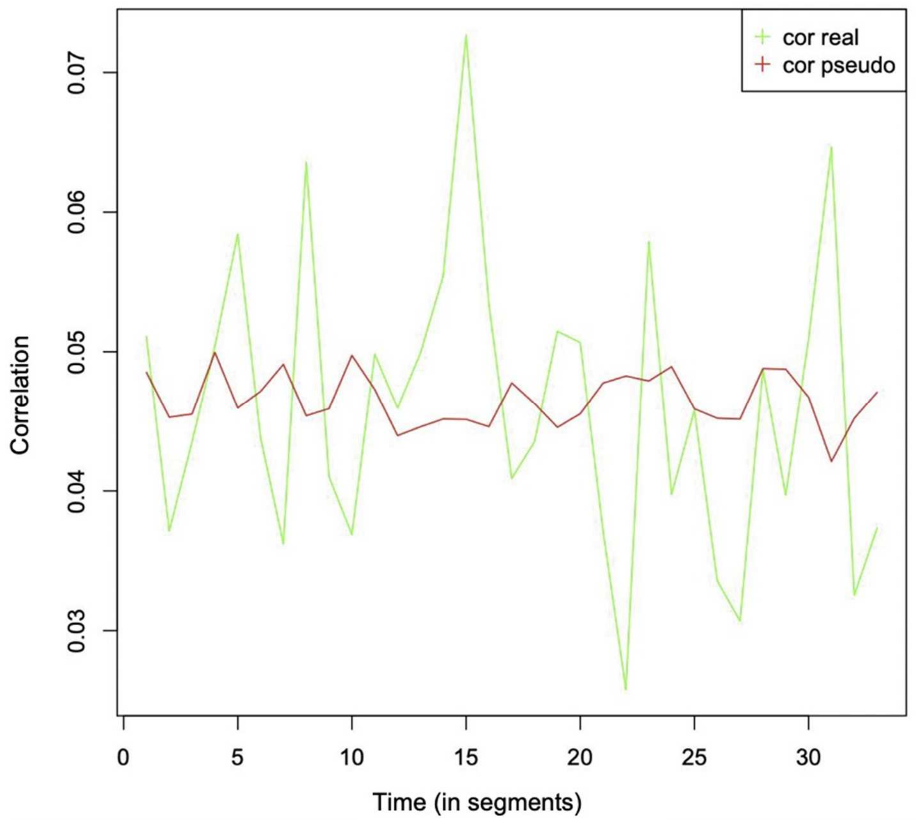

Figure 5
Electrodermal Activity Segment Synchrony Session 1

Skin temperature synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -1.884 (*SD*=0.007), which indicates a lack of synchronicity between the couple's skin temperature. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around

-4, 1, and 4 second lags as shown in Figure 6.

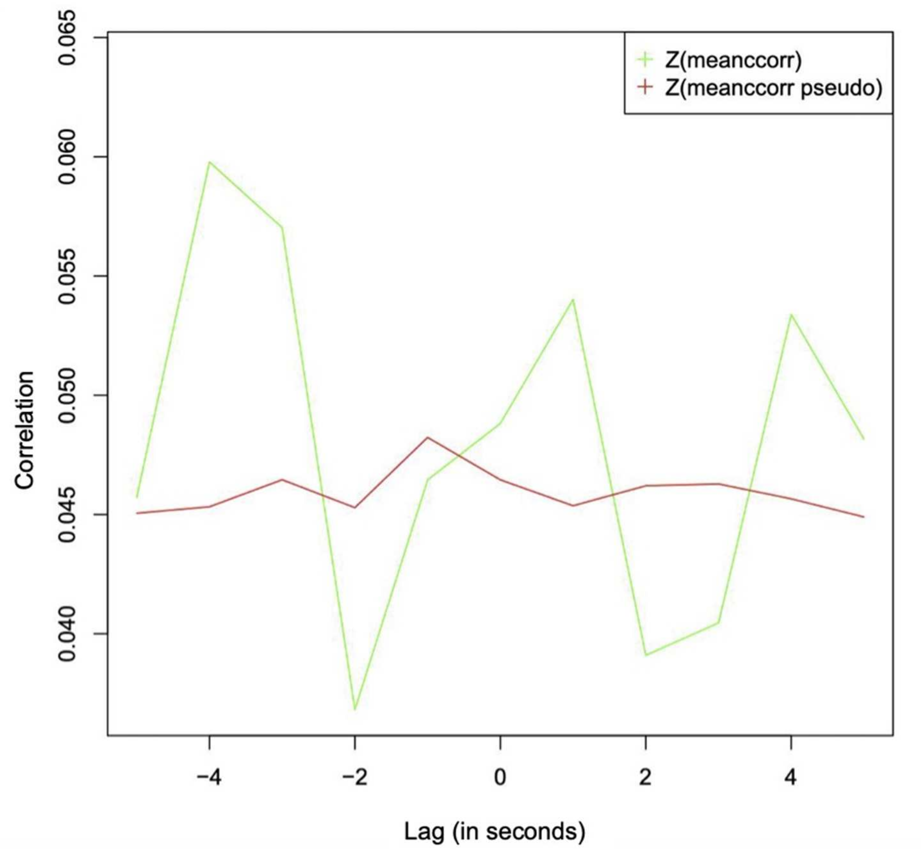

Figure 6
Skin Temperature Lag Synchrony Session 1

Additionally, the skin temperature synchrony measured during the first session appeared to have greater synchrony than would be expected under a null hypothesis during four phases throughout the session as shown in Figure 7.

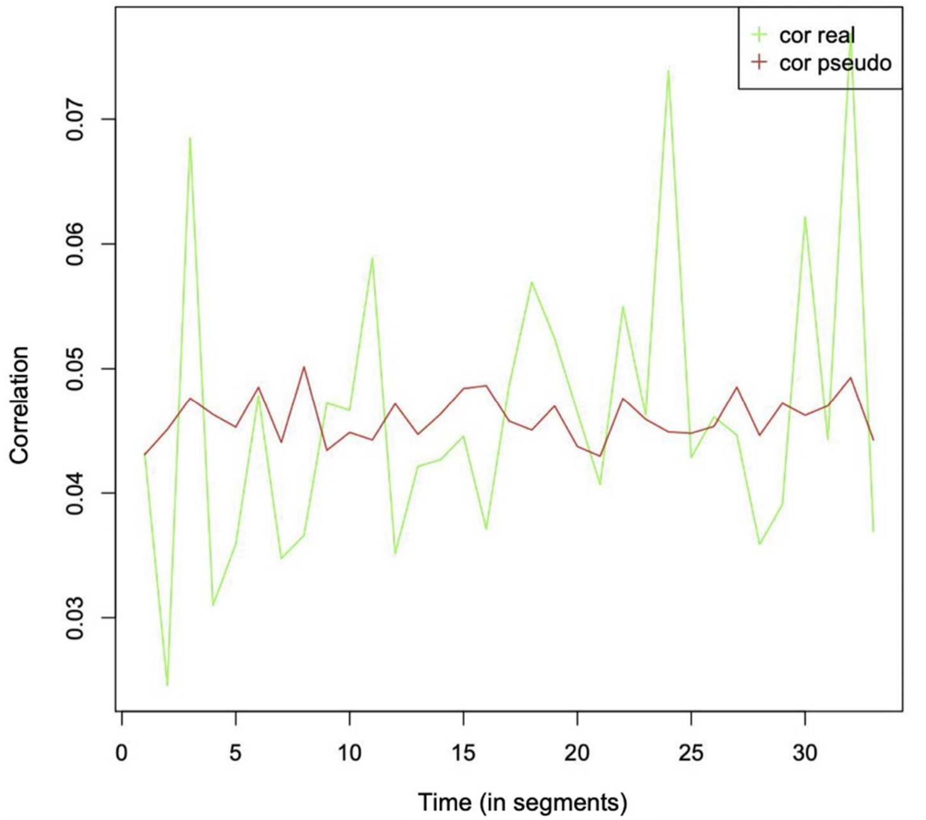

Figure 7
Session 1 Skin Temperature Segment Synchrony

Session 2

Heart rate synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}=1.44 (*SD*=.008), which indicates a very large effect size. This effect size indicates a high degree of synchrony that took place between the couple during the second session with regard to heart rate. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -3, 3, and 4 second lags as shown in Figure 8 in Appendix B. Additionally, the heart rate synchrony measured during the second session appeared to have greater synchrony than would be expected under a null hypothesis

during several segments throughout the session as shown in Figure 9 in Appendix B, including segments 0-5, 8-11, 13-18, and 26-32.

Electrodermal activity synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -2.038 (*SD*=0.007), which a lack of synchronous relationship between the couple's electrodermal activities during session 2. However, the results indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -1 and 1 second lags as shown in Figure 10 in Appendix B. Additionally, the electrodermal activity synchrony measured during the second session appeared to have greater synchrony than would be expected under a null hypothesis during several segments throughout the session as shown in Figure 11 in Appendix B.

Skin temperature synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= 0.302 (*SD*=0.007), which indicates a small effect size. This effect size indicates a small degree of synchrony that took place between the couple during the second session with regard to skin temperature. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -4, -1, 1, 2, and 3 second lags as shown in Figure 12 in Appendix B. Additionally, the skin temperature synchrony measured during the second session appeared to have greater synchrony than would be expected under a null hypothesis during six phases throughout the session as shown in Figure 13 in Appendix B.

Session 3

Heart rate synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -0.706 (*SD*=.006), which indicates a lack of synchronous relationship between the couple's heart rate. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around a -4 second lag as shown in Figure 14 in Appendix B. Additionally, the heart rate synchrony measured during the third session appeared to have greater synchrony than would be expected under a null hypothesis during six phases throughout the session, including segments 3-8, 15-17, and 24-28, as shown in Figure 15 in Appendix B.

Electrodermal activity synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -2.520 (*SD*=0.005), which indicates a lack of synchronous relationship between the electrodermal activities of the couple. However, the results indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -2, -1, and 0 second lags as shown in Figure 16 in Appendix B. Additionally, the electrodermal activity synchrony measured during the third session appeared to have greater synchrony than would be expected under a null hypothesis during four phases throughout the session, including segments 3-5, 18-23, and 30-33 as shown in Figure 17 in Appendix B.

Skin temperature synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -1.310 (*SD*=0.006), which indicates a lack of synchronous relationship between the skin temperatures of the couple. The results specifically indicated that the observed

synchrony was greater than what would be expected under a null hypothesis around -2 and 3 second lags as shown in Figure 18 in Appendix B. Additionally, the skin temperature synchrony measured during the third session appeared to have greater synchrony than would be expected under a null hypothesis during six phases throughout the session, including segments 8-12, 15-17, and 23-26 as shown in Figure 19 in Appendix B.

Session 4

Heart rate synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -2.357 (*SD*=.004), which indicates a lack of synchronous relationship between the couple with regard to heart rate during the fourth session. However, the results show that the observed synchrony was greater than what would be expected under a null hypothesis around a 2 second lag as shown in Figure 20 in Appendix B. Additionally, the heart rate synchrony measured during the fourth session appeared to have greater synchrony than would be expected under a null hypothesis during five phases throughout the session as shown in Figure 21 in Appendix B, especially during segments 10-13.

Electrodermal activity synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -2.134 (*SD*=0.006), which conveys a lack of synchronous relationship between the electrodermal activities of the couple during the fourth session. However, the results indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -3, -2, and -1 second lags as shown in Figure 22 in Appendix B. Additionally, the electrodermal activity synchrony measured during the fourth session appeared to have greater

synchrony than would be expected under a null hypothesis during four phases, including segments 6-10, 19-22, and 24-26 as shown in Figure 23 in Appendix B.

Skin temperature synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -0.151 (*SD*=0.005), which indicates a lack of synchronous relationship between the skin temperatures of the couple. However, the results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -3, -1, 0, 1, and 2 second lags as shown in Figure 24 in Appendix B. Additionally, the skin temperature synchrony measured during the fourth session appeared to have greater synchrony than would be expected under a null hypothesis during several segments, including segments 4-8 and 22-24, as shown in Figure 25 in Appendix B.

Session 5

Heart rate synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= 1.539 (*SD*=.006), which indicates a high effect size. This effect size indicates a high degree of synchrony that took place between the couple during the fifth session with regard to heart rate. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -4 and 2 second lags as shown in Figure 26 in Appendix B. Additionally, the heart rate synchrony measured during the fifth session appeared to have greater synchrony than would be expected under a null hypothesis during seven phases throughout the session, including segments 3-9, 17-22, and 28-30, as shown in Figure 27 in Appendix B.

Electrodermal activity synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -0.571 (*SD*=0.006), which reveals a lack of synchronicity between the couple with regard to electrodermal activity. The results indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -4, -3, -1, 0, 1, 3, and 4 second lags as shown in Figure 28. Additionally, the electrodermal activity synchrony measured during the fifth session appeared to have greater synchrony than would be expected under a null hypothesis during several segments throughout the session as shown in Figure 29 in Appendix B.

Skin temperature synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= 0.796 (*SD*=0.009), which indicates a medium effect size. This effect size indicates a medium degree of synchrony that took place between the couple during the fifth session with regard to skin temperature. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -4, -3, -2, -1, 0, 1, 2, and 3 second lags as shown in Figure 30 in Appendix B. Additionally, the skin temperature synchrony measured during the fifth session appeared to have greater synchrony than would be expected under a null hypothesis during five phases, including segments 12-13, 16, 23, 25, and 26-32, as shown in Figure 31 in Appendix B.

Session 6

Heart rate synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}=-0.546 (*SD*=.006), which indicates a lack of a synchronous relationship between the couple with regard to heart rate. However, the results indicated that the observed synchrony was

greater than what would be expected under a null hypothesis around 0, 1, 2, and 4 second lags as shown in Figure 32 in Appendix B. Additionally, the heart rate synchrony measured during the sixth session appeared to have greater synchrony than would be expected under a null hypothesis during four phases throughout the session, including 10-12, 22-24, and 28-33, as shown in Figure 33 in Appendix B.

Electrodermal activity synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -0.352 (*SD*=0.002), which indicates lack of synchronicity between the couple's electrodermal activity during the sixth session. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around 1, 2, and 4 second lags as shown in Figure 34. Additionally, the electrodermal activity synchrony measured during the sixth session appeared to have greater synchrony than would be expected under a null hypothesis during five phases throughout the session as shown in Figure 35 in Appendix B, including segments 3-5, 10-13, and 16-20.

Skin temperature synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -0.747 (*SD*=0.005), which indicates a lack of synchronous relationship between the couple's skin temperature during the sixth session. The results indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -3, -1, 0, 1, 2, and 3 second lags as shown in Figure 36 in Appendix B. Additionally, the skin temperature synchrony measured during the sixth session appeared to have greater synchrony than would be expected under a null hypothesis during five phases throughout the session, including segments 3-8 and 16-18, as shown in Figure 37 in Appendix B.

***Session** 7*

Heart rate synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}=2.474 (*SD*=.007), which indicates a very large effect size. This effect size indicates a strong degree of synchrony that took place between the couple during the seventh session. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -1, 0, 3, and 4 second lags as shown in Figure 14 in Appendix B. Additionally, the heart rate synchrony measured during the seventh session appeared to have greater synchrony than would be expected under a null hypothesis during six segments throughout the session, including segments 3-8, 15-17, 24-27, and 27-31 as shown in Figure 39 in Appendix B.

Electrodermal activity synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= -1.496(*SD*=0.008), which indicates a lack of synchrony between the couple's electrodermal activity during the seventh session. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -3, -2, 0, and 3 second lags as shown in Figure 40. Additionally, the electrodermal activity synchrony measured during the seventh session appeared to have greater synchrony than would be expected under a null hypothesis during six phases throughout the session, including segments 5-8, 20-22, and 28-30 as shown in Figure 41 in Appendix B.

Skin temperature synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= 1.113 (*SD*=0.004), which indicates a large effect size. This effect size

indicates a high degree of synchrony that took place between the couple during the seventh session with regard to skin temperature. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -4, -2, -1, 0, and 4 second lags as shown in Figure 42. Additionally, the skin temperature synchrony measured during the seventh session appeared to have greater synchrony than would be expected under a null hypothesis during five phases throughout the session as shown in Figure 43, which included segments 16-19, 20-21, and 25-27.

Session 8

Heart rate synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}=1.333 (*SD*=.008), which indicates a very large effect size. This effect size indicates a strong degree of synchrony that took place between the couple during the eighth session. The results specifically indicated that the observed synchrony was greater than what would be expected under a null hypothesis around 0, 2, 3, and 4 second lags as shown in Figure 44 in Appendix B. Additionally, the heart rate synchrony measured during the eighth session appeared to have greater synchrony than would be expected under a null hypothesis during eight phases throughout the session, including segments 9-18, 20-24, and 27-33 as shown in Figure 45 in Appendix B.

Electrodermal activity synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= 0.163(*SD*=0.003), which indicates a very small effect size. This effect size indicates a very low degree of synchrony that took place between the couple during the eighth session with regard to electrodermal activity. The results specifically indicated that the

observed synchrony was greater than what would be expected under a null hypothesis around -2, -1, 0, 2, and 3 second lags as shown in Figure 46. Additionally, the electrodermal activity synchrony measured during the eighth session appeared to have greater synchrony than would be expected under a null hypothesis during six phases throughout the session, including segments 8-16 and 27-30 as shown in Figure 47 in Appendix B.

Skin temperature synchrony was calculated using sampling frequency at one Hz, a segment size of five minutes, and a cross-correlation window of five seconds. The non-absolute effect size was ES_{noabs}= 0.568 (*SD*=0.003), which indicates a medium effect size. This effect size indicates a medium degree of synchrony that took place between the couple during the eighth session with regard to skin temperature. The results indicated that the observed synchrony was greater than what would be expected under a null hypothesis around -1, 0, and 1 second lags as shown in Figure 48. Additionally, the skin temperature synchrony measured during the eighth session appeared to have greater synchrony than would be expected under a null hypothesis during eight phases throughout the session as shown in Figure 49 in Appendix B, which included segments 5-8, 9-12, 24-27, and 28-31.

Research Question 2: What impact does Emotionally Focused Therapy have on couples' physiological synchrony over eight counseling sessions?

Over the course of eight sessions, the measures of physiological synchrony did not yield consistent results as shown in Table 1. Effect sizes varied from very small to very large and indicated synchrony and a lack of synchrony throughout the eight sessions. Heart rate and skin temperature demonstrated similar effect sizes over the course of eight sessions. When heart rate had an effect size, so did skin temperature. Six of the eight sessions indicated a lack of electrodermal activity between the couple.

Table 1
Synchrony statistics and effect sizes over eight weeks of EFT

	Heart rate		Electrodermal activity		Skin temperature	
Session	Synchrony statistic (z)	Effect size	Synchrony statistic (z)	Effect size	Synchrony statistic (z)	Effect size
1	-0.002	-0.754	0.001	1.074	-0.003	-1.884
2	0.003	1.441	-0.003	-2.038	0.001	0.302
3	-0.001	-0.706	-0.004	-2.520	-0.001	-1.310
4	-0.003	-2.357	-0.004	-2.134	0.001	-0.151
5	0.002	1.539	-0.001	-0.571	0.001	0.796
6	-0.003	-0.546	-0.001	-0.352	-0.001	-0.747
7	0.004	2.474	-0.002	-1.496	0.001	1.113
8	0.003	1.333	-0.001	0.163	0.005	0.568

The effect sizes of heart rate synchrony were very high when they were present. The average non-absolute effect size for heart rate synchrony was ES_{noabs}=0.303 (*SD*=1.627), which is not significantly different from zero in a one-sample t-test ($t(7)=0.53$, $p=0.615$). Most of the electrodermal activity synchrony effect sizes were negative, indicating a lack of synchrony. The average non-absolute effect size for electrodermal activity synchrony was ES_{abs}= -0.984 (*SD*=1.264), which is not significantly different from zero in a one-sample t-test ($t(7)= -2.20$, $p=0.063$). The effect sizes of skin temperature indicated the small to medium levels of synchrony between the couple. The average non-absolute effect size synchrony for skin temperature was ES_{noabs}= -0.164(*SD*=1.063), which is not significantly different from zero in a one-sample t-test ($t(7)= -0.440$, $p=0.676$).

Table 2
One-sample t-test of synchrony effect sizes

Physiological Measurement	Effect size mean (no abs)	Effect size SD	DF	t-value	*p* value
Heart rate	0.303	1.627	7	0.53	0.615
Electrodermal activity	-0.984	1.264	7	-2.20	0.063
Skin temperature	-0.164	1.063	7	-0.44	0.676

The SUSY analysis revealed a lack of significant synchrony that occurred over the eight sessions of Emotionally Focused Therapy with regard to heart rate, electrodermal activity, and skin temperature.

Research Question 3: What impact does Emotionally Focused Therapy have on individual's regulatory capacities as measured through heart rate variability over eight sessions?

Over the eight sessions, the time-domain measurements of Participant 1 indicated an overall decrease in heart rate variability as shown in Table 3. Especially compared to the first two sessions, there was an increase in the amount of time between heart beats, indicating a greater regulatory capacity in Participant 1 over the course of eight sessions. There were more consistent heart rates at lower rates after participation in EFT.

Table 3
Participant 1 HRV time-domain results over eight sessions of EFT

Session	Mean RR (ms)	Mean HR (bpm)	Min HR (bpm)	Max HR (bpm)	SDNN (ms)	RMSSD (ms)	NN50 (beats)	pNN50 (%)
1	1737	60.135	51.22	105.43	1813.4	2470.6	709	68.77
2	3530	78.454	62.48	129.48	2629.8	4055.4	229	88.08
3	1590	67.168	53.13	90.53	1518.8	2112.3	521	56.26
4	1555	81.855	62.73	94.70	1757.4	2172.2	1074	61.09
5	1616	75.639	62.77	87.20	1758.0	2320.8	841	60.16
6	1650	65.348	57.22	88.72	1615.5	2140.1	889	56.77
7	1364	64.831	59.18	81.92	1347.1	1838.6	916	60.34
8	1294	64.966	57.50	90.80	1420.9	1828.4	734	53.50

In addition to increasing the amount of time between heart beats in Participant 1, there was also a slight decrease in high frequency heart beats and increase in low frequency heart beats as shown in Table 4, which indicates decreased regulatory capacities.

Table 4
Participant 1 HRV frequency-domain results over eight sessions of EFT

Session	VLF Peak Frequency (0.00-0.04)	LF Peak Frequency (0.04-0.15)	HR Peak Frequency (0.15-0.40)	Total power (ms^2)	Total power (log)	LF/HF ratio
1	0.037	0.053	0.150	4183865	15.247	5.621
2	0.040	0.040	0.163	4618133	15.346	4.685
3	0.037	0.063	0.157	2879900	14.873	5.693
4	0.040	0.040	0.150	3519504	15.074	5.867
5	0.040	0.053	0.150	3585033	15.092	5.434
6	0.033	0.040	0.150	3160121	14.966	5.275
7	0.040	0.040	0.150	2441628	14.708	5.024
8	0.040	0.047	0.170	2490631	14.728	5.336

Participant 2 demonstrated a decreased amount of time between heart rates and higher heart rates over eight sessions as shown in Table 5, which indicates decreased regulation.

Table 5
Participant 2 HRV time-domain results over eight sessions of EFT

Session	Mean RR (ms)	Mean HR (bpm)	Min HR (bpm)	Max HR (bpm)	SDNN (ms)	RMSSD (ms)	NN50 (beats)	pNN50 (%)
1	3906	81.366	57.900	101.85	2467.7	3389.4	375	84.08
2	4062	78.099	61.36	92.33	2533.8	3580.5	182	85.85
3	9206	80.126	58.05	125.22	2790.5	4110.2	297	90.27
4	3527	81.653	62.80	116.42	2151.2	2926.9	663	76.29
5	2624	82.312	67.05	98.07	2140.6	2929.4	744	74.10
6	8681	79.527	54.97	118.48	2117.1	2887.4	157	80.93
7	11325	79.838	56.5	125.15	2967.0	4248.2	185	88.52
8	10687	86.017	58.23	113.07	3254.7	4782.3	128	95.52

Participant 2 also showed an increase in high frequency heart beats and decrease in low frequency heart beats. These measurements also indicate a decreased regulatory capacity over the eight sessions.

Table 6
Participant 2 HRV frequency-domain results over eight sessions of EFT

Session	VLF Peak Frequency (0.00-0.04)	LF Peak Frequency (0.04-0.15)	HR Peak Frequency (0.15-0.40)	Total power (ms^2)	Total power (log)	LF/HF ratio
1	0.040	0.047	0.153	3531804	15.077	5.379
2	0.040	0.043	0.150	3920565	15.182	5.801
3	0.040	0.040	0.150	467043	14.576	5.598
4	0.037	0.047	0.167	2766363	14.833	5.454
5	0.040	0.060	0.160	3490543	15.066	4.998
6	0.040	0.057	0.153	1005917	13.821	5.601
7	0.033	0.057	0.150	2048448	14.533	5.759
8	0.040	0.040	0.150	2916240	14.886	5.308

The researcher conducted a linear regression analysis to determine if LF/HR ratios of Participants 1 and 2 were correlated. There was not a significant relationship reported between the two ($F(2, 8) = 3.60$, p=0.107). The overall regression correlation (r) was not significantly different from zero at -0.612, indicating 37% of the variability in Participant 1's LF/HF ratio was accounted for by Participant 2's LF/HF ratio. The trends in LF/HF ratio can be seen in Figure 50.

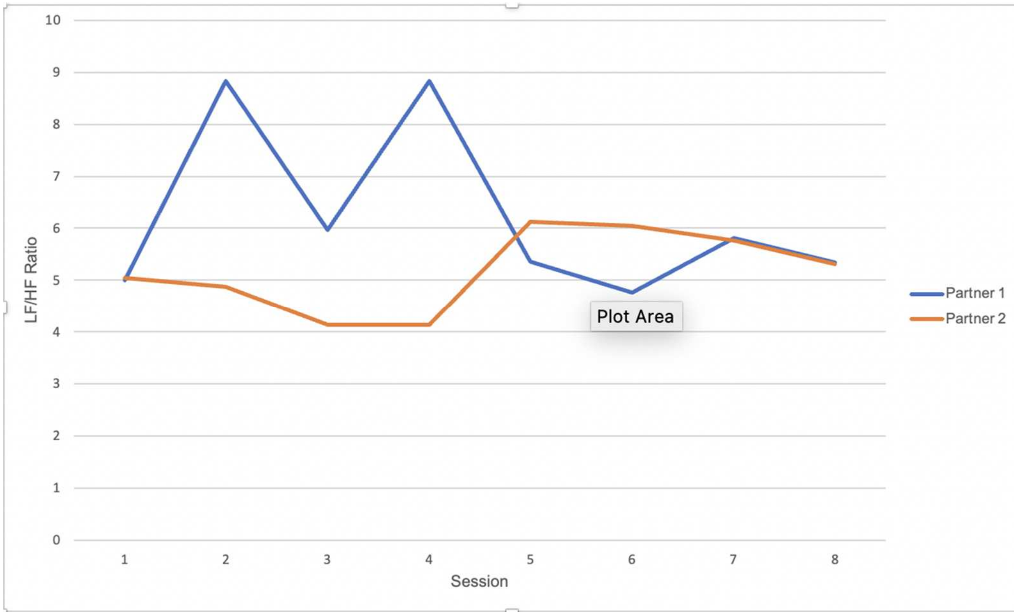

Figure 50
Participant 1 and 2 LF/HF Ratio

Summary

SUSY did reveal small to large synchrony effect sizes for 25% with regard to electrodermal activity and 50% of the sessions with regard to heart rate and skin temperature. However, the strength and consistency of the effect sizes prevented synchrony within the data from being significant according to the one-sample t-test. The linear regression of the couples' LF/HF ratio indicated a negative relationship but not significantly so. Inferences from these results are drawn in the following chapter.

CHAPTER FIVE

DISCUSSION

This study investigated the effects of Emotionally Focused Therapy (EFT) on a couple's coregulatory tendencies during eight sessions over several weeks. Specifically, the coregulatory tendencies were measured through physiological synchrony of heart rate, electrodermal activity, skin temperature, and heart rate variability from a couple in EFT counseling. Existing research into physiological synchrony demonstrates physiological mirroring occurs within the autonomic nervous system during empathic interaction (Ax, 1964; Decety & Jackson, 2004). This mirroring is also known as emotional contagion as the emotional state of one member of the dyad tends to impact the second member of the dyad (Coutinho et al., 2014). This existing research of the counseling process demonstrates the coregulatory effects of the therapeutic process, which can serve to increase emotional regulation within the couple and the individual (Porges, 2011).

When interpreting physiological data from the psychotherapy process, Deits-Lebehn et al. (2020) recommends exercising caution during interpretation due to the complexity involved in interpretation, which was carefully considered when evaluating the previously discussed results. Additionally, due to the case study sample size and limited number of sessions, there was a limited capacity for the data to yield significant results. Further study with greater sample sizes and number of sessions would be required to draw more significant conclusions about physiological co-regulation during EFT.

Heart Rate

Four of the eight sessions indicated a strong degree of synchrony between the couple with regard to heart rate with very large effect sizes. However, the other four sessions demonstrated a complete lack of synchronicity between the couple. This lack of consistency indicates the in

synchrony and out of synchrony vacillation with regard to heart rate that occurred between the couple over the course of eight sessions of EFT.

Existing research suggests this lack of heart rate synchrony may actually be the result of adopting a more empathic response to their partner's experience. Voutilainen et al. (2018) found that the heart rate of a person extending empathy increases while the heart rate of the person receiving empathy decreases, which could account for the lack of synchrony during the course of the sessions. Therefore, the lack of significant synchrony between the couple could indicate alternating moments of empathy that is being given by one partner and being received by the other. Additionally, the goals of stage one of the EFT change process de-escalate the high levels of conflict couples often enter the counseling process with. According to Levenson and Gottman (1983), greater heart rate synchrony is correlated with greater conflict between the couple. Existing literature indicates the lack of heart rate synchrony between partners could be a result of de-escalation between them.

Additionally, the lagged heart rate synchrony of the SUSY analysis indicated a growing capacity for the couple to synchronize with one another over the course of the eight sessions. As Figures 2, 8, 14, 20, 26, 32, 38, and 44 (Appendix B) indicate, there are significant moments of synchrony that take place throughout the session that are delayed as partners respond to one another. Figure 8 displays minimal synchrony occurring through the session, except for the lag of 2-3 seconds. This lag indicates that one participant's heart rate was more synchronous than the surrogate estimate with the partner's at a 2-3 second delay. However, the significance of this lagged synchrony is not reported within the SUSY analysis because of the lack of synchrony that occurs at -4, -2, -1, 0, and 1 second lags.

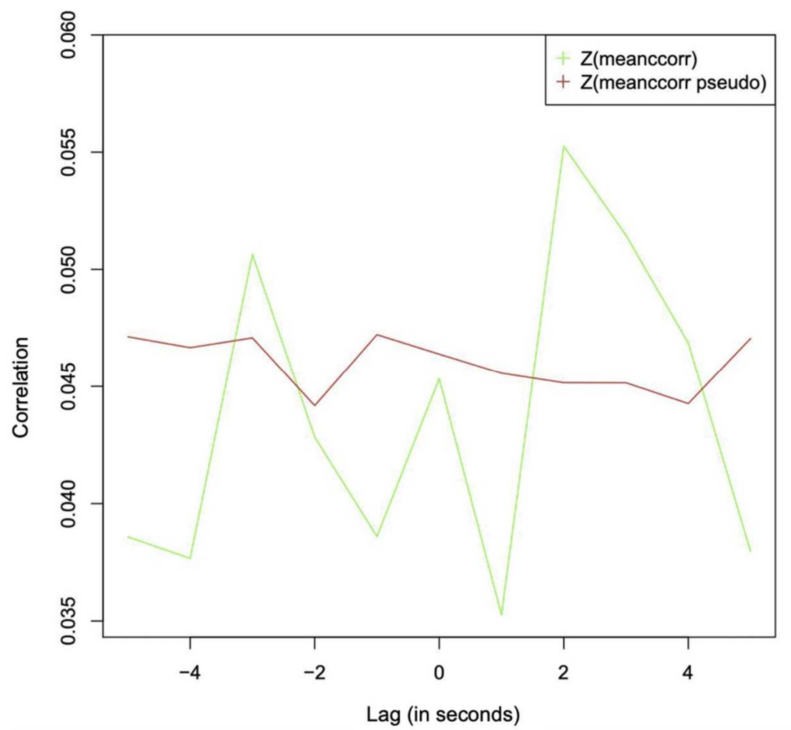

Figure 8
HR Lag Synchrony Session 2

These significant lags are recorded throughout the eight sessions at various time points, which may indicate the delay from one partner's sharing during the session to impact the partner and coregulate around this experience.

Electrodermal Activity

The first session indicated high degrees of synchrony between the couple, which may have been due to the shared stress levels in the couple as activation of the sympathetic nervous system increases electrodermal activity. This synchrony is likely due to anxieties that research shows are typical during the first session of the counseling process (MacFarlane et al., 2015). The high degree of synchrony that occurred during the session also could be attributed to the presence of couple blaming. Previous couples' physiological research indicates high degrees of electrodermal synchrony are correlated with blaming patterns between partners (Päivinen et al., 2016). Therefore, the initial electrodermal synchrony that occurred between the couple could

also be attributed to the blaming behaviors they entered treatment with, which are common for couples who are beginning the counseling process (Päivinen et al., 2016). From the first EFT session, the clinician seeks to reframe the cycle of blaming the couple has found themselves in through externalizing the issues of distress between the couple. This reframe may have contributed to the shift in synchrony that occurred after the first session when the cycle of the couple was introduced to them.

The next six sessions indicate predominantly out of synchrony phases that take place between the couple. Previous research suggests out of synchrony phases can be partially due to the turn-taking behavior of conversation (Reed et al., 2013). Electrodermal activity could have increased according to whomever was speaking. In the eighth session, the effect size of the couple's electrodermal activity synchrony was positive and very small, which indicated a shift in synchrony between the couple. The shift from the very strong out of synchrony phase of sessions 2-4 to a low effect size of in phase synchrony in the final session could indicate a shift to an increase comfort level with talking over the course of the eight sessions.

The lack of synchrony results from this study contradict existing research into electrodermal activity synchrony research on couples. Liu et al. (2016) found electrodermal activity synchrony was significantly higher in couples that were sitting face to face as compared to the synchrony measured when sitting back-to-back, suggesting visual proximity is correlated with electrodermal activity synchrony. However, in this study, the couple was within visual proximity but did not have the synchrony reported from previous studies. This incongruence could be due to the participants' discussion around the distressing parts of their relationship rather than sitting in silence as was the case with Liu et al. (2016). Additionally, participants' focus on the clinician rather than focusing on one another. Additionally, the significance of face-

to-face contact could potentially explain the sustained spikes in synchrony that occurred throughout the sessions. Enactments, or face to face conversations, occurred throughout the eight sessions as the clinician facilitated conversation between the partners around their more vulnerable feelings (Johnson, 2004). These segments of electrodermal activity synchrony could be a result of the face-to-face contact during the enactments.

The lagged electrodermal activity synchrony also appeared to increase in significance over the course of treatment. Figures 4, 10, 16, 22, 28, 34, 40, and 46 all indicate a significant lagged synchrony through the course of the sessions. Figures 10 and 46 demonstrate the expansion of lagged synchrony that occurred over the course of the eight sessions.

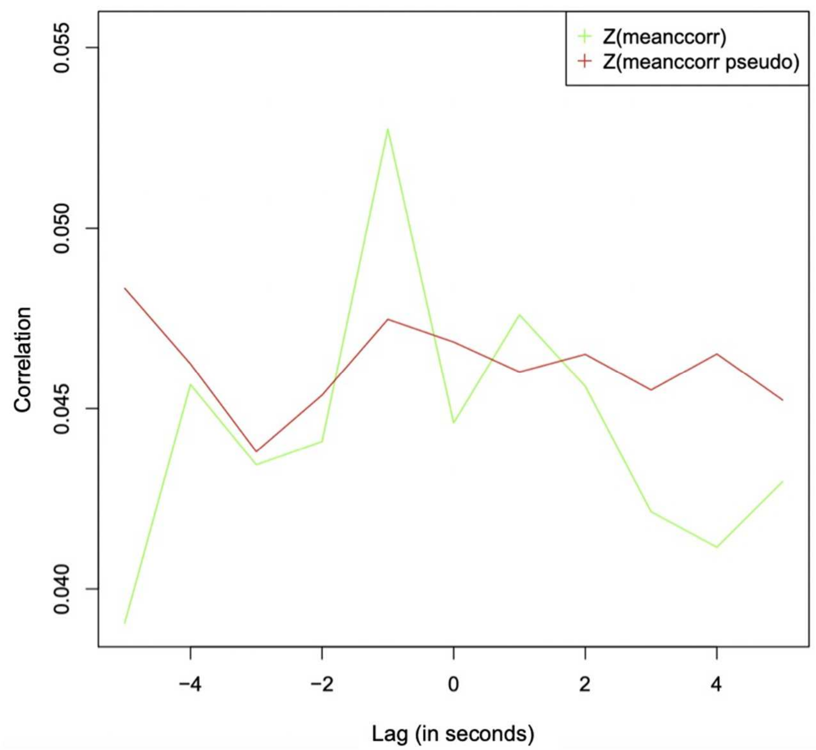

Figure 10
EDA Lag Synchrony Session 2

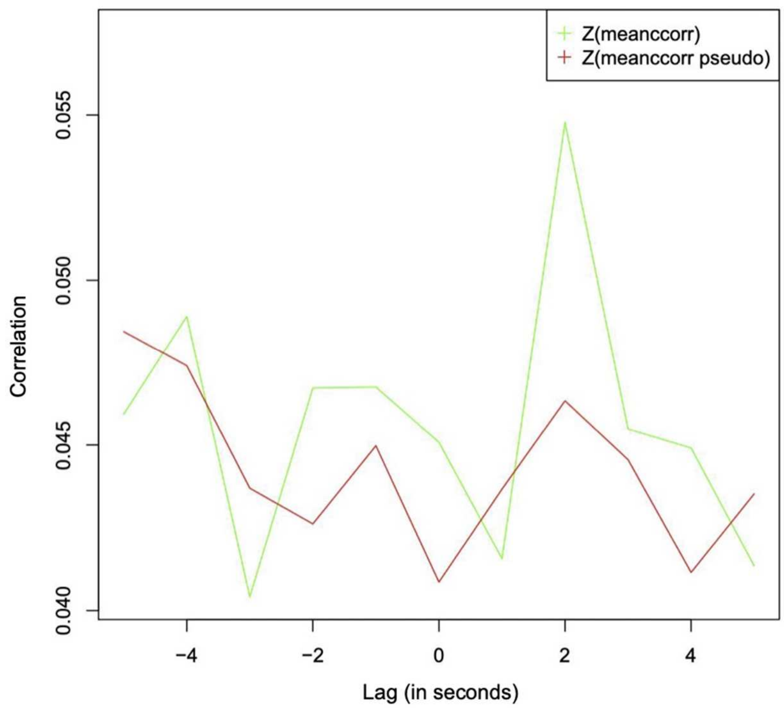

Figure 46
EDA Lag Synchrony Session 8

Figures 10 and 46 reflect the expanded synchrony that occurred between the partners after receiving EFT counseling.

Skin Temperature

Four of the eight sessions indicated synchrony with regard to skin temperature with small to large effect sizes. Most of the effect sizes from the first six sessions indicated a small degree of synchrony or a lack of synchrony altogether. The last two sessions were a large and medium effect size of synchrony between the couple with regard to skin temperature. Previous literature on skin temperature synchrony and attachment figures offers a potential way to interpret this shift between the couple.

Mother-child attunement has been positively correlated with the physiological synchrony of facial skin temperature measurements (Ebisch et al., 2012). As mothers watched their children in distressing situations, their skin temperature readings measured by facial thermal imprints

synchronized (Ebisch et al., 2012). In a similar experiment, mothers were shown to have greater synchrony than strangers who watch a child they were unfamiliar with in a distressing situation (Manini et al., 2013). This temperature synchrony appears to be stronger and more responsive in attachment figures (Manini et al., 2013).

These results of attachment figure skin temperature synchrony may apply differently to couples who come in for counseling. As interactions with their partner is often the source of distress, it may be difficult to exercise this level of empathy for their partner in the midst of their own distress (Johnson, 2004). EFT seeks to use the externalization of the cycle to expand the couple's awareness of the experience of their partner (Johnson, 2004). This shift in skin temperature synchrony may potentially indicate a capacity for empathizing with their partner's distress as is supported in existing literature. Additionally, Ebisch et al. (2012) showed there were about 10 seconds for the synchrony between mother and child to occur, which exceeded the five second lag that was measured in the SUSY analysis. Future studies on skin temperature synchrony could expand the lag window of analysis to account for the delay in synchrony.

Despite this 10 second lag reported in literature, every session showed significant synchrony at various lag points for skin temperature as shown below.

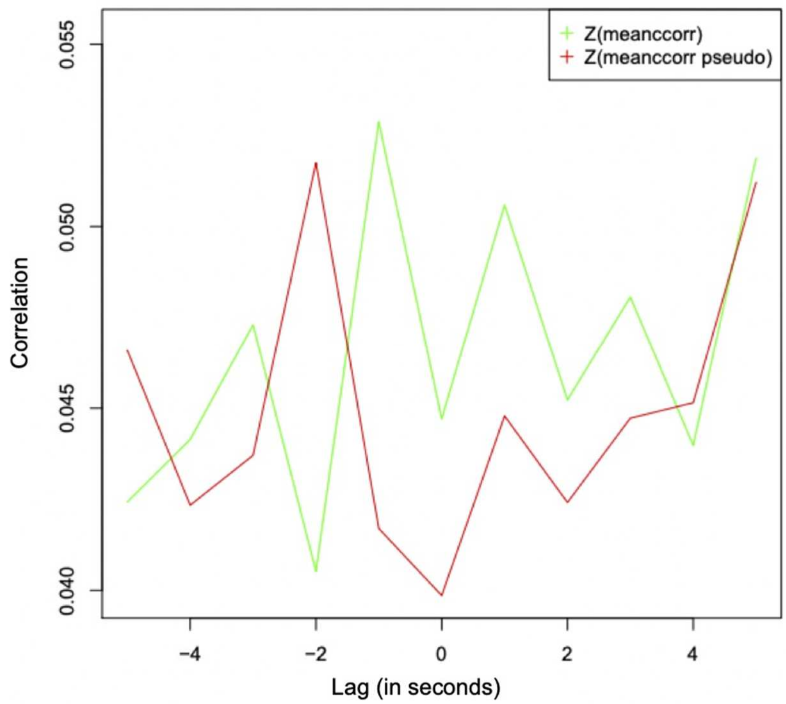

Figure 36
Skin Temperature Lag Synchrony Session 6

Figure 36 displays the skin temperature synchrony during a session in which there was no reported relationship between the skin temperatures according to the SUSY analysis. However, Figure 36 clearly displays greater synchrony than would be expected at a lag of -4, -3, -1, 0, 1, 2, and 3 seconds. However, the out of synchrony phases dilute the relevance of these synchronous lags. This dilution indicates that couples' therapy may not be an appropriate setting to apply typical synchrony analysis. It is important to utilize analyses that account for the delay in emotional processing that occurs between couples.

Heart Rate Variability

The correlation between the couple's LF/HF ratios of the sessions was not significant but indicated a negative relationship. For most of the sessions, decreases in Participant 1's ratio tended to occur with increases in Participant 2's ratio. This trend indicates an alternating regulatory capacities of the couple over the course of the eight sessions of EFT.

Existing literature supports the findings of heart rate variability synchrony. When using non-absolute z values, Coutinho et al. (2021) found one partner's heart rate variability tended to increase while the partner's did the inverse over the course of the couples counseling process. Heart rate variability measures parasympathetic control of the body, which facilitates emotional regulation (Moore & Calkins, 2004). According to Coutinho et al. (2021), the inverse synchrony that takes place could indicate one partner increasing the capacity to emotionally regulate as the other partner decreases in theirs. In other words, as one partner shares their emotionally dysregulated spaces with the other, that sharing actually provides more grounding and stability for the other. By analyzing the lag between the two, it can be determined which partner is shifting in emotional regulation and how that shift affects the other partner. Heart rate variability synchrony would indicate both members of the couple losing their capacity for emotional regulation (Timmons et al., 2015). In fact, a greater amount of heart rate variability synchrony between the couple is correlated with heightened cardiac inflammation (Wilson et al., 2018). A lack of heart rate variability synchrony indicates the capacity of the couple to be emotionally resilient as one partner is more regulated and capable of extending support to the other, leading to the process of coregulation.

Lag Synchrony

For heart rate, electrodermal activity, and skin temperature, the SUSY analysis indicated varying levels of lagged synchrony. For each measure of physiological reactivity, there was synchrony for various measures during the sessions that occurred at a negative lag, positive lag, and at no lag. This variability indicates that there was no consistent sense of leadership within the synchrony. At different points across the sessions, both members of the couple had delayed synchrony, potentially in response to observing and processing their partner's response. The

balance between positive and negative lag synchrony could indicate a co-regulatory process as both members of the couple are empathizing and attuning with their partner's shared experience, resulting in a physiological synchronizing to it. The inconsistent lag synchrony (i.e. significant at -4 seconds one session and -1 seconds the next session) is supported by literature as existing research shows that emotional processing speed and responsiveness are impacted by clarity, attention, and intensity (Sperry & Ekland, 2021). The lag synchrony could demonstrate the impact of one partner's shared experience on the other as they seek to co-regulate in the EFT process.

Over the course of the sessions, the clinician would help one client to get clearer on their emotional experience before sharing it with their partner. The significant amount of lagged synchrony that took place in the sessions shows the capacity of the couple to influence each other's emotional arousal by sharing their own emotional experience. There was a lagged effect because they were not being impacted by one event instantaneously but instead reacting to the other's shared experience, which took a few seconds to clarify, communicate, integrate, and respond. There is a high need for future research to be able to capture this lagged synchrony to show the bidirectional influence each member of the couple has upon the other's physiological experience.

Segment Synchrony

The SUSY analysis also indicated various phases of the session that were in and out of synchrony throughout the course of all eight sessions. As referenced in attachment literature, polyvagal theory, interpersonal physiological research, and in EFT guidance, the goal for couples is not to achieve perfect synchrony all of the time (Bowlby 1988; Porges, 2011; Palumbo et al., 2016; Johnson, 2004). The goal that has been shared by all of these perspectives is to generate

more flexibility in synchrony and out of synchrony to produce more emotional regulation. Specifically, the goal of EFT is to develop more interpersonal synchrony, and therefore coregulation, around moments of distress. Therefore, the segment synchrony that is displayed throughout the eight sessions may indicate a growing amount of flexibility within the couple rather than remaining in a rigid and distressed state.

A majority of the time during the initial steps and stages of EFT are focused on organizing individual and couple emotional experience. This organizing takes place through extensive conversation between the clinician and each client as the clinicians asks questions and uses a variety of interventions to gain more clarity on the intrapersonal experience of each client. This organization process then clarifies the signal that each partner then sends to one another, opening the door to coregulatory experiences. The lack of synchrony during these first eight sessions is likely due to the abundance of organization that took place during the sessions as the clinician clarified their emotional experiences. However, video review indicated that the moments of session that were correlated with higher synchrony occurred when the couple shared this clarified signal with their partner and were able to coregulate with one another. This balance between organization and synchrony demonstrates the clinical significance of organizing a client's experience to ensure a clarified signal is sent that is more likely to result in coregulation.

Implications

Understanding the counseling process of change from a holistic perspective has been increasingly emphasized in mental health literature. Beyond the previous research into the effects of the counseling process, there remain many questions around the specific nature of the change process that generates change and relief in the lives of clients. Therefore, this study has several implications for the model of Emotionally Focused Therapy, mental health professionals, and

counselor educators and researchers to develop a more complete understanding of the change process to implement interventions more effectively.

Implications for Emotionally Focused Therapy

According to the International Centre for Excellence in Emotionally Focused Therapy, their "mission includes the further expansion and refinement of the Emotionally Focused Therapy (EFT) model through process and outcome research" (2021). While there have been several studies that review the outcomes of EFT, there has been a lack of measuring the change process itself as it is being implemented. Measuring the physiological responses of clients during session over time gives more insight into the interventions that result in distress for the clients and how that distress changes over the course of treatment.

A majority of interpersonal physiology research lacks clear and consistent terminology and a grounding theory. According to Kleinbub (2017), it is important for interpersonal physiology research to be interpreted through the lens of clinical theory and its interventions to maximize clarity and application. Research recommends theoretical models that are operationalized as "promising candidates" (Kleinbub, 2017, p. 8) for interpersonal physiological studies. The steps, stages, and various interventions of EFT (Johnson, 2004) provide the structure needed to analyze and interpret the physiological responses during counseling sessions. ICEEFT has developed a rigorous coding system for clinicians to use in operationalizing their work to understand it more thoroughly and implement the model with more clarity. This operationalization allows for videos to be coded and analyzed for physiological synchrony. This analysis would allow EFT clinicians to understand the effectiveness of their model in order to implement it with more clarity. In existing research, Ham and Tronick (2009) set an example of utilizing attachment theory to ground interpersonal physiology research and using the research to

strengthen the evidence base for attachment theory. EFT has a similar opportunity to utilize interpersonal physiology research to strengthen its argument for the power of the model, especially around its corrective emotional experiences that it views as a catalyst for change (Johnson, 2004).

Implications for Clinicians

According to Deits-Lebehn et al. (2020), measuring physiological measurements to study the counseling process could “increase understanding of how and why therapy works and can consequently aid in the improvement of therapy effectiveness and client outcomes” (p. 496). Pinpointing impactful moments of the change process allow mental health professionals to grow in their awareness of the change process, so it can be facilitated more effectively. Marci and Riess (2005) demonstrated how psychophysiological data collected during the counseling process facilitated counselor insight of the client and directed therapeutic exploration according to the theory of change. Clinicians who practice EFT could benefit from understanding the process of change from a physiological level. Physiological data could also be taken to measure other counseling theories to promote more clarity into the process of change.

The integration of physiology and the counseling process also promotes a more holistic appropriate to wellness by promoting a biopsychosocial emphasis, offering a new form of advocacy for mental health professionals (Moss, 2020). This advocacy is especially important in the United States system of managed care, which often does not cover extended treatment plans or couples counseling. Mental health’s greatest advocacy in the world of managed care is to “maintain its integrity as a profession” (Cantor & Fuentes, 2008, p. 644) and the “elimination of mind-body dualism” (Belar, 1995, p. 139). Psychophysiological research promotes a holistic

approach to healthcare, which could help clinicians to advocate for clients' right to have mental health care coverage.

Implications for Counselor Education

There is an established gap between practice in the counseling field and the research performed by counselor educators (Hays et al., 2019). There is little counseling research that is conducted in clinical settings (Fouad, 2013), and counseling research rarely pertains to issues clinicians find to be relevant in the field (Nielson, 2015). Counseling research clearly highlights the necessity for more research-practice partnerships to bridge the gap between counseling sessions and research (Hays et al., 2019). These partnerships serve to better inform research questions and findings, creating a more cohesive field. This research being done by counselor educators promotes more trainee opportunities to engage with clinicians and contribute to professional identity formation, creating a more effective counselor education training experience (Hays et al., 2019). Taking psychophysiological measurements during counseling sessions could be the foundation for research-practice partnerships as it is both relevant to counselor educators and clinicians alike.

In addition to the potential for this line of research to bridge the researcher-practitioner gap, psychophysiological research also promotes a new understanding of the change process. "The automation, objectivity, and ecology of the autonomic measures, and their ability to detect implicit intersubjective dynamics…outline the potential hiding in [interpersonal physiology] as a research and clinical tool" (Kleinbub, 2017, p. 8). Marci and Riess (2005) used physiological research to increase clinician empathy for the client experience. Researchers and educators in counselor education can utilize physiological measurements taken during the counseling process to better understand the process of change taking place to benefit clinicians and clients alike.

Limitations

Acknowledging the limitations of a research project is essential to ensure this line of work can be continued through future research projects. Several limitations of the research project are due to the relatively new implementation of wearable devices to detect physiological measurements during the counseling process, which will hopefully be addressed in future research projects.

Data were only collected from a single, heterosexual couple in a case study format, which severely limits the generalizability of the study. Additionally, the amount of eight sessions was an appropriate length of time to measure change according to existing EFT research (Greenberg et al., 1993). However, the clinician working with the clients and the primary researcher agreed that collecting data for a longer period of time may have revealed more information about the process of change. Likewise, the couple stated they felt as if they were just starting to feel a shift in their relationship at home during the final week of data collection.

Data collection was interrupted twice by various travels of the clinicians and the clients. There was resultant inconsistency between the times in which data collection was taken by the primary researcher. There were also extra protocols in place regarding social distancing procedures to maximize safety from COVID-19, which may have been distracting from the therapeutic process.

Implications for Future Research

The results of this study and its associated limitation have several implications in research moving forward. First, future studies could increase sample size and include more diverse participants to represent a larger part of the population with regard to gender, sexual orientation, race, and socioeconomic status. This increased sample size would increase the

capacity to generalize the rests to the larger population who could benefit from couples' therapy. This extension in participants could also span for a longer period of time. Additionally, monitoring the physiological responses of the facilitating clinician could also indicate the levels of coregulation that could be taking place between the clinician and client, especially during the rapport building and organizing phases of the EFT counseling process.

The results indicate accounting for the lag that occurs between couples during the counseling process may be more appropriate for this setting than measuring synchrony at the exact same moment in time. Accounting for this lag time in future research projects will allow for a greater understanding of the influence of one partner on the other, providing greater insight into the coregulation that occurs between them. Additionally, the data revealed a noticeable increase in synchrony during specific times over the course of the counseling session. It would be beneficial to analyze if there were specific EFT interventions that were correlated with greater levels of synchrony between the couple. This analysis would provide more specific insight to clinicians who apply the model. By coding the moments in which synchrony is more likely, future research could provide more conclusive indications into the occurrence of coregulation between the couple. The physiological data could also be analyzed along with qualitative data taken by couples who are receiving counseling to develop their understanding of the changes they are seeing in their own counseling process. By continuing to improve the understanding of the change process of EFT, it can be implemented more effectively, creating sustainable and lasting changes in the emotional regulation of couples and individuals who comprise them.

Conclusion

Effective strategies to expand the emotional regulation are needed to mitigate the suffering from a variety of mental health disorders (Gross, 2013). Social bonds that open

emotional channels between people promote emotional stabilization and synchronization through a process known as coregulation (Butler & Randall, 2013). This synchrony can be seen in psychophysiological measurements, such as heart rate, electrodermal activity, and skin temperature (Palumbo et al., 2016). Coregulatory experiences that expand emotional regulation have been find to be more likely to occur within the context of secure attachments (Roth et al., 2013). Emotionally Focused Therapy is an established clinical methodology that has been shown to increase secure attachment (Wiebe & Johnson, 2016).

Findings of this study demonstrate synchrony levels with significant effect sizes in heart rate, electrodermal activity, and skin conductance. However, the vacillation between in and out of synchrony phases was too high to generate conclusive results. This study is the first of its kind to measure interpersonal physiological synchrony while implementing an established clinical model. These results offer a solid foundation for future EFT research to clarify the vacillation between in and out of synchrony moments and explore the physiological effects of specific interventions. Additionally, the study suggests the necessity of evaluating lagged synchrony as each member of the couple is impacted by the other, promoting the process of coregulation. With this clarity, EFT clinicians will be able to more accurately understand the holistic impact of their work and offer an example for other models to replicate as they explore the psychophysiological impact of their own work. This line of research opens a new door for clinicians to advocate for the field of mental health and for their clients with regard to managed care. This study shines light on a new way for clinicians to continue to explore the idea of emotional regulation and how they can benefit clients lives through the expansion of it.

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APPENDICES

Appendix A

Demographic Survey for Participants

1. Identified race:

2. Identified gender
    a. Male
    b. Female
    c. Non-binary / third gender
    d. Prefer not to say

3. Identified sexual orientation
    a. Heterosexual
    b. Homosexual
    c. Bisexual
    d. Other
    e. Prefer not to say

4. How long have you and your partner been in an exclusive, committed relationship (years, months)?

5. Are you currently living together? If so, for how long (years, months)?

6. How many counseling sessions have you had with your current counselor?

7. Have you attending counseling before? Select all that apply.
    a. Yes- as a couple
    b. Yes- as an individual
    c. No

8. Are you currently receiving individual counseling?
    a. Yes
    b. No

9. Do you have atrial fibrillation or heart block or take medications that alter your heart rate? If so, please describe the condition.
    a. Yes
    b. No

10. Are you currently engaging in an extramarital affair(s)?
    a. Yes
    b. No

11. Do you believe your partner is currently engaging in extramarital affair(s)?
    a. Yes
    b. No
12. Does your use of substances (drugs, alcohol, etc.) impair your daily functioning, or do you experience withdrawal symptoms with discontinued use?
    a. Yes
    b. No

13. Does your partner's use of substances (drugs, alcohol, etc.) impair daily functioning, or do they experience withdrawal symptoms with discontinued use?
    a. Yes
    b. No

14. Is there ongoing abuse currently taking place in the relationship?
    a. Yes
    b. No

15. How satisfied are you with your current sex life with your partner?
    a. Extremely satisfied
    b. Somewhat satisfied
    c. Neither satisfied nor dissatisfied
    d. Somewhat dissatisfied
    e. Extremely dissatisfied

Appendix B

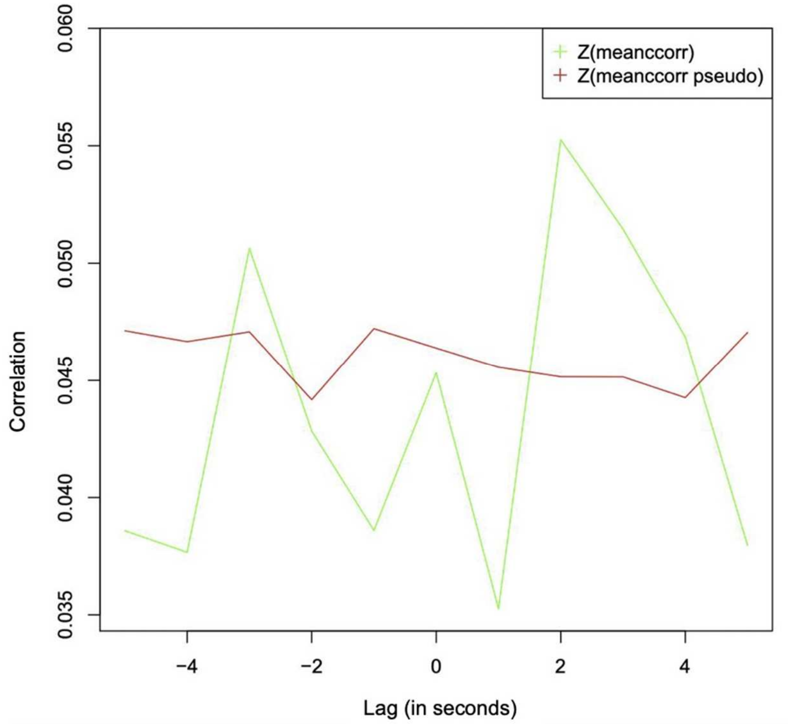


Figure 8
HR Lag Synchrony Session 2

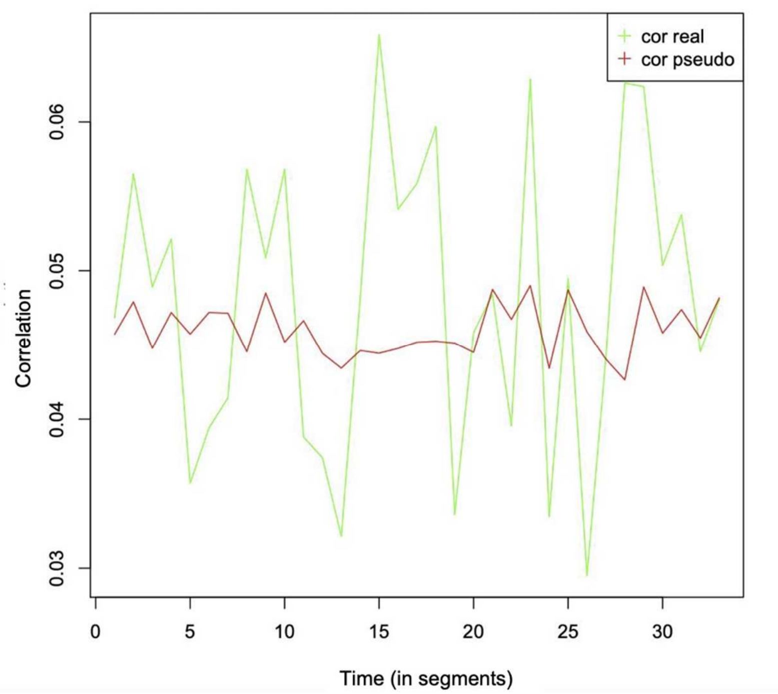


Figure 9
HR Segment Synchrony Session 2

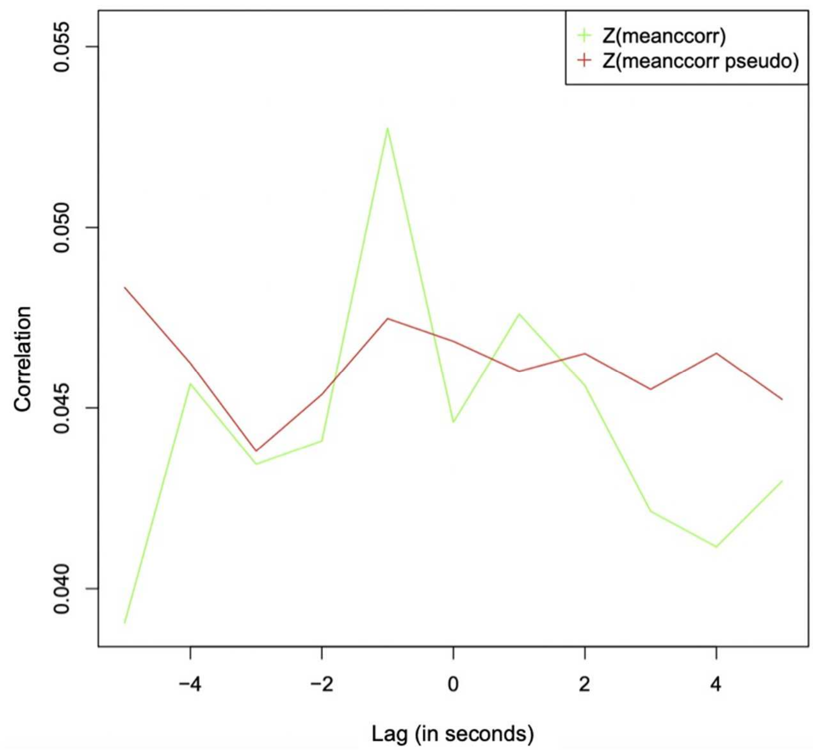


Figure 10
EDA Lag Synchrony Session 2

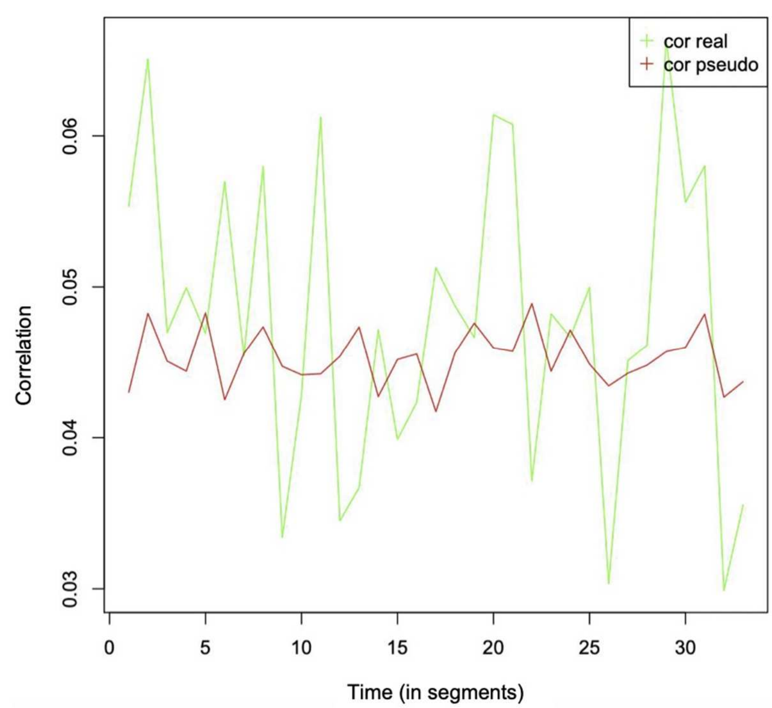


Figure 11
EDA Segment Synchrony Session 2

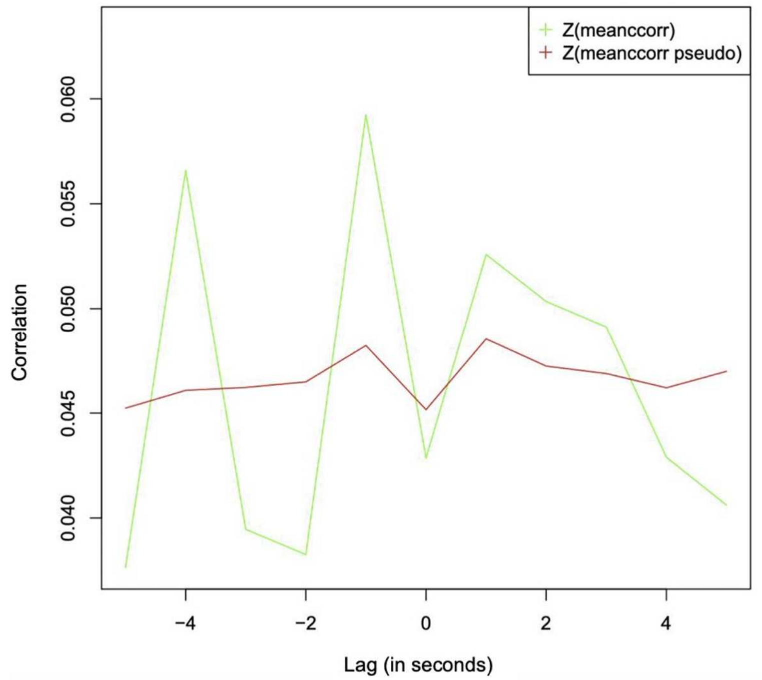


Figure 12
Skin Temperature Lag Synchrony Session 2

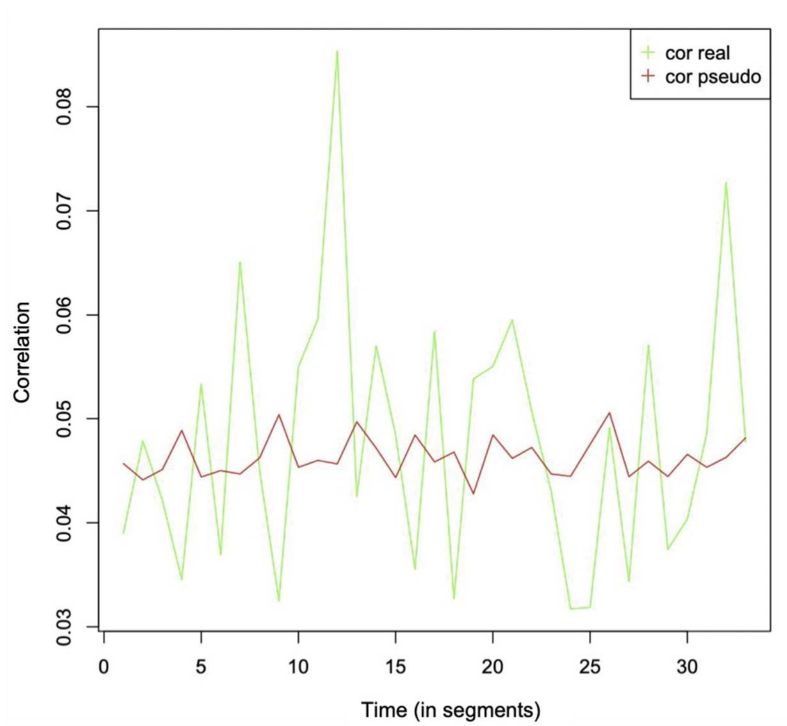


Figure 13
Skin Temperature Segment Synchrony Session 2

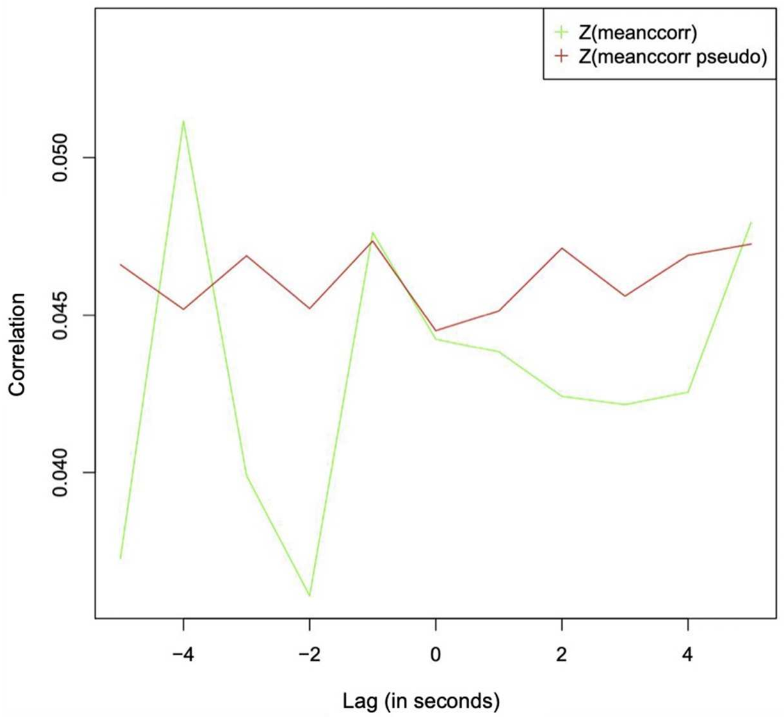


Figure 14
HR Lag Synchrony Session 3

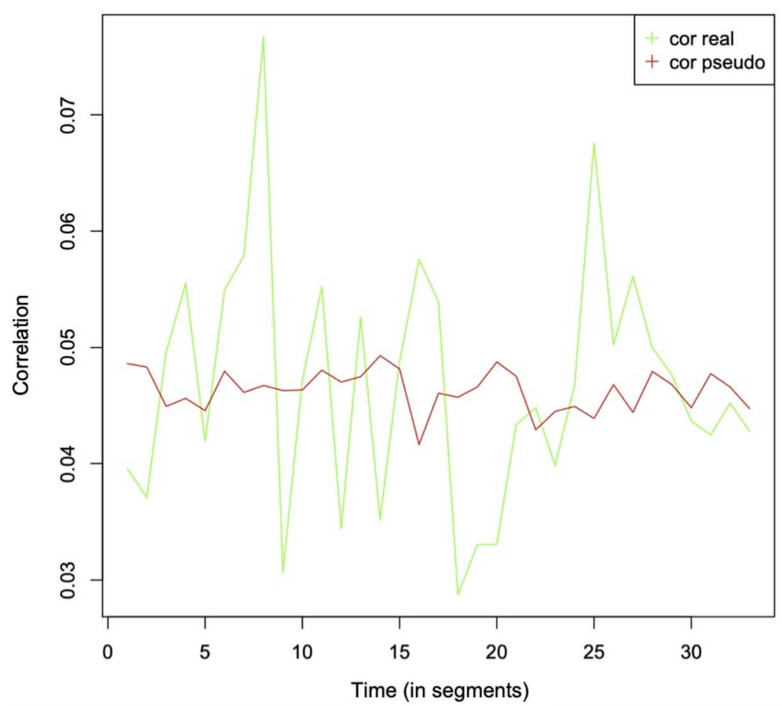


Figure 15
HR Segment Synchrony Session 3

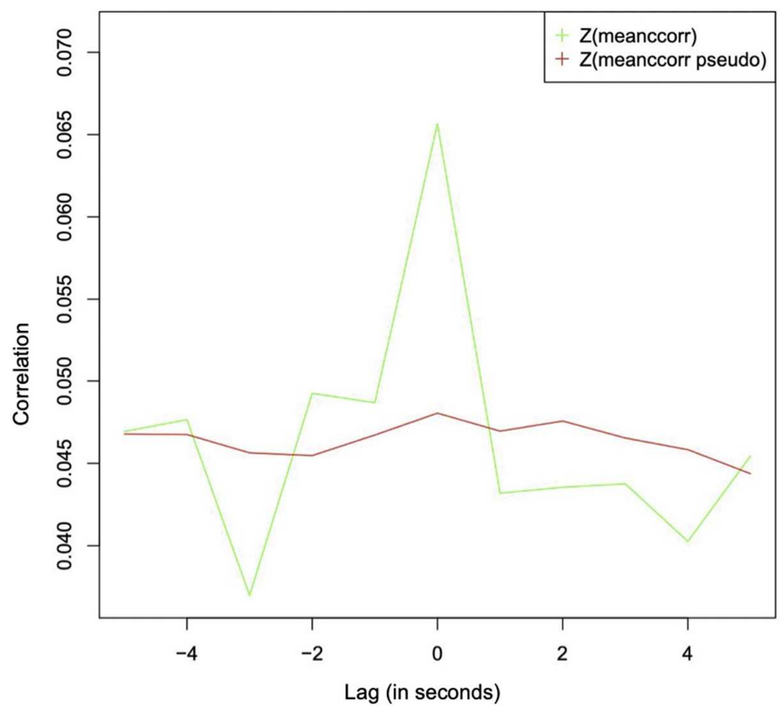
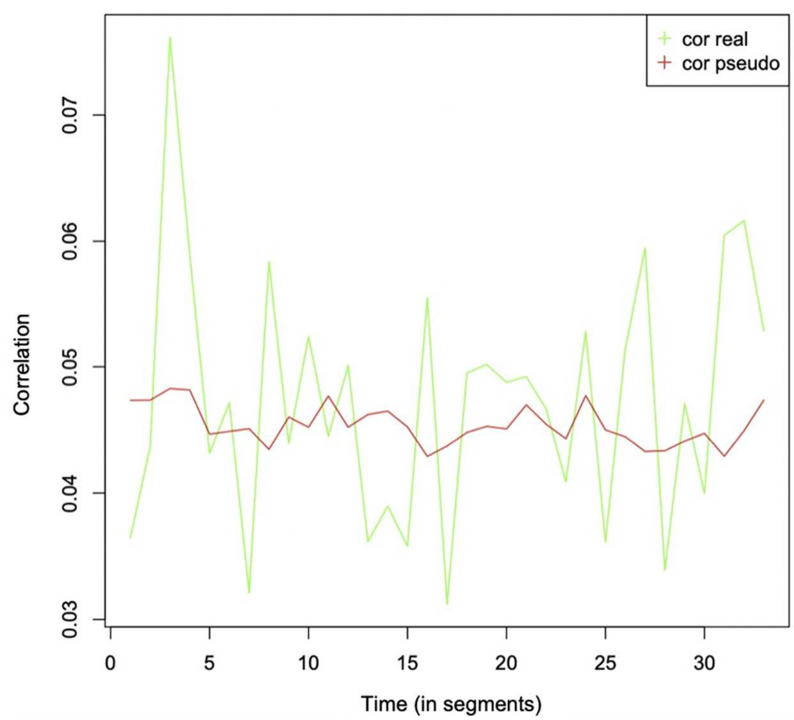


Figure 16
EDA Lag Synchrony Session 3



Segment 17
EDA Segment Synchrony Session 3

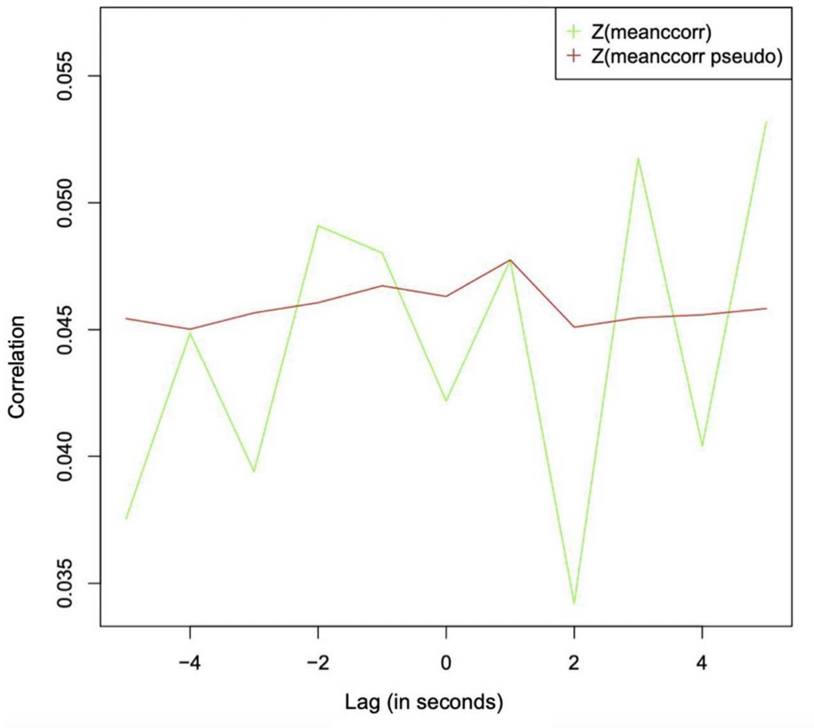


Figure 18
Skin Temperature Lag Synchrony Session 3

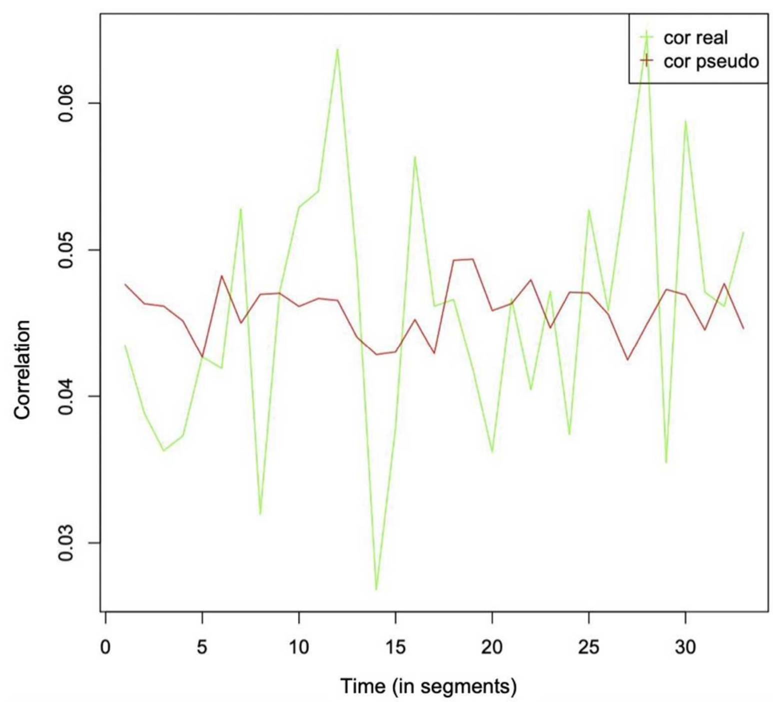


Figure 19
Skin Temperature Segment Synchrony Session 3

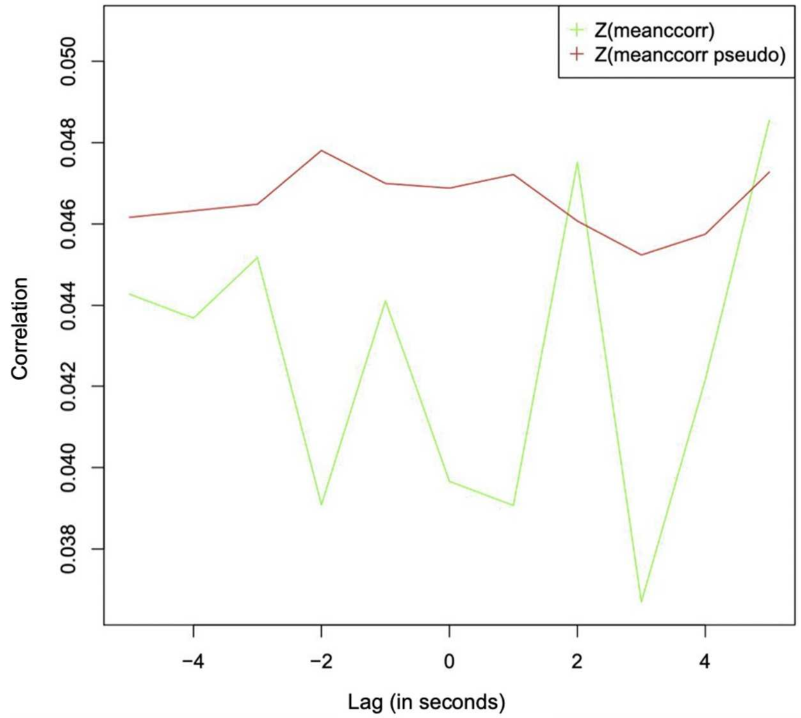


Figure 20
HR Lag Synchrony Session 4

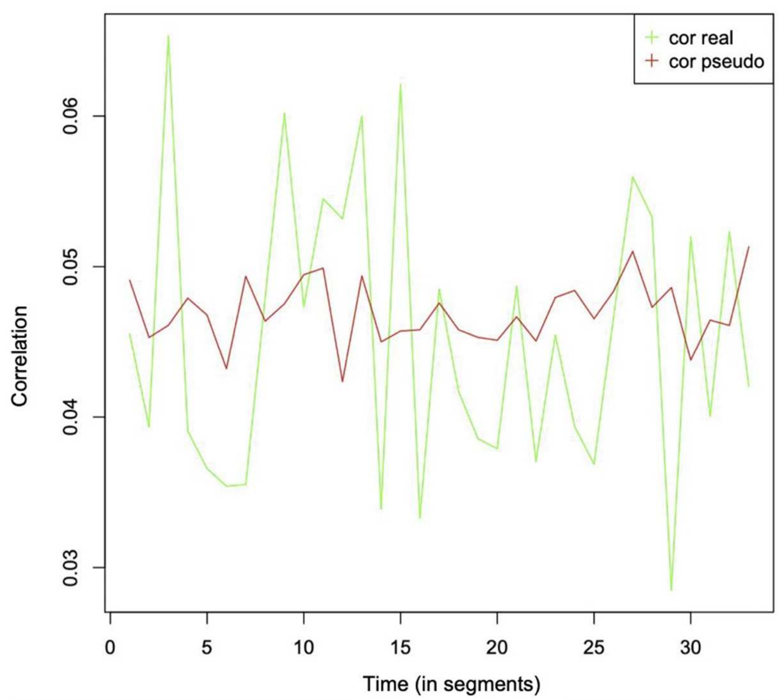
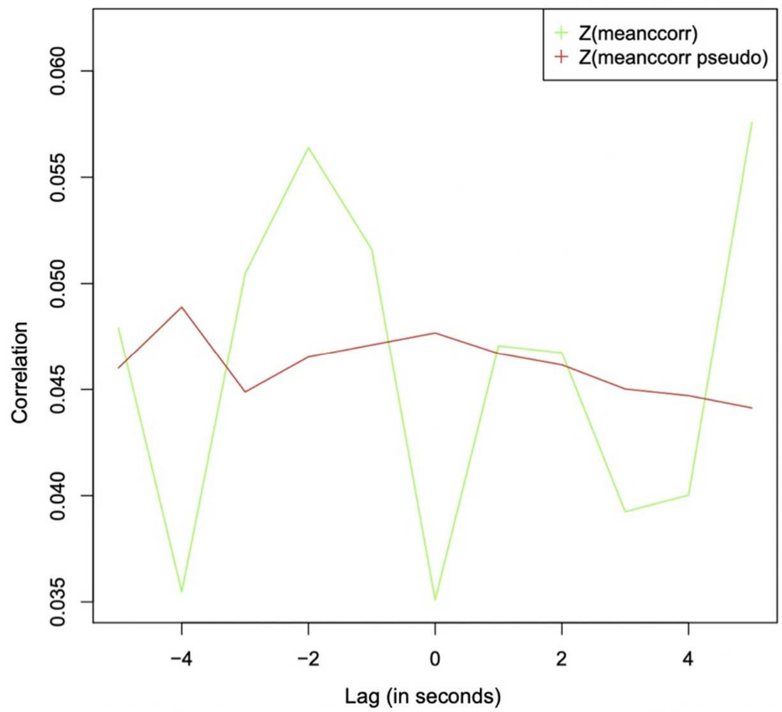


Figure 21
HR Segment Synchrony Session 4



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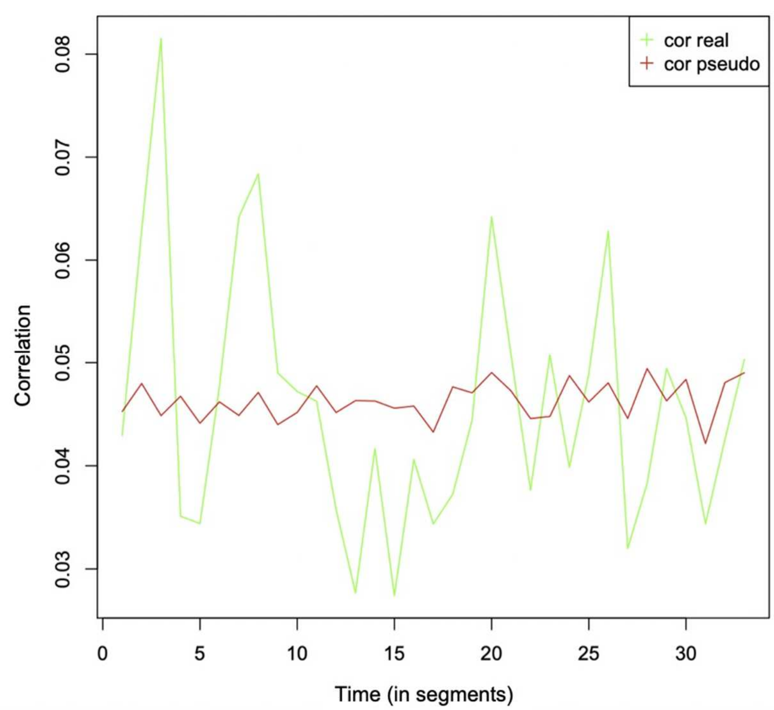
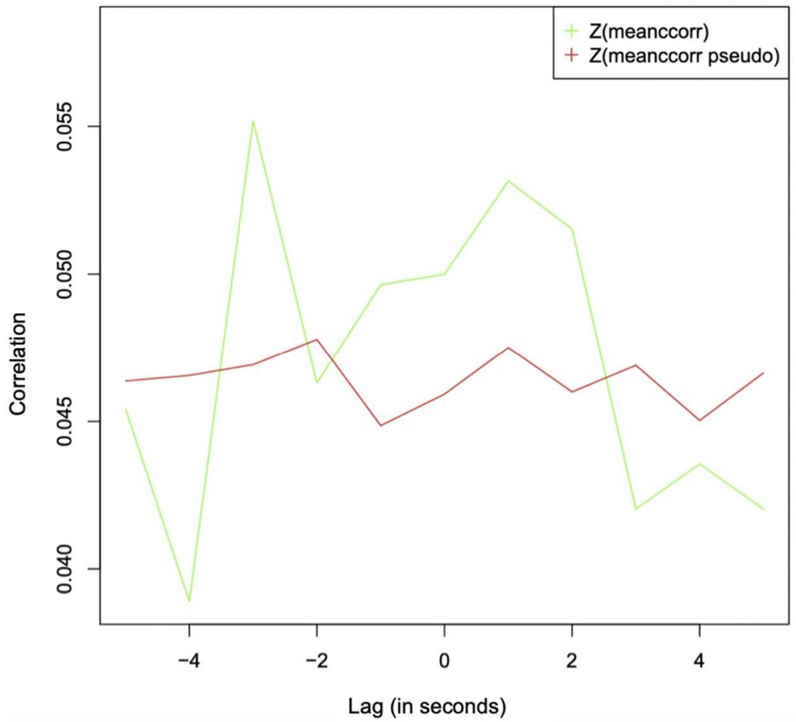


Figure 23
EDA Segment Synchrony Session 4



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Skin Temperature Lag Synchrony Session 4

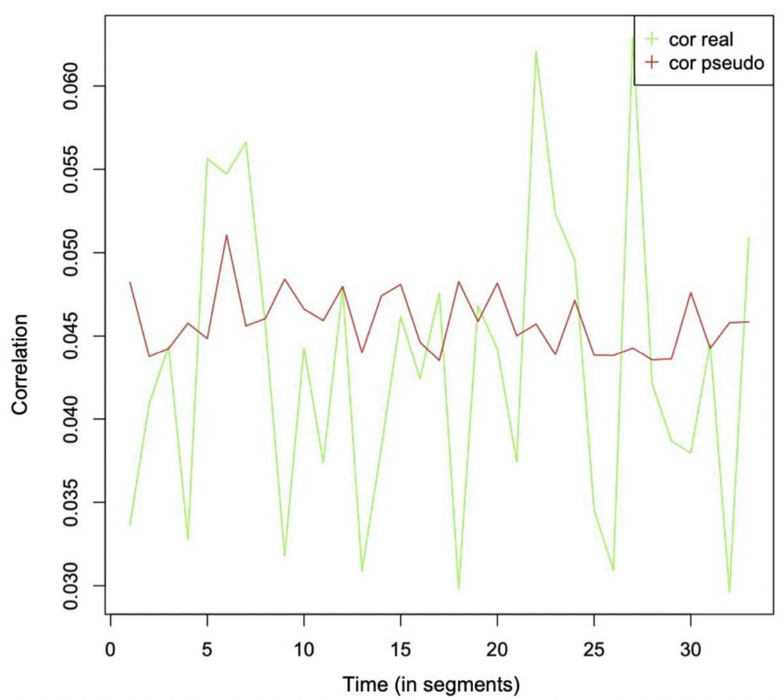
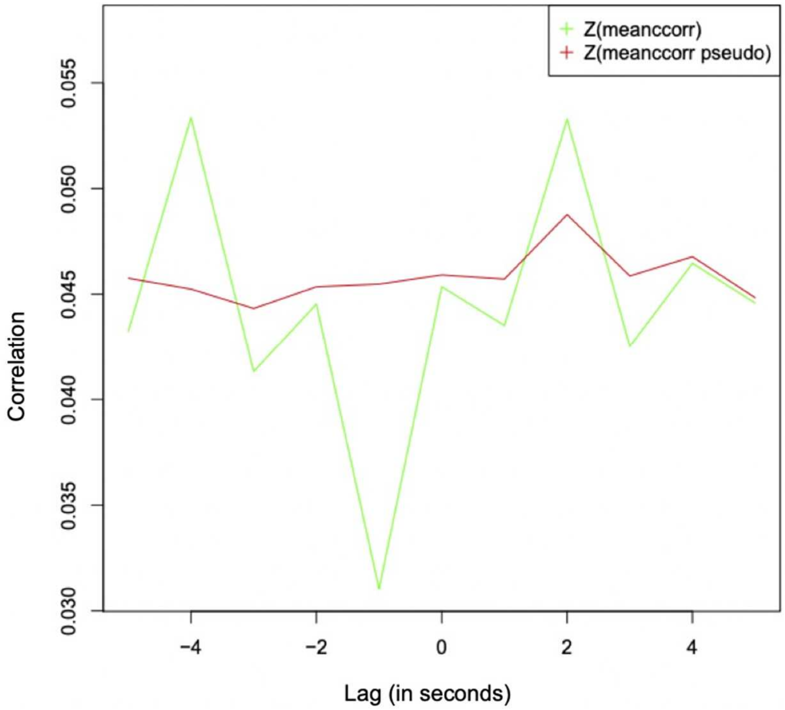


Figure 25
Skin Temperature Segment Synchrony Session 4



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HR Lag Synchrony Session 5

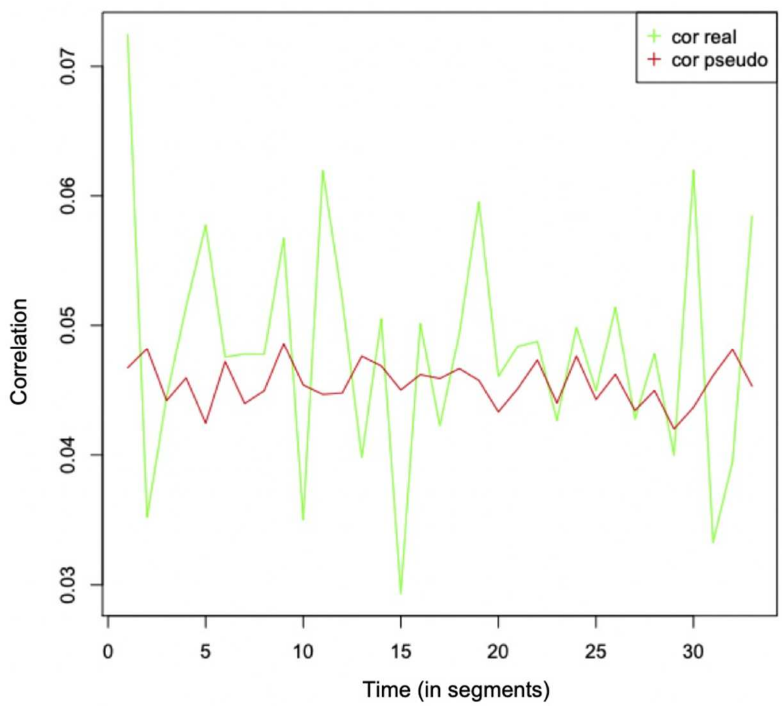


Figure 27
HR Segment Synchrony Session 5

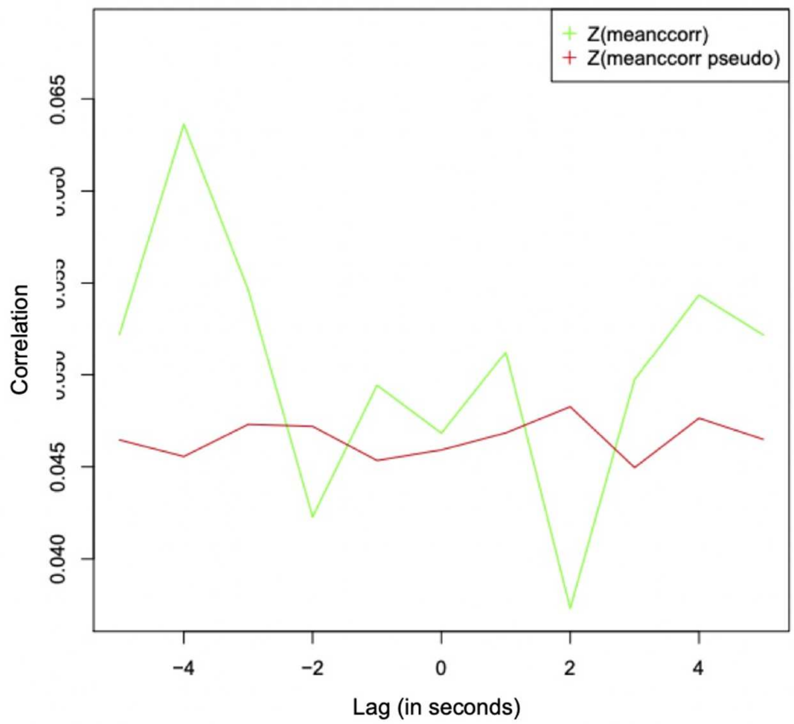


Figure 28
EDA Lag Synchrony Session 5

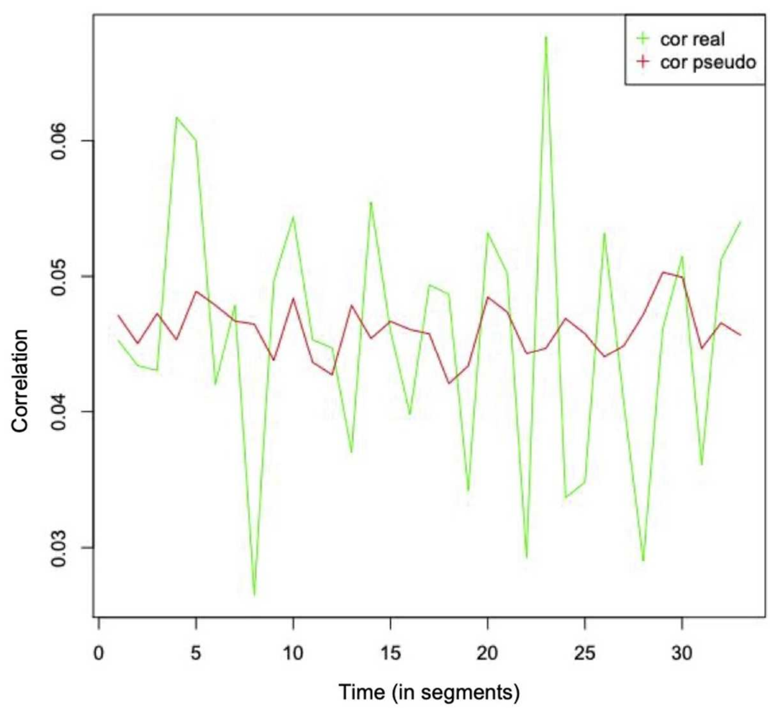


Figure 29
EDA Segment Synchrony Session 5

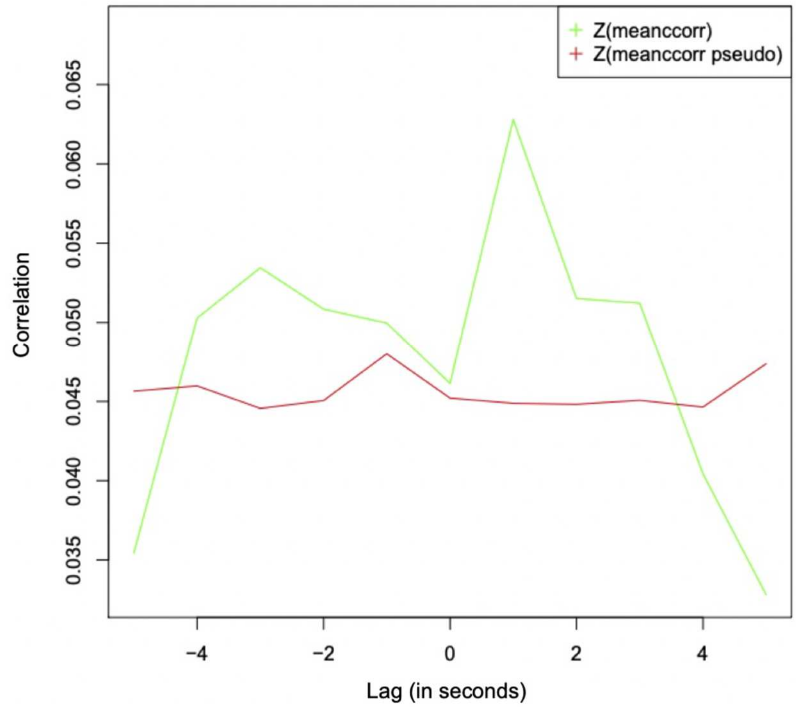


Figure 30
Skin Temperature Lag Synchrony Session 5

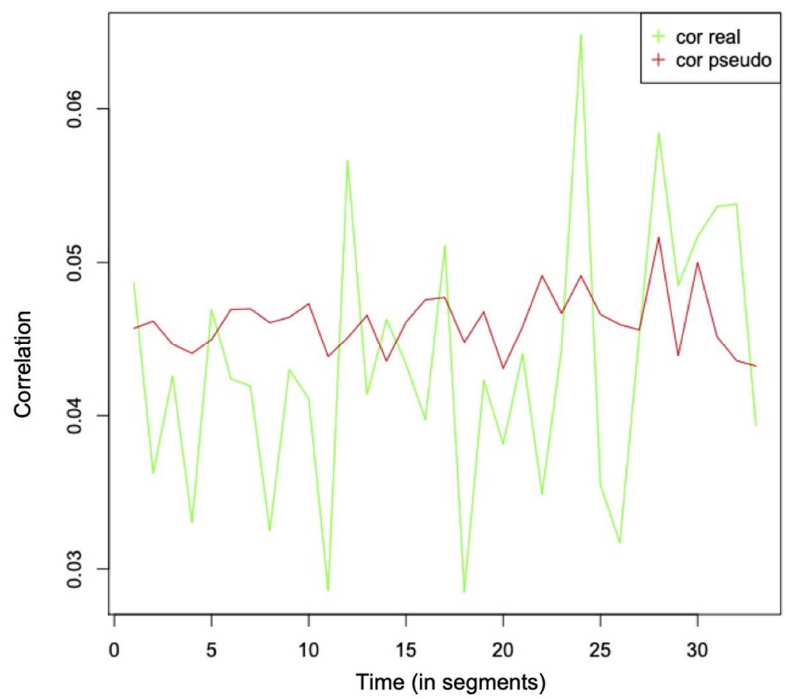
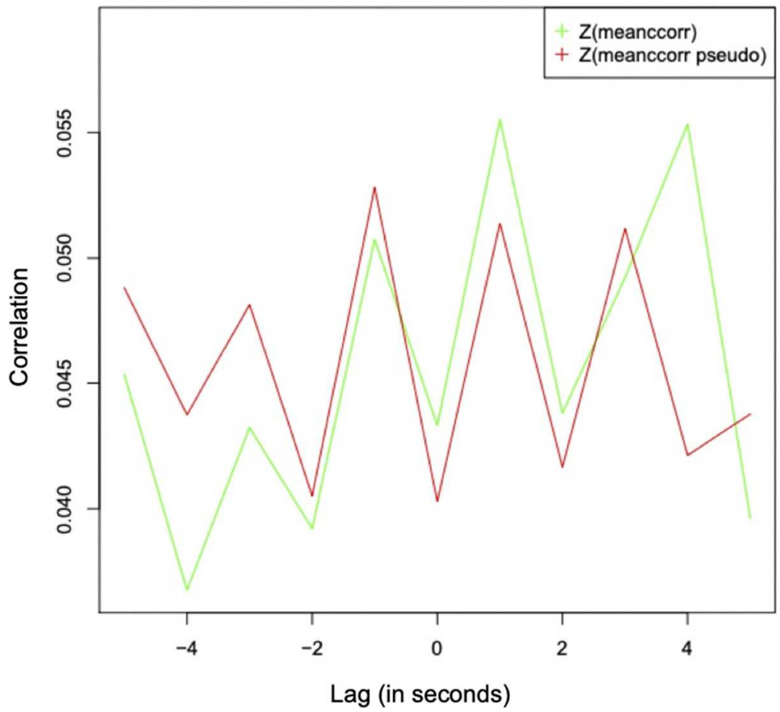


Figure 31
Skin Temperature Segment Synchrony Session 5



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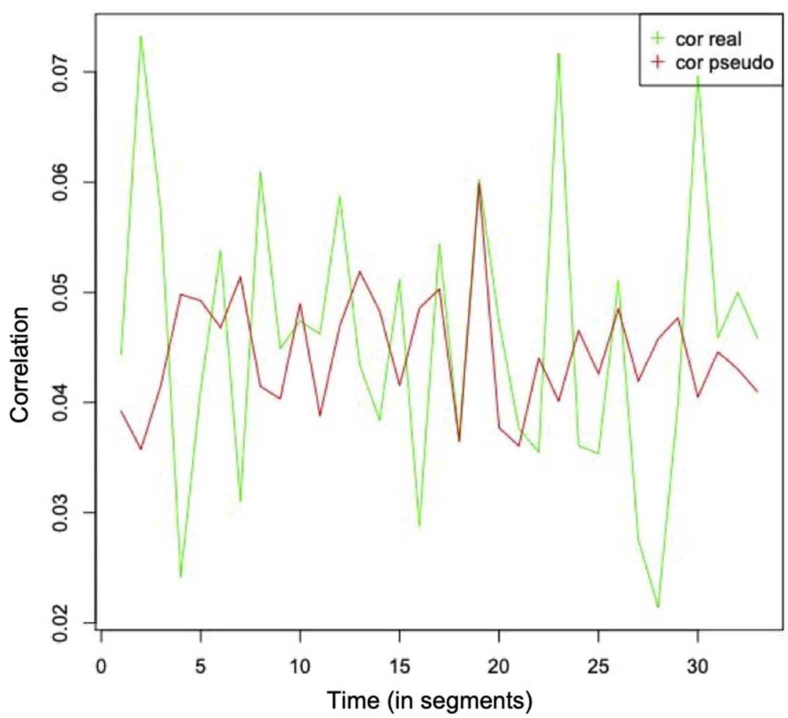

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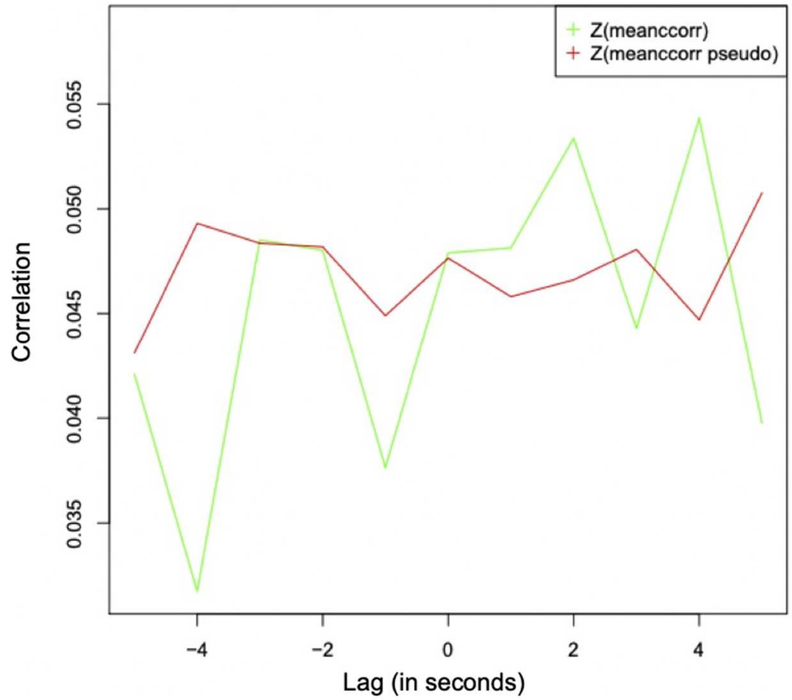
HR Segment Synchrony Session 6



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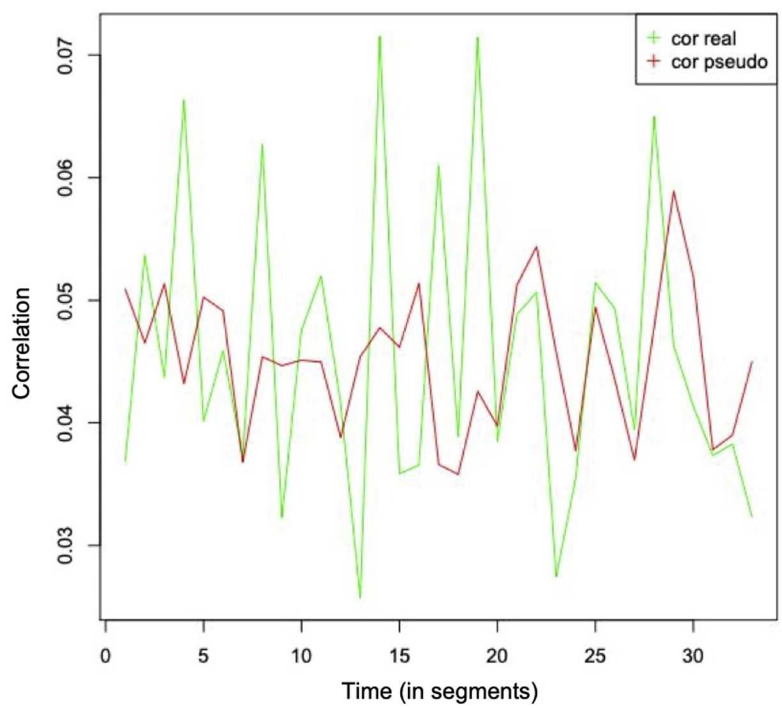

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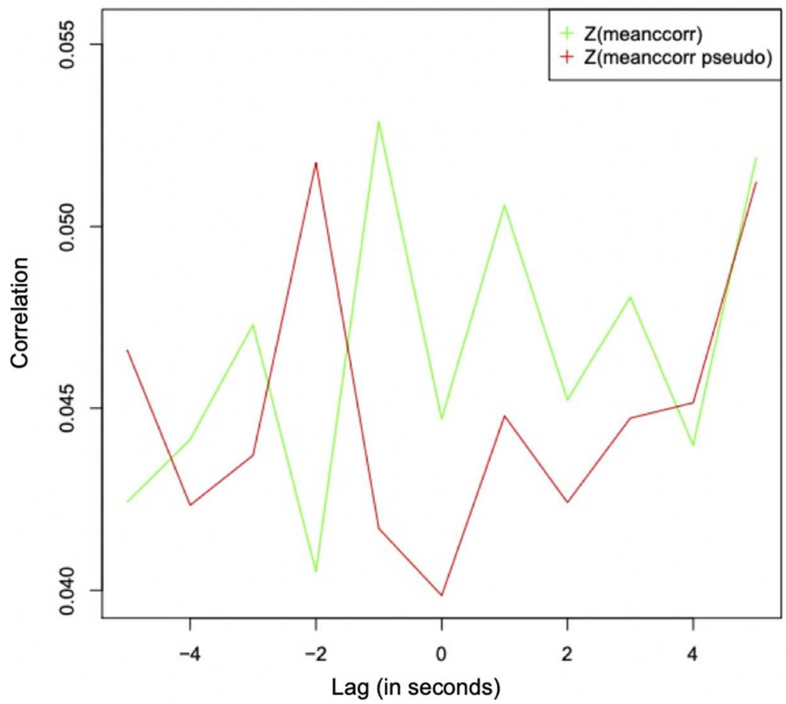

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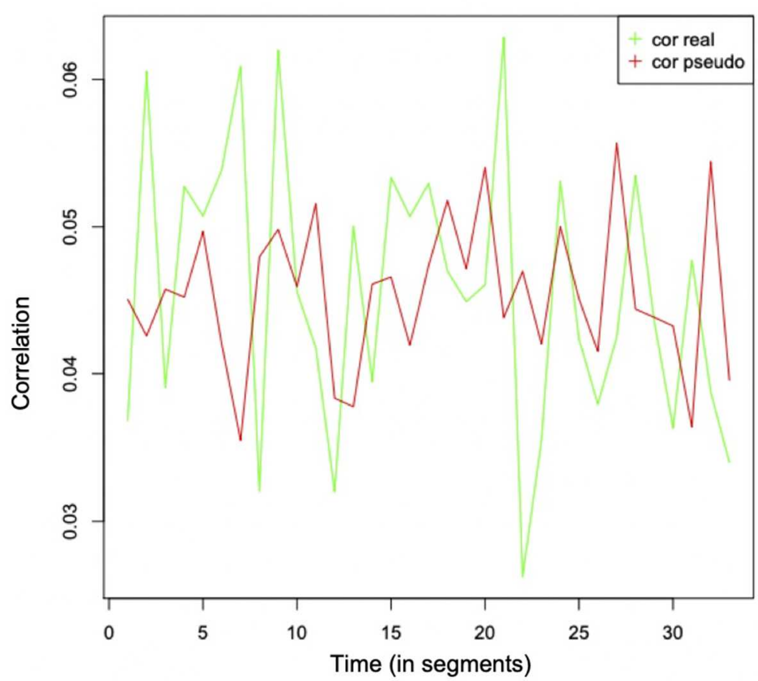
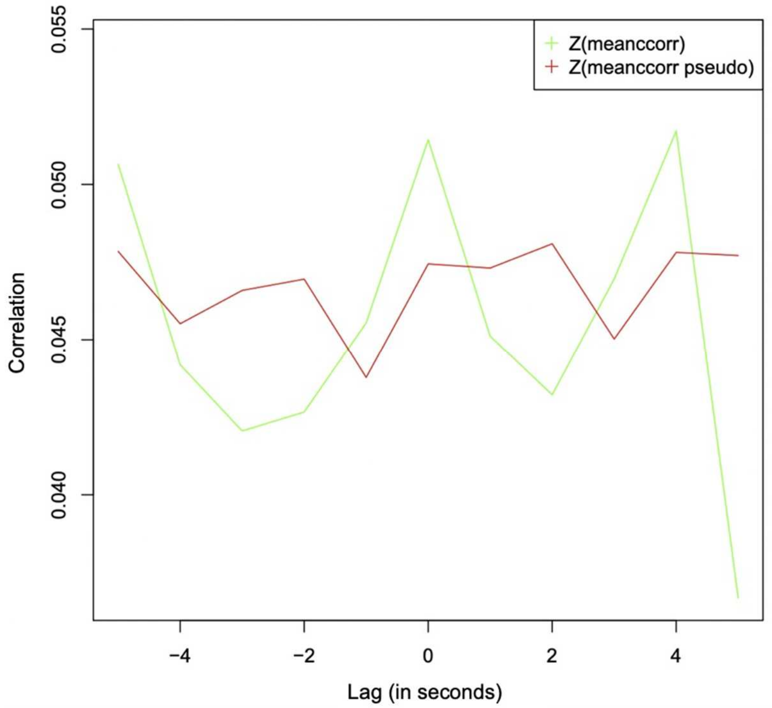


Figure 37
Skin Temperature Segment Synchrony Session 6



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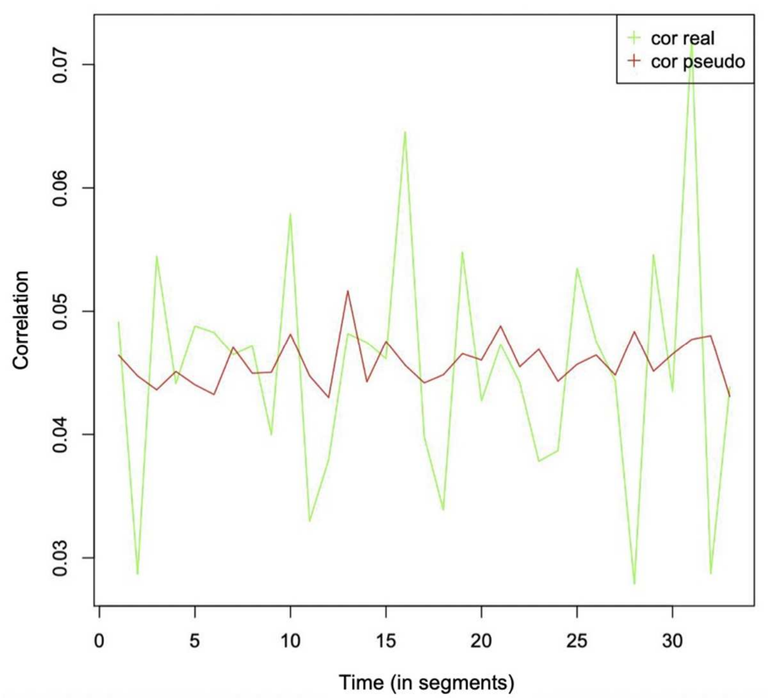

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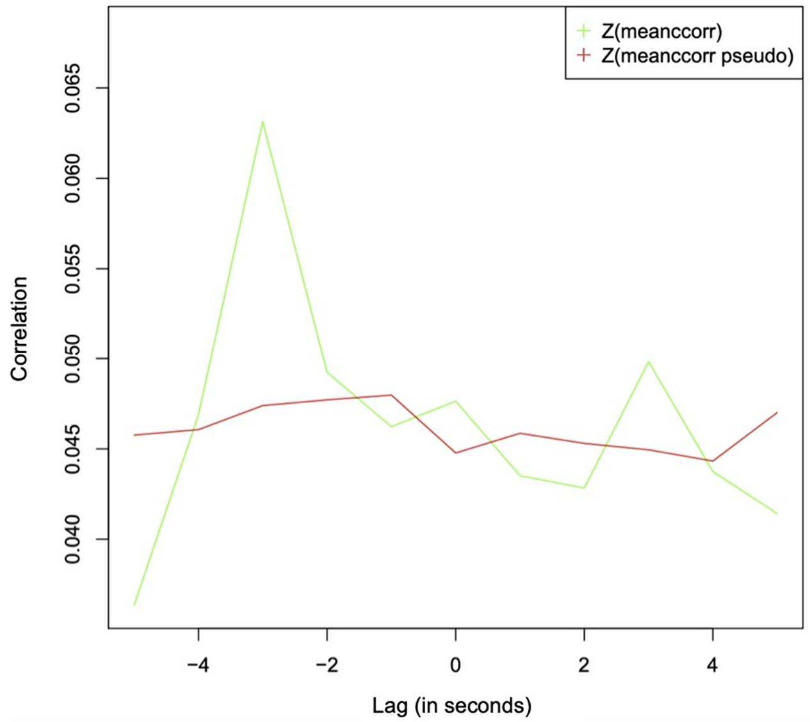
HR Segment Synchrony Session 7



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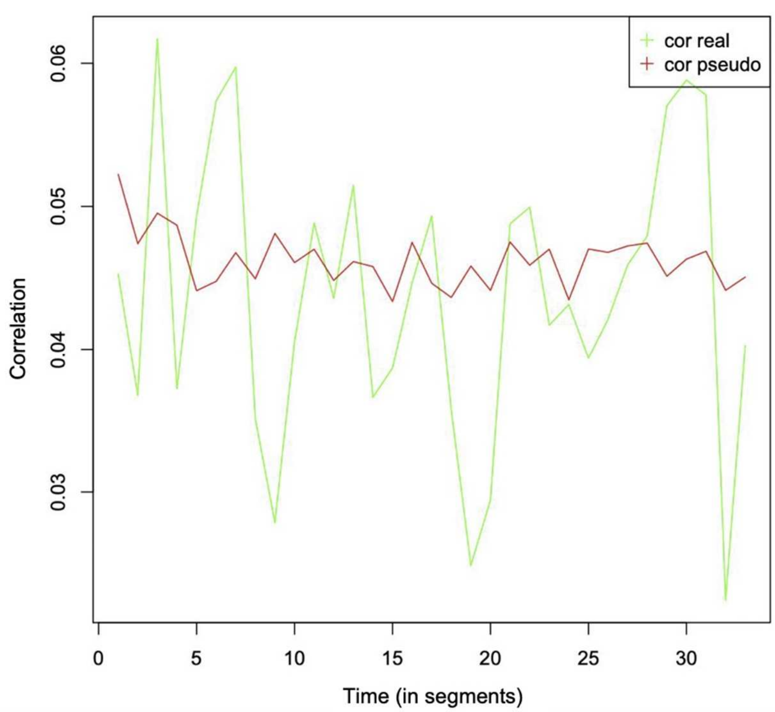

Figure 41
EDA Segment Synchrony Session 7

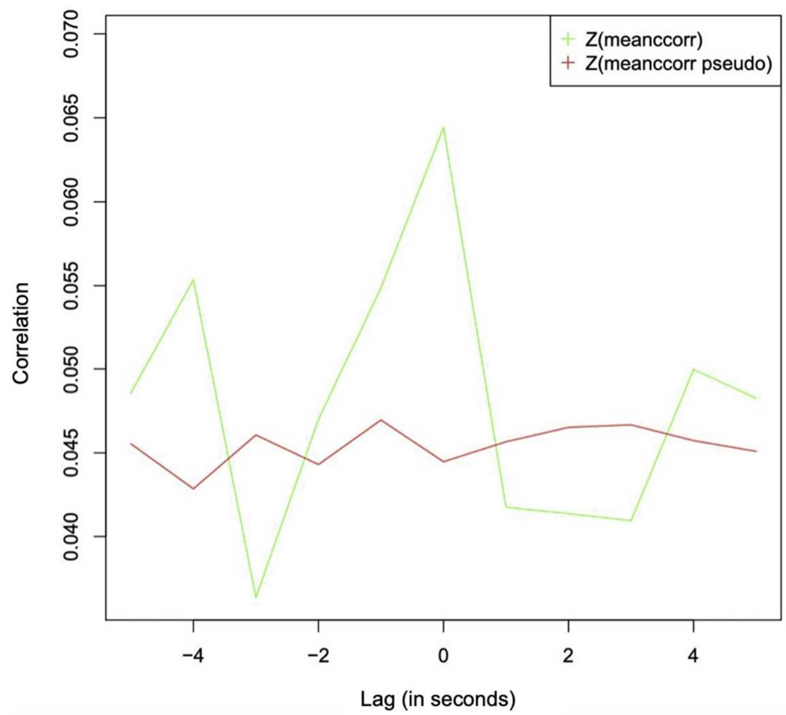

Figure 42
Skin Temperature Lag Synchrony Session 7

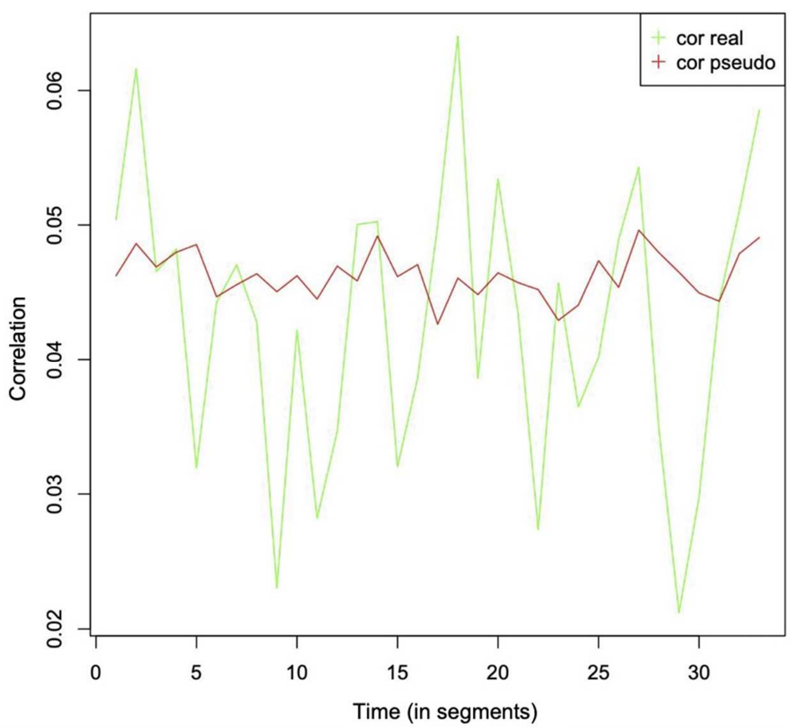

Figure 43
Skin Temperature Segment Synchrony Session 7

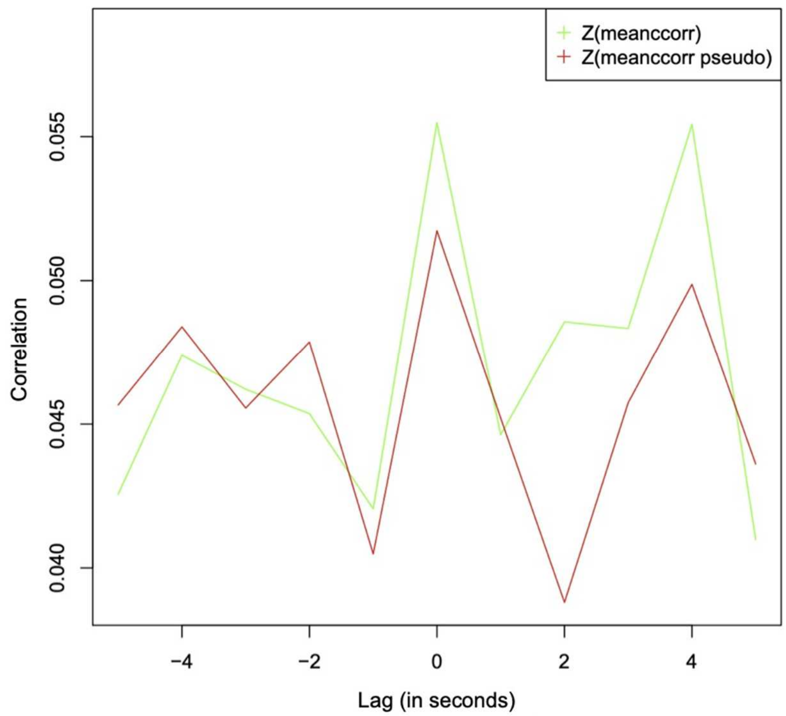

Figure 44
HR Lag Synchrony Session 8

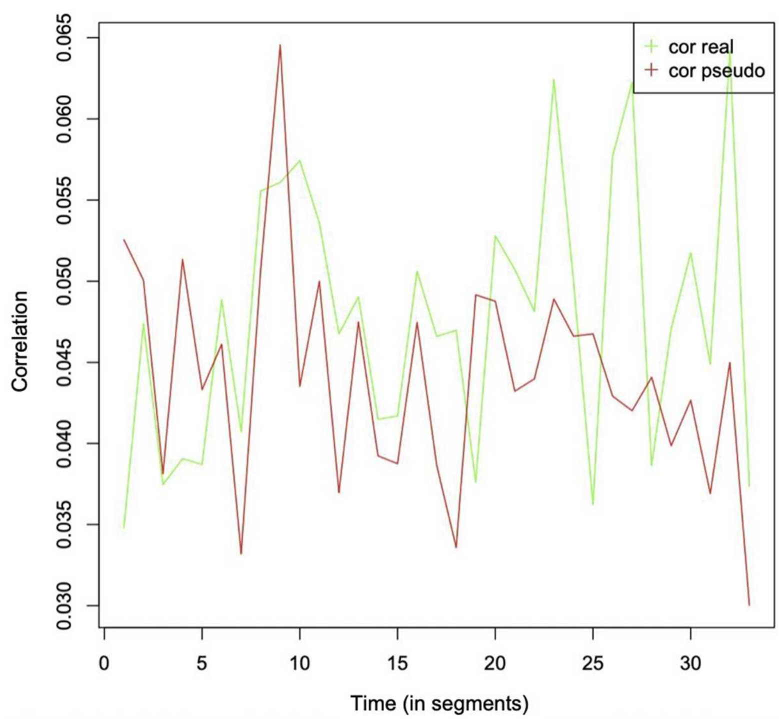

Figure 45
HR Segment Synchrony Session 8

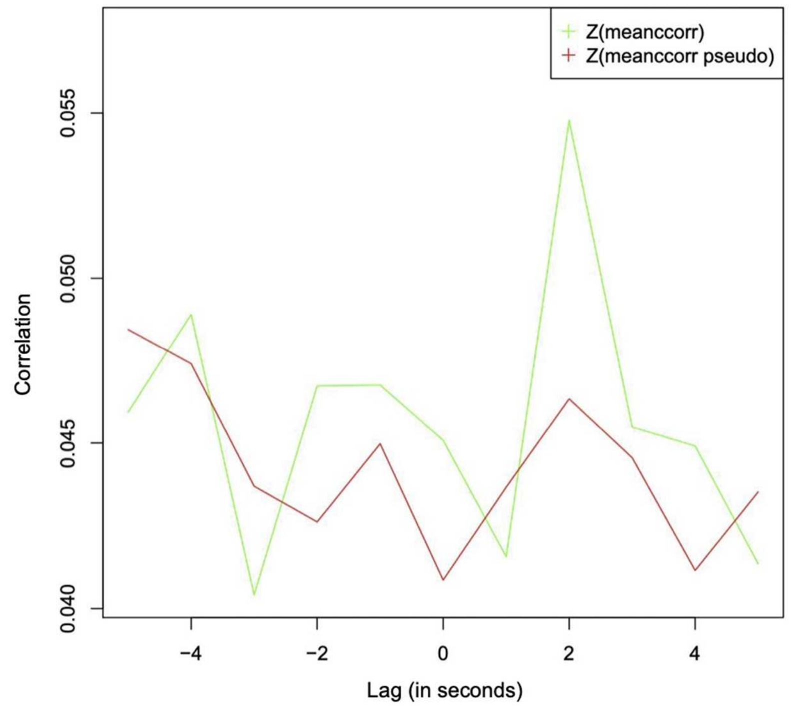

Figure 46
EDA Lag Synchrony Session 8

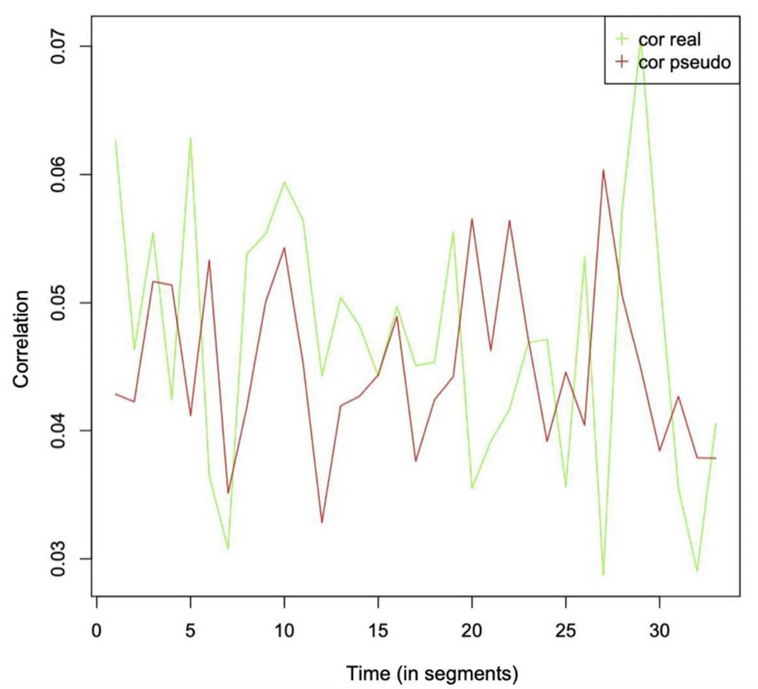

Figure 47
EDA Segment Synchrony Session 8

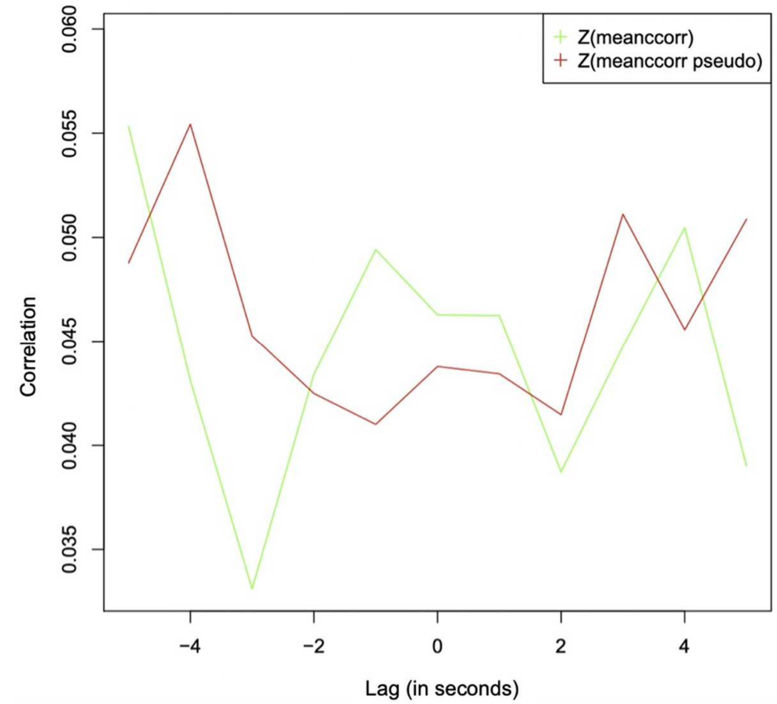

Figure 48
Skin Temperature Lag Synchrony Session 8

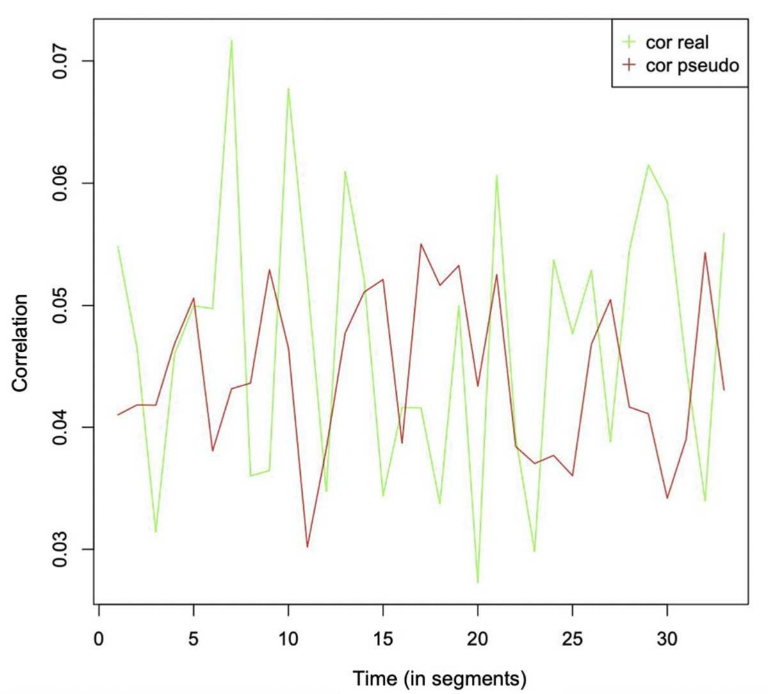

Figure 49
Skin Temperature Segment Synchrony Session 8

UNIVERSITY OF ARKANSAS

To:	Julia L Conroy MULN 220Q
From:	Douglas J Adams, Chair IRB Expedited Review
Date:	01/19/2021
Action:	**Expedited Approval**
Action Date:	01/19/2021
Protocol #:	2012304431
Study Title:	Physiological Measurements in Couples Counseling
Expiration Date:	12/30/2021
Last Approval Date:	

The above-referenced protocol has been approved following expedited review by the IRB Committee that oversees research with human subjects.

If the research involves collaboration with another institution then the research cannot commence until the Committee receives written notification of approval from the collaborating institution's IRB.

It is the Principal Investigator's responsibility to obtain review and continued approval before the expiration date.

Protocols are approved for a maximum period of one year. You may not continue any research activity beyond the expiration date without Committee approval. Please submit continuation requests early enough to allow sufficient time for review. Failure to receive approval for continuation before the expiration date will result in the automatic suspension of the approval of this protocol. Information collected following suspension is unapproved research and cannot be reported or published as research data. If you do not wish continued approval, please notify the Committee of the study closure.

Adverse Events: Any serious or unexpected adverse event must be reported to the IRB Committee within 48 hours. All other adverse events should be reported within 10 working days.

Amendments: If you wish to change any aspect of this study, such as the procedures, the consent forms, study personnel, or number of participants, please submit an amendment to the IRB. All changes must be approved by the IRB Committee before they can be initiated.

You must maintain a research file for at least 3 years after completion of the study. This file should include all correspondence with the IRB Committee, original signed consent forms, and study data.

cc: Kristi L Perryman, Investigator