

A Mismatch of Emotion States: A Mechanism for Applied Memory Reconsolidation

Doctoral Project

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School of Behavioral Sciences

California Southern University

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of the requirements
for
the degree of

DOCTOR

OF

PSYCHOLOGY

by

Mary Bowles

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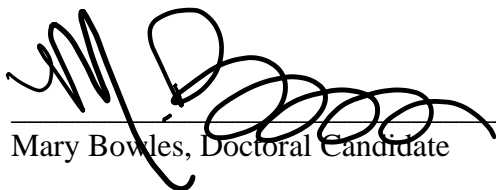
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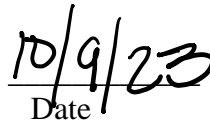
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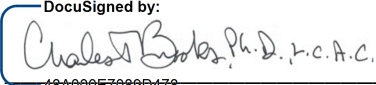
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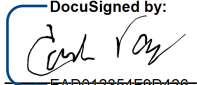
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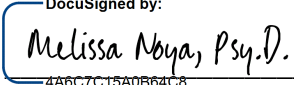
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DEDICATION

This project is dedicated first and foremost to my husband! There are not words to describe the magnitude of the support and encouragement this man gave me through my academic career and in every aspect of my life and our lives together. His physical, emotional, and financial presence for me and our kids throughout this process was instrumental to the completion of this degree and the health of our children and our family. I am so grateful for the time he has taken to read, learn, question, and, as if he were my own personal lab rat, apply my work to his own life and perspectives. His genuine goodness and integrity make the world a better place and this work could not exist without him. He taught this anxiety ridden woman through his love, support, and loving constructive challenge that we can overcome our histories and improve our lives by being willing to change our perspectives, by pushing unnecessary social norms, and by managing our own discomfort with stepping out of the box to create a new sense of normal that is effective, not just mindlessly and needlessly expected.

Secondly, this doctoral project and the completion of my degree would not have been possible without our seven kids! Initially, the birth of my children motivated me to pursue my high school education again after dropping out in 10th grade after years of struggling academically, emotionally, and behaviorally. Thus began my love for learning that evolved from a goal of getting my high school diploma to graduating high school with a 3.7 GPA. I began college 10 years later with a blended family that included seven children under 15 years of age. Even with a husband and seven children I was able to sustain honors level grade point averages at every level of my college career (AA, BA, MA, DMFT) including a 4.0 GPA in my doctorate (PsyD) core courses. My family was my initial and continual motivation to be a Marriage and Family Therapist to help support them financially, but also because having them made me want

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to prove that a person can have a family and be a self-valuing individual too. I believe I demonstrated that balance by valuing them and me. Hearing “I’m so proud of you” from my, now adult kids is an incredible pay off!

Thirdly, I want to thank my parents. My mom for giving us Betty (the voice of reason and the presence of balance and predictability in our often-chaotic lives), for always being comfortable talking about difficult topics that needed to be addressed, and for leaving her books available for my leisure reading from as early as I can remember. Some of my favorites were her medical books and nursing manuals which gave me a love for the physiological side of people and for the Joy of Sex book, which showed me there were more ways to look at the world than what is perpetuated in societal messages. I want to thank my dad for giving us Janie (who demonstrates kindness, love, and appreciation when too often our family has not demonstrated those critically important characteristics) and for telling me, “You’re resourceful,” causing me to look it up because I was not exactly sure what it meant. That is when I believe I actually became resourceful, showing me that we can become the compliments we are given; one of the most important therapeutic skills I have obtained outside of academia.

Last, but certainly not least, I am dedicating this project to ME! I did this and I did it with a lot going on!!! In the process of completing my college education over the last 15 years, I lived a lot of life. They were good, bad, great, and terrifying moments, but above all I did it beautifully connected to the people listed above and to so many more constant and new amazing friends and family!! Of the good and bad, most moments were incredibly good! We raised seven children (plus some important extras who needed us) and survived to become empty nesters. Besides the day-to-day good and bad (mostly good) fluctuations in life, we had so many big and valued moments! Out of seven children, the terrifying moments included the one breaking his back in a

college football game and having three ACL surgeries, one had a hip and a shoulder surgery (one which resulted in blindness developing in one eye), one was diagnosed with thyroid cancer and had surgery, one was diagnosed with testicular cancer and had surgery, both survived it to show their dad how to do the same thing after he was diagnosed with testicular cancer just three months after our son's diagnosis. All are now cancer free! During this time my mom died and a nephew took his own life (both struggled with lifelong depression), we had five of our children (and the grandchildren) move out of state (one moved back!), my father had multiple strokes, and we sold our house, preceded though, by getting all seven kids home together one more time. We all lived through a pandemic, we had all of our children struggle with mental health in one way or another, and I finally accepted my own diagnosis of and received treatment for ADHD, which ultimately saved this project! But the great moments are what have sustained me throughout! Seven kids (plus two) graduated from high school (all with some form of scholarship), two graduated from college, two got married, and three became parents and gave us six beautiful grandchildren (three biological, three bonus, and all equally valued), and my husband and I renewed our vows and celebrated 20 years of marriage with unconditional love like nothing I have ever seen or experienced. With all of this, the majority of which has occurred over the last five years, I did the work! I grew, I learned, I suffered, I experienced, I stayed focused, I fell behind, and ultimately, I overcame! I am resourceful and resilient!

ACKNOWLEDGMENTS

As noted in my dedication, originally, my adult education began through wanting to set a good example for my children. Subsequently attending college, I was focused on supporting my family by becoming a Marriage and Family Therapist in private practice. It was my clientele in that therapeutic setting and my loved ones who have and do struggle with anxiety, depression, and trauma that fed my desire to do more. Being a private practice therapist was not enough. These people motivated me to unite my love for physiology and my knowledge of family systems, which led to further exploration into the connections between the smallest particle within us and around us to the vastness of the universe. The result is a view of the world that is motivated by self-preservation and growth, not by selfishness or intention to harm. This led me to explore empirical research about the brain and its effect on the body (including behaviors, emotions, motivations, memories, etc.) to apply that evidence in a psychological framework to increase the potential for effective, rapid, and permanent change. These incredibly valued people have motivated me to look for ways to simplify, speed up, and minimize the risks of treating mental illnesses and to increase the potential that individuals will seek help sooner and recover more quickly. Additionally, these wonderful humans have driven me to simplify the language used to discuss mental health and mental health treatment with the intent to limit confusion, misinformation, condescension, and reduce stigma that prevents and inhibits people from seeking out and accessing effective help. As such, my next work, written with the general population as the target audience, will be dedicated to my clients and loved ones. For now, I must start by acknowledging them and the benefit their struggles have had on the larger system.

My process for exploring my interests led me to several people I need to acknowledge, for either their direct interaction with me or their work that influenced my journey. So, I want to

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begin sharing my gratitude with Dr. Martha Stark, faculty at Harvard Medical School. She affectionately reached out to me after reading my first published article in the *Neuropsychotherapist* and has since shared that she presents some of my work in her curriculum. Personally, she has peer reviewed my work, written recommendations, and became a beautifully valued friend! But more importantly, her reaching out to me to share her appreciation for my work and to ask my perspective regarding our mutual topics of interest has cured my imposter syndrome, validated my work and approach, and has resulted in a beautiful friendship with an incredibly tender and positive human who is feeding the human system so much good!

I also want to genuinely state my gratitude to my doctoral project chair, Dr. Charles Brooks, for his patience, expertise, and feedback throughout this project. Along with Dr. Brooks, I need to thank my doctoral project committee members, Dr. Carlos Vazquez, Dr. Jonathan Rich, and Dr. Samone M. Smith-Brown for their ongoing feedback and for challenging me away from my tunnel vision. I am so thankful for how each encouraged my growth and challenged my knowledge, which is always instigating of further knowledge seeking.

Next, I must thank those pivotal to achieving my academic goals and motivating me along the way. So many educators along the way offered me essential feedback for growth and motivation to continue, but my Bachelor level professors at Colorado Mesa University stand out profoundly! Dr. Karen Ford, Dr. Bruce Bishop, and Dr. Susan Becker have all earned a spot on my gratitude list for making every course more than challenging; they were rigorous! On multiple occasions I have referred to my stored homework assignments to guide me in multiple courses throughout my post-BA education. I am so grateful to them for making me work for my grades. I am also so thankful for Michelle Matarazzo, LMFT who supervised my undergraduate practicum. She fed more of my love for this field by showing me the therapeutic environment

can be filled with compassion, authenticity, and true connection. Her approach really helped to balance out the rote programming that can arise from a counseling program and changed it from a program to a human relationship.

Finally, but with an impossible number of names to mention in gratitude, I must thank the late Dr. Pieter Rossouw for giving us and teaching me Neuropsychotherapy. Without it, understanding how to apply what I knew from neuroscience to what I knew about human behavior and family systems would have been impossible. I needed all the extra pieces that Neuropsychotherapy provided! I must also thank Dr. Jon Connelly for teaching me so much more about thinking outside the box and the value of breaking unhealthy and ineffective social norms. He can always find good in people, which offers value to the system. I also want to thank him for trusting me to write and present neuroscientifically about Rapid Resolution Therapy (RRT) as another way to help others think outside the box. I also need to thank Dr. Daniel J. Siegel for giving me the scientifically all-inclusive Interpersonal Neurobiology, critical to seeing the entire system. I have spent hours with his work and value so much his perspective and approach, even only having interacted in passing.

Thank you to all involved, named and unnamed, in my journey that is concluding with the completion of this project but that could not exist without every one of them, beginning to end! Going forward in my work, I expect to gather many more people to value as a part of my human system.

Abstract

Hoping to improve the target for successful psychotherapy and increase positive outcomes for patients, the purpose of this qualitative study was to investigate emotional approach state with avoid state pairing as a mechanism for establishing the required mismatch for successful memory reconsolidation in humans, as guided by Elsey et al.'s (2018) theoretical framework for successful memory reconsolidation and Lange et al.'s (2020) Psychometric Network Theory of Emotion, and supported by The Hebbian Principle (Hebb, 1949), Pavlov's Theory of Classical Conditioning (Pavlov, 1928), and Skinner's Theory of Operant Conditioning (Skinner, 1953). This study asked how operant and classical conditioning relate to the neuroscientific understanding of memory consolidation and reconsolidation, if emotion is a possible target for successful memory reconsolidation in humans, and how successful emotion pairing alone is at reducing discomfort from trauma and stressor cues. The key aspects of the literature review uncovered the required components for successful memory reconsolidation, including the distinction between extinction and erasure, clarity around what comprises emotionally motivated approach and avoid states, and the status of prolonged exposure (PE) as a first treatment for PTSD and the holes in its research. The sampling for this project included 21 RRT transcripts and one RTM script. Each document was evaluated for the presence of possible emotion pairing. Study results showed more than half included obvious emotion pairing including laughter in 14 of 21 transcripts, 100% of the transcripts were absent PE, and met Elsey et al.'s required components.

Keywords: memory reconsolidation, emotion pairing, trauma, rapid-resolution therapy, rapid trauma treatment

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CHAPTER ONE

OVERVIEW OF THE STUDY

Little is known about what takes place at the neural level when an individual realizes therapeutic success following therapy for a stressful event (e.g., traumatic, anxiety, or panic inducing experience). Scientific research has supplied empirical evidence that learning (memory consolidation) occurs through classical conditioning (Pavlov, 1928) and operant conditioning (Skinner, 1938, 1953). Animal research with *Aplysia Californica* (sea slugs), Medaka fish, and Crab Chasmagnathus has empirically identified memory change (memory reconsolidation) at the neural level, although little empirical evidence exists for humans (Carew et al., 1981; Carew et al., 1983; Eisenberg et al., 2003; Hawkins et al., 1983; Nader et al., 2000b; Pedreira et al., 2002; Sara, 2000). Research has also resulted in evidence of memory reconsolidation in rats (Debiec et al., 2002; Debiec et al., 2006). The aim of this research was to shed light on the theoretical application of memory reconsolidation through the classical conditioning of emotions as a mechanism for change in human beings. Ecker explained that erasure of emotion from those memories with the retention of the emotionless memory is the result and the maintenance of the reconsolidated memory is effortless (Ecker et al., 2012a, 2012b).

In this doctoral project I explored the pairing of approach state emotions (e.g., calm, peaceful, humorous, funny) with avoid state emotions (e.g., fear, anger, disgust, sadness) that, for clients, have become associated with trauma and stressor cues. Elliot (2006) stated:

Approach motivation may be defined as the energization of behavior by, or the direction of behavior toward, positive stimuli (objects, events, possibilities), whereas avoidance motivation may be defined as the energization of behavior by, or the direction of behavior away from, negative stimuli (objects, events, possibilities). (p. 112)

This project sought to establish that approach state emotion pairing with avoid state emotions will interrupt avoidance state predictive cues and are a means to enhance possibilities for clients resulting in the erasure of emotional responses consolidated with avoid state memories (Elliot & Covington, 2006; Elliot, 2001, 2008; Eder et al., 2013; Schiller et al., 2010). Such pairing results in the required mismatch between what is predicted when a retriggering cue occurs and what follows the cue (Ecker et al., 2012a, 2012b). For example, an individual who is repeatedly triggered by the name of her perpetrator after a sexual assault, but then intentionally experiences a sense of calm or the recall of a previous humorous experience at the same time she is addressing the name of the assailant, subsequently begins to effortlessly experience laughter instead of the previously consolidated fight-flight-flee response.

Longstanding theories provide validation for this process. The Hebbian Principle (Hebb, 1949) established that cells that fire together wire together and cells that fire apart wire apart. Pavlov's Theory of Classical Conditioning (Pavlov, 1928) and Skinner's Theory of Operant Conditioning (Skinner, 1938, 1953) both established common means for memory consolidation. The Psychometric Network Theory of emotions established an understanding of emotions as electro-chemical changes at the synaptic level, which motivate an individual to take an action based on presented internal or external stimuli (Lange et al., 2020). Theories of Memory Reconsolidation by various researchers establish the required components for successful memory reconsolidation to occur and validates the phenomenon of memory reconsolidation (Besnard et al., 2012; Debiec et al., 2006; Debiec et al., 2002; Ecker et al., 2012a, 2012b; Elsey et al., 2018; Haubrich, & Nader, 2016; Lee, 2009; Lee et al., 2017; Nader & Einarsson, 2010; Nader et al., 2000a & 2000b; Schiller et al., 2010; Tronson & Taylor, 2007). Each theory offers foundational

validation for the argument that pairing opposing emotions may result in successful memory reconsolidation in human beings as well.

Existing peer reviewed case study transcripts, published in academic journals and academic libraries are presented here as validation for further study and the aim of this project is to demonstrate that individuals do not necessarily need weeks of talk or exposure therapy, but instead they need experiences with different emotional states that oppose their current emotionally avoidance activated states when difficult emotions arise (Lane et al., 2015). The argument follows that when a client can experience what they would like to feel, neural networks stop sending messages to the body to take action upon an event that is no longer happening. Subsequently, the stored message to take action that was stored at the time the original stressful memory was formed, or consolidated, becomes erased. Lastly, I sought to use qualitative analysis to answer the conditions for which emotion pairing is effective or ineffective.

Background of the Problem

The American Psychological Association (APA) (2017a, 2017b, & 2018) recommends Prolonged Exposure (PE) (Foa, 2011 & 2018) therapy as a first-line treatment and Eye Movement Desensitization and Reprocessing (EMDR) (Shapiro, 2013, 2014, & 2017; Shapiro & Maxfield, 2002) as a second-line treatment for anxiety, panic, and trauma-based disorders. Repeated exposure, according to memory reconsolidation protocol, is unnecessary and potentially strengthening rather than deleting of a neural network (Ecker et al., 2012a). Repeated exposure can be overwhelming to the client and a likely reason for the excessive drop-out rates (36%) according to a Steenkamp, Litz, Hoge, and Marmar's (2015) metanalysis of PE studies. Foa et al. (2018) report similar results. Memory reconsolidation requires that some triggering of the prior avoid state event is required to unlock the storing neural network, but that prolonged

exposure can inhibit the change process by upregulating the fight-flight-freeze response (Hypothalamus-Pituitary-Adrenal [HPA] Axis), thus the client is in an avoid state where effective approach state learning cannot as easily occur (Ecker et al., 2012a, 2012b, Elsey et al., 2018). In addition, this statement offers validation for the required approach state and the inhibition of change that occurs with an avoid state.

Ecker et al. (2012a, 2012b) reported that in order for successful activation of the memory reconsolidation process there must be a mild reactivation, or retriggering, of the original learning experience (event). This is the first step in the memory reconsolidation process. Change at the neural level does not require the extended reliving of an event, instead, and of importance, is that this step requires only a *mild* reactivation. Elsey et al. (2018) concurs in that longer reactivation periods inhibit change from new learning. This required *brief* reactivation is also an argument against prolonged exposure using systematic desensitization which requires a prolonged series of repeated exposure periods pairing relaxation techniques to a hierarchy of fears that gradually increase from the least anxiety provoking fear to the most provoking (Thomas et al., 2017).

Step two in the reconsolidation process is to create a mismatch experience. A mismatch must, “deviate saliently from—what the reactivated target memory expects and predicts about how the world functions” (Ecker, 2012a, p. 21). A mismatch can be considered a self-disagreement with prior emotional learning and signals the mismatch, which is required for successful memory reconsolidation. This project posits that there must be more than cognitive disagreement. There must be an emotional, or emotion state, disagreement.

Step three occurs through the erasing or revising of the target experience through a new learning experience (often indirect exposure). Ecker et al. also wrote that steps two and three can overlap with one another and may require the repeating of both steps. This step must be

completed within a five-hour window before the original memory network locks its synapses and prevents new neural network formation.

The aim of this project was to provide evidence that the pairing of emotions (classical conditioning) can elicit permanent change by erasing, which is different from extinguishing, fight, flight, and freeze responses in individuals who report experiencing triggers to prior stressful events. Following erasure sessions, approach state reflexive responses become the operant conditioning for sustained erasure of emotional reactions. To clarify, erasure occurs as a result of a separate neural network being created from the original network and extinguishing occurs as a result of a parallel and equally accessible network that can be used, which often results in relapse (Skinner, 1938, 1953, 1963; Ecker, 2012a, 2012b; Foa, 2011). In addition, this study aimed to consider newer more effective and rapid approaches to mental health treatments that are likely effective as a result of indirect exposure, as opposed to interoceptive and imaginal exposure as set forth in the PE treatment protocol (Foa, 2011). The method of study was through transcripts from some new and different approaches to therapy that include RRT (Connelly, 2016, 2019) and Reconsolidation of Traumatic Memory (RTM) (Gray & Bourke, 2015; Gray et al., 2021; Gray & Teall, 2016; Tylee et al., 2017), both of which are not solely based in talk therapy. Transcripts from other single session and professed rapid treatment modalities were also sought, although no transcripts were located that involved treatment for a target issue that concluded within three session hours or less.

Statement of the Problem

For as long as psychotherapy has been an option, what works and what does not work for each individual client has been largely subjective and mysterious, yet approaches to mental health treatment are ever increasing and the number of individuals who seek out and receive

mental health services is also increasing. In 2019, 16.1 percent of adults received mental health services at any point during the previous year, which is an increase from 13.0 percent from 2002 (Substance Abuse and Mental Health Services Administration, 2020). While psychotherapy approaches and mental health clientele are increasing, empirical evidence of neural change in humans, at the current moment, cannot be obtained. With such dramatic increases, understanding how and what creates change for human beings in mental health settings is becoming equally and profoundly necessary. Furthermore, establishing evidence for the shared components of the multiple approaches to psychotherapy must become a focused interest. Fortunately, there exists vast historical and current data for the argument that memory reconsolidation is the mechanism for change in animals. There also exists substantial validation for classical and operant conditioning in humans as a form of learning along with validation for multiple theories of emotion. So the time has come to combine historical and recent neuroscientific research and apply it to the human animal in hopes of weeding out what works from what does not work in the psychotherapeutic setting, thus fine tuning the target for successfully reducing the need for long-term mental health treatment, improving mental health treatment, clearing the path for utilization of the most effective therapies, and weeding out the techniques that plug up the system creating confusion and increasing mental health stigmas rather than decreasing them. With so many types of therapies, it is time to separate what does from what does not work in the therapeutic setting.

Purpose of the Study

The purpose of this doctoral project was to qualitatively investigate emotion pairing as a means to successfully reconsolidate avoid state emotions to approach state emotions. More specifically, this project intended to establish emotion pairing as the mechanism for creating the

necessary prediction error (mismatch) for successful memory reconsolidation and erasure of consolidated memory emotion avoidant states (Elseley et al., 2018).

Research Questions

RQ1. How do operant and classical conditioning relate to the neuroscientific understanding of memory consolidation and reconsolidation?

RQ2. Is emotion a possible target for successful memory reconsolidation in humans?

RQ3. How successful is emotion pairing alone at reducing discomfort from trauma cues?

Methodology for this research study was unlike many established memory reconsolidation studies with human subjects where the modes of memory reconsolidation involve interference with the re-stabilization of a memory after activation by manipulating neurotransmitters and neuromodulators or by injecting various drugs that interfere with protein synthesis at the synapse (Fonseca et al., 2006; Besnard et al., 2012). Instead, this project assessed transcripts from existing publicly published and deidentified Rapid Resolution Therapy (RRT) transcripts from actual client sessions and evaluated the treatment script for Reconsolidation of Traumatic Memory (RTM) (Connelly, 2016, 2019; Gray et al., 2021; Gray & Teall, 2016; Tylee et al., 2017; Gray & Bourke, 2015). Additional RTM and rapid treatment transcripts were sought, but none were located. Access to these transcripts came from existing publicly published case study transcripts and peer reviewed articles that included the RTM treatment protocol script. These treatment modalities demonstrated emotion pairing in practice without the use of neurotransmitters and neuromodulators manipulation. Intention in this doctoral project was the argument that emotion pairing may be a useful tool for reducing traumatic triggers and should be studied in future research.

Theoretical Framework

This doctoral project was grounded on multiple theoretical frameworks. To begin with, the Hebbian Principle asserts that cells [neurons] that fire together, wire together and cells that fire apart wire apart (Hebb, 1949). The Hebbian Principle validates the changes that occur using Pavlov's Theory of Classical Conditioning (Pavlov, 1928) (pairing) and Skinner's Theory of Operant Conditioning (Skinner, 1953) (positive and negative punishment and reinforcement) confirming how learning takes place and remains stable over time, resulting in memory consolidation (Squire et al., 2015).

Nader et al. (2000a, 2000b) and Sara (2000), reported on how memories, when reactivated can become unstable (labile) and open for change. While there is empirical evidence of memory reconsolidation in animals, there was little in the way of evidence in its application with humans. Elsey et al. (2018) noted, however, one of the first studies by Walker et al. (2003) demonstrated inferred memory reconsolidation in humans who learned a finger tapping sequence, followed by a competing finger tapping sequence, which resulted in the loss of the original learned sequence. Elsey et al. provided a number of examples where memory reconsolidation research was conducted on humans with similar results to those of animals and that also align with the inferred applied memory reconsolidation using the following required steps, "reactivation x manipulation interaction, time dependency, memory specificity, and dissociation of immediate and delayed effects" (2018, p. 798-799). Ecker (2012a, 2012b) offered a more simplified version stating the need for reactivation, a mismatch (prediction error) that unlocks the synapse, and then repetition (practice) to erase the old learning and revision of the memory through new learning.

In addition, the Psychometric Network Theory of Emotion informs that emotions are electro-chemical changes at the synapse that activate an individual to take an action based on given internal or external appetitive or aversive stimuli to illicit approach or avoid states (Elliot, 2006, 2008; Elliot et al., 2001; Elliot et al., 2013; Lange et al., 2020). Elliot et al. (2013) clarified,

Emotion is not just construed as a phenomenological experience, but is seen as a process that has implications for the way in which organisms are both energized and directed, the two fundamental definitional components of motivation...Most connect approach motivation to concepts of appetition, reward, and incentive, and connect avoidance motivation to concepts of aversion, punishment, and threat. In addition, there is considerable agreement that normal, adaptive functioning entails an appetitive physical and/or psychological orienting toward reward and incentive. (p. 308)

Memory reconsolidation studies have used observable responses in animals and humans as the measure for success. However, as of yet, there has not been a study that uses subjective emotional states as the measure for success. Because the subjects of the transcripts in this doctoral project were human, subjective perspective of emotional change were the measure. Unfortunately though, inferred memory reconsolidation continues to be one of the certain outcomes in this project.

Using these theoretical frameworks, I sought to demonstrate that by pairing a desirable emotional (approach) state, (one that can be subjectively measured) with an undesirable emotional (avoid) state, the transcript subjects would experience a prediction error (mismatch). Additionally, the repeated (practiced) emotional response would become the positive reinforcement for strengthening the new desirable response, just as Pavlov's dog developed an

approach state when presented with the bell. The result was subjects, that afterward, maintained a complete emotional absence of the bodily responses from traumas or stressors that originally elicited fight, flight, or freeze responses.

Significance of the Study

The early 1900's gave the world Pavlov's (1928) classical conditioning while the mid-1900's gave the world Skinner's (1938, 1953) operant conditioning and Hebb (1949) gave the world the Hebbian Principle. Multiple theories of emotions followed, as did what we now call memory reconsolidation (Misanin et al., 1968; Nader, 2013; Schneider & Sherman, 1968). Finally, in the late 1990's and early 2000's, Elliot's approach and avoidance motivation came into light (Elliot, 2006, 2008; Elliot & Covington, 2001; Elliot et al., 2013; Elliot & Thrash, 2002). The valuable data provided by these researchers offers a robust foundation for the application to memory reconsolidation in this project. Based on these researchers, the value of this project was to contribute to a greater awareness of emotion motivation as a fundamental component to successful psychotherapy treatment and increase available information about how to enhance neuroplasticity in the therapeutic relationship. In addition, offering a new understanding of the value of personal emotional disagreement can result from a mismatch experience to illicit new emotion motivations even when old emotion motivations were originally encouraged.

The concept of emotion pairing is new, and the beneficiaries of this research are multiple. First, for those individuals who are unable or unwilling to participate in multiple talk therapy sessions, the pairing of emotion approach states with emotional avoid states can alleviate the fear of having to talk about events or details about a stressful event. Talk therapy does not work for every patient or client, so techniques that improve successful treatment must be discovered (Lutz

et al., 2017; Morrison et al., 2017; Swift & Parkin, 2017). In addition, future clients and patients may get to experience how quickly they can adjust their own emotional responses without searching for meaning, reasoning, belief systems, or intentions. Lastly, psychotherapists and psychologists may experience a reduction in vicarious trauma when traumatic stories do not need to be shared in full detail. More importantly, clients and clinicians can experience humor as a component to treatment and gain access to emotional motivation states that are already present for each client who will subjectively measure their own improvement.

Limitations and Delimitations of the Study

One limitation in this project was the lack of empirical evidence that a subject's neural networks will be rewiring themselves during this project, because as of yet, the ability to witness such change in humans is not available. The assumption had to be made that, like other animals, human animals were also experiencing the same neural change as those witnessed empirically in animals. Additional limitations exist in relation to the abstract notion that emotion is being manipulated, not just cognition. The project is also limited in that there could not be a full intake history or mental health assessment completed on each subject. The focus was only on each transcript client's subjective emotion states only.

The purpose of this was to establish experiential theoretical justification for further studies and applications. A delimitation of this study was present because of the variability in subjective perspectives. In particular, the trigger issue being addressed by each subject and the emotional experience that were addressed in each transcript varied. As such, clarity because of the possible vast differences in these transcripts can be problematic.

Ethical Considerations

This project adhered to the ethical standards for research as set forth by the American Psychological Association's (APA) Ethical Principles of Psychologists and Code of Conduct (APA, 2017b). These standards include adherence to Respect for Persons, Beneficence (do no harm, including physical or psychological harm), justice, and informed consent. These standards also adhere to the avoidance of coercion and deception. Because the chosen transcripts were already published, these standards were easily addressed and managed.

Definitions and Key Terms

Approach Motivation

Elliot (2006) wrote, "Approach motivation may be defined as the energization of behavior by, or the direction of behavior toward, positive stimuli (objects, events, possibilities)" (p.112).

Avoidance Motivation

According to Elliot (2006) "avoidance motivation may be defined as the energization of behavior by, or the direction of behavior away from, negative stimuli (objects, events, possibilities)" (p.112).

Consolidation

Alberini et al (2013) stated, "Memory consolidation is a fundamental process of long-term memory formation...has been described to occur in a multitude of different types of memories, species, and memory systems. It refers to the stabilization process of a newly formed long-term memory" (p. 81). When the original memory is established, it remains susceptible to change through behavior and electro-chemical signaling but over time becomes stable and resistant to change.

Counterconditioning

The American Psychological Association (2020) stated that counterconditioning is, an experimental procedure in which a nonhuman animal, already conditioned to respond to a stimulus in a particular way, is trained to produce a different response to the same stimulus that is incompatible with the original response. This same principle underlies many of the techniques used in behavior therapy to eliminate unwanted behavior in people.

In this project, emotion counterconditioning could be considered a mode of treatment.

Destabilization (Deconsolidation, Labilization)

The unlocking of a memory network, which increases the potential for rendering a memory susceptible to change as a result of reactivation of the original memory trace by unlocking the synaptic space where a memory is stored (Ecker, et al., 2015; Lee et al., 2017; Nader et al., 2000b).

Emotion learning (emotional memory)

Ecker et al. (2012a) stated emotional learning is,

learning that occurs in the presence of strong emotion includes the formation, in non-conscious or “implicit” memory networks of the brain, of a mental model (template or schema) that is the individual’s adaptive generalization of the raw data of perception and emotion. Emotional implicit memory operates to detect the arising of similar situations and generates a self-protective or benefit-seeking response with compelling power and speed (p. 202).

Erasure

Elsley et al. (2018) wrote that erasure is the “dissociation of immediate and delayed effects” (Elsley et al., 2018, p. 798-799). “Erasure occurs either endogenously, through new learning that

re-encodes the unlocked neural circuitry, or exogenously, as when chemical agents prevent circuits from reconsolidating, destroying them” (Ecker et al., 2015, p. 24). The result of erasure is the emotional knowing that had previously activated approach or avoid state motivations so can no longer activate the same state.

Memory Reconsolidation

Elsley et al. (2018) defines memory reconsolidation as, “the reactivation dependent induction of a transient, unstable state of a previously consolidated memory, during which the memory trace may be modified or disrupted and requiring a time-dependent process of re-stabilization in order to persist” (p. 93). Ecker et al. (2012a) also writes,

memory reconsolidation: a type of neuroplasticity which, when launched by the specific series of experiences required by the brain, unlocks the synapses of a target emotional learning, allowing that learning to be re-encoded or “re-written” in memory (during a time period of several hours) according to new learning experiences, resulting in either full nullification (erasure), weakening, modification, or strengthening of the original learning, depending on characteristics of the new learning. (p. 204)

Elsley et al. (2018) also added that reactivation of original memories should be brief, because longer reactivations have shown reduced impact from the subsequent learning.

Mismatch (Prediction Error)

An experiencing of

something distinctly discrepant with what the reactivated target memory “knows” or expects—a surprising new learning consisting of anything from a superfluous but salient novelty element to a direct contradiction of what is known according to the target

learning...triggered only by new information that is at odds with the contents of an existing learning. (Ecker, 2015, p. 7)

Additionally, “reconsolidation is triggered by a violation of expectation based upon prior learning, whether such a violation is qualitative (the outcome not occurring at all) or quantitative (the magnitude of the outcome not being fully predicted)” (Lee, 2009, p. 417) or more simplified, a disagreement between the originally consolidated memory and a new experience. See also: mismatch experience, prediction error experience, juxtaposition experience (Ecker et al., 2015), Surprises (Solms, 2015), Violating expectations (Lee et al., 2017).

Reactivation (also Retriggering)

Retrieval, or re-exposure, of an original memory trace by a suitable cue or reminder (Lee et al., 2017; Ecker et al., 2015), “which may result in destabilization of the previously-learned neural representation of memory” (Lee et al., 2017, p. 14). Elsey et al. (2018) noted that memory reactivation should be brief because the longer the reactivation period before new learning took place, the lower the change that was observed through memory reconsolidation techniques.

Organization

Chapter One presented an overview of this doctoral project. The overview includes an introduction, the background of the problem, statement of the problem, purpose of the study, theoretical framework, significance of the study, limitations and delimitations, definitions, and key terms. The final area covered presented how the final chapters in this doctoral project are organized.

To follow, in Chapter Two, the literature review presents the foundational literature on original memory formation (memory consolidation) and the necessary components for the change of a memory (memory reconsolidation). The resulting memory reconsolidation is

critically reviewed, establishing the connections between historical knowledge about how neurons connect to form memories and how learning is established. The major portion of the literature review focused on the most recent research on memory reconsolidation, emotion, approach and avoid states, and the classical conditioning of emotions as a means of erasing learned emotional avoidance states and increasing emotional approach states.

Methodology is the focus in Chapter Three. This chapter addresses the demonstration of emotion pairing in practice and without the use of neurotransmitters and neuromodulators manipulation as a means of successfully achieving memory reconsolidation. The research questions and a discussion of the problem include an in-depth outline with supporting content surrounding memory establishment (consolidation) and change (memory reconsolidation). This chapter also offers depictions of the connections to theoretical frameworks.

Chapter Four follows with a clear and detailed presentation of the insights and emerging themes discovered in the literature and archival transcripts. Demographic data regarding transcript selection and settings are shared. Connections to each research question was the major focus.

Chapter Five, Discussion, thoroughly asserts the findings, draws connections to the potential that emotion pairing toward an approach state is an effective technique for removing cues (triggers) that activate an avoid state when not useful or necessary. Implications for further professional and scholarly work are also discussed, finishing with future research topics, including pairing approach states into avoid states and finally, ending with insights and personal reflections.

CHAPTER TWO

LITERATURE REVIEW

Understanding the foundations for learning and memory is important for achieving a clear understanding of this project. This chapter includes a review of the origin of memory formations, also called memory consolidation and learning. This chapter reviews the literature that explains extinction and the necessary components for extinction to occur. Comparatively, I explored erasure of emotional learning to include the necessary components for successful erasure, or what is termed memory reconsolidation.

In addition, I define approach and avoid states by their distinguishing components that are encoded through learning experiences. Namely, emotion, motivation, somatosensory (interoceptive) responses, and feelings are clarified in this chapter to enhance understanding in this project. There are multiple definitions for the word ‘emotion’ and multiple theories that guide emotion research, so operational definitions are included for clarification of their uses in this project.

To follow is an exploration of one of the gold standard treatments for trauma and new alternative treatments that have not yet met mass empirical support. The necessary steps for conducting the gold standard treatment protocols are included and compared to the scientifically verified steps necessary for successful memory reconsolidation to occur at the neural level. Research results that run counter to the gold standard treatment approaches being considered the most effective are also explored.

This project hypothesized the following treatment modalities, Rapid Resolution Therapy (RRT) (Connelly, 2019) and Reconsolidation of Traumatic Memories (RTM) (Gray et al., 2017a, 2017b, 2021), meet components for memory reconsolidation and both result in erasure of

previously encoded emotional learnings, thus clearing trauma by pairing salient positive emotional approach states with previously encoded emotional avoid states. In addition, this project hypothesized that Prolonged Exposure (PE) takes more time than necessary for change to occur and risks retraumatizing clients unnecessarily.

This review included methodological problems with past studies and controversy in the literature. Specifically, this review includes content that argues that the extinction process does not result in permanent change, but rather creates a competing neural network that does not connect to the original memory storage network and the potential for spontaneous recovery remains intact (An et al., 2017; Becker & Kindt, 2017; Ecker 2015, 2017; Ecker & Bridges, 2020; Ecker & Hulley, 2019; Gerlicher et al., 2019; Kalisch et al., 2019; Maren, 2022; Salinas-Hernández & Duvarci, 2021; Yoo et al., 2017). Conceptual and theoretical frameworks will also be included in this review.

Memory Consolidation

Specifically, memory consolidation refers to how memories are formed at the neural level through conditioning, or learning; classical and operant conditioning and the necessary steps to follow to encode such learning. In addition, once an emotionally distressing memory is consolidated, the result is often an innate threat; a continued avoid state, even absent the threat cue (Ledoux & Daw, 2018). This avoid state, a conditioned response to stimuli, is a result of conditioning through experience. Unconditioned responses, like salivation to the smell or presence of food, are innate (unconditioned responses; UCS) and are not the result of learning experiences (Akpan, 2020). While there are many learning theories that result in neural encoding of information to be used in future situations, Classical and Operant Conditioning are the two forms of learning considered in this project.

Classical Conditioning

Classical Conditioning, realized by Ivan Pavlov (Akpan, 2020) while researching digestion in dogs, found that learning happens through association. Specifically, Pavlov was researching digestion in dogs when he noticed the dogs would begin salivating when the assistants carrying the food entered the room. This observation led him to pair the ringing of a bell (neutral stimulus—NS) with the presentation of food (unconditioned stimulus—UCS), which resulted, initially, in only an orienting response followed by salivation (unconditioned response—UCR) with repeated pairings during conditioning. After conditioning the dog continued to salivate (conditioned response—CR) to the presence of the bell (conditioned stimulus—CS). Just as the dog reflexively salivated to the presence of food through experiencing of the pairing of food with the ringing of a bell, the dog began to reflexively salivate to the ringing of the bell.

Operant Conditioning

B. F. Skinner's (Akpan, 2020; Ryan et al., 2019) research resulted in what is now known as operant conditioning (also called instrumental conditioning); more specifically, that learning occurs through positive and negative reinforcement and punishment to increase or decrease behavior. Some examples of each include the following:

- Positive reinforcement—adding something to increase a subject's behavior
 - A toddler cries and a parent provides a cookie resulting in the toddler crying more often.
- Negative reinforcement—subtracting something to increase a subject's behavior
 - A child does not receive screentime after refusing to clean his room, resulting in the child refusing to clean his room less often.

- Positive punishment—adding something to decrease a subject’s behavior
 - A man touches the metal prongs with his fingers while plugging in a cord and receives a shock, resulting in him keeping his fingers out of the way each time in the future.
- Negative punishment—subtracting something to decrease a subject’s behavior
 - A mother ignores child crying for a toy, so the child learns to cry for toys less often.

The subject forms an association between the behaviors and the consequences, which results in a reflexive response (Apkan, 2020). The target learning will occur more effectively if the subject values what is being added or subtracted, because reflexes ensure the well-being of an organism and serve to motivate the subject toward appetitive and away from aversive stimuli (Apkan, 2020; Ryan et al., 2019; Fonzo, 2018). Thus, similar future experiences that result in the same outcome satisfy an agreement with prior learning experiences that well-being is sustained or maintained resulting in enduring behavioral responses.

Neural Connections

Through learning experiences, neural networks are created in the brain. Donald Hebb (1949) coined the term “cells that fire together, wire together,” which is a quote that signifies that learning (memory consolidation) has taken place and structural change has occurred at the neural level. This quote also summarizes what is also known as the Hebbian Principle, Hebb’s Law, and the Hebbian Theory and it specifically indicates that an initially short-term (labile) memory is converted into a long-term (stable) memory in the hours following learning (Hawk & Abel, 2017).

Carew et al., (1983) studied procedural (intrinsic) memory connections and confirmed Hebb's theory when they witnessed the formation of a neural connection in an *Aplysia californica* (sea hare/sea slug) through operant conditioning, as Hebb described. The brain's ability to restructure (modify, change, and adapt) itself through new learning is called neuroplasticity (Voss et al., 2017) and the neural restructuring of the brain through the reorganization of consolidated synaptic connections by "firing apart" informs what is now known as memory reconsolidation, which is the dissolving of the proteins that consolidated, or "wired" neurons together to form a consolidated network (Solms, 2021).

As noted above, the result of learning experiences is an established neural network in the brain that through electrochemical responses within that network energize various electrochemical signals, namely the neurotransmitters dopamine and acetylcholine, to reflexively motivate an individual to take action to approach appetitive or avoid aversive stimuli (Bazzari & Parri, 2019; Harmon-Jones & Harmon-Jones, 2021; Langille & Brown, 2018; Solms, 2021). The specific neurotransmitter that motivates approach behaviors is dopamine and the neurotransmitter acetylcholine motivates avoidance behaviors, although acetylcholine production also elicits dopamine release (Krawczyk et al., 2021). The resulting electrochemical signals motivate future behaviors in the direction of approach or avoidance, depending on which direction has value for the subject based on those prior learning experiences (Ledoux, 2017; Bach & Dayan, 2017; Solms, 2021).

Conditioning can result in more than just observable behavioral changes in an organism, as when seeing a dog's salivation or a mouse avoiding a foot shock. Conditioning also results in cognitive, physical, emotional, motivational, and state changes that are activated through electrochemical signaling (cues) across those experientially founded neural networks. Those

underlying internal cues can have as dramatic and reciprocal an effect on behavior as the external stimuli did that originally conditioned that learning.

Emotion

To begin with, there are many major theories of emotion including James-Lange Physiological Theory of Emotion, The Cannon-Bard Theory of Emotion, Schachter and Singer's Two-Factor Theory of Emotion, Arnold's Appraisal Theory, Richard Lazarus' Cognitive Appraisal Theory of Emotion, and Zajonc's Affective Primacy Theory (Lange et al., 2020; Ledoux, 1998; MacCormack & Lindquist, 2017; Moors, 2021). Joseph LeDoux is one of the leading researchers on emotions, in particular research on fear, anxiety, and the amygdala (Kida, 2019; LeDoux, 1998; Schiller et al., 2010). He summarized the evolution of theories of emotion from William James theory, which posits that responses (actions) cause feelings. He added that Schachter, Singer, and Cannon stated that the cognitive labeling of arousal determines the emotion an individual feels. He also added that appraisal theory by Arnold, and others, stated that emotions are the result of the appraisal of a drive (action tendency) to move toward or away from a stimulus, but that the awareness of the stimulus is not required (Ledoux, 1998). Ledoux added that Zajonc followed in the 1980's with the concept that emotion can exist before and without cognition.

Researchers often suggest that animals experience positive emotion (affect) when the animal is in an approach motivated state, as in Pavlov's dog being motivated by the presence of the food (Harmon-Jones & Harmon-Jones, 2021). Interestingly, Pavlov's research noted the psyche (mood and personality) of the dogs he used in research (Todes, 2000):

Pavlov noticed that, just like people, different dogs like different foods, and that a dog's food preferences change from day to day and moment to moment. Also, like people, dogs

have different personalities. Some dogs were “greedier” for food than others, and so they produced more appetite juice. Some dogs were “dreamier” than others: these dogs would be more likely to get their gastric juices flowing just by seeing food. Other dogs were more “cold-blooded”: Their gastric glands did not start working until the food was actually in their mouths. Some dogs were “cunning” and easily insulted: If the experimenter showed some food to such a dog without actually feeding it, the dog might think it was being teased and react much as a hungry person would in that situation; that is, it would get angry and turn away from the experimenter rather than producing gastric juice in eager anticipation of a meal.

For these reasons, the personality and mood of a dog added an unpredictable element to the digestive machine. In characterizing his dogs’ mood and personality, Pavlov was influenced both by the patterns of gastric flow and by subjective interpretations of the dogs’ behavior. The main point is that these experiments did not turn out exactly the same each time. For precisely this reason—that the dogs’ psyche did not behave predictably—Pavlov did not think it was a simple reflex (p. 62-63).

He later called such considerations of an animal’s thoughts and emotions unscientific and would financially fine his research assistants for mentioning them. Shortly thereafter though, he began to consider ways to study animal psyche using saliva to show excitation or inhibition, or approach and avoidance states, as Todes (2000) wrote of Pavlov’s drive to,

uncover the secrets of human thoughts and emotions, and...what made people love and hate, cooperate and wage war. Perhaps he would even discover how society could produce fewer “bad machines” and more good ones—that is, more generous, intelligent, and noble types of humans (p. 69).

Eventually, Pavlov surmised that animal behaviors were a result of environmental stimuli that engage with the dog's senses that elicited either excitation or inhibition (Todes, 2000).

Pavlov also noted that he believed people responded similarly to stimuli and responded along a continuum of both inhibition or excitation and that people, like dogs tended to favor one or the other, an approach or an avoid state. One professor in Todes (2000) described a critical component of Pavlov's research was that psychological processes play a profound role in how human bodies respond physiologically to stimuli and that awareness is not a necessary component for that conditioning or the physiological responses. Responses to any number of stimuli (e.g., smells, locations, tastes) may be conditioned reflexes encoded during prior experiences that individuals may not recall consciously, but the body stores subconsciously.

Recent research, which combined the most widely held categories of emotion theories, found that the psychometric network theory of emotions aligned well with each emotion component (Lange et al., 2020). Psychometric network theory states there are three requirements to be integrated from all theories. The theory requires that humans have distinct emotions that account for variations in emotions within and between individuals and emotion components can have causal relationships. All components, thoughts (cognitions), motivations, feelings, facial expressions, appraisals, arousal, meaning, interoception, valence, beliefs, social influences, hormones, neurotransmitters, and consequences exist on a network which elicit collective and varying responses because each component has a bidirectional causal relationship with each other component in the network. The network itself is modifiable through experience because relevant appraisals of situations can increase or decrease the strength of the bidirectional relationship (Lange et al., 2020; Moors, 2022). Lange et al. believed this theory could also account for the interaction between the network components and innate emotions, which

accounts for the biological network theory as well. Lange et al. presented a clarifying metaphor using a traffic jam as the network, and any number of components can be part of the jam, but other components (cars) may have influenced the cause of the jam but escaped becoming a part of the traffic jam.

Motivation

Elliot (2006) explained that throughout history approach and avoidance motivations have been defined using various terms, including joy versus trouble (Democritus), pain versus pleasure (Bentham, Wundt, Freud), satisfaction versus discomfort (Thorndike), moving towards versus moving away (Jung, Tolman, Pavlov, Horney, and Rogers), positive versus negative (Skinner), appetitive versus aversive and reaction potential versus inhibitory potential (Hull), attract versus repel (Miller), good and bad (Sullivan), deficit needs and growth needs (Maslow), and Hebb (1949) added that approach and avoidance behaviors are determined by stimulation, respectively, above or below certain thresholds. Many more philosophers, theorists, and researchers presented various other terms to demonstrate approach and avoidance motivations throughout the years, but one of the most commonly used definitions of motivation includes a solid connection to emotion. Monni et al. (2020) cited that emotion is the “energization of behavior by, or the direction of behavior toward, positive stimuli (objects, events, possibilities), whereas avoidance motivation may be defined as the energization of behavior by, or the direction of behavior away from, negative stimuli (objects, events, possibilities)” (p. 2). This definition fits well within the theoretical framework for emotions, psychometric network theory of emotions, guiding this project.

In agreement with this definition, Ryan et al. (2019) stated that both approach or avoidance based mental and physical responses are determined by prior experiences with reward

or punishment, as in operant conditioning, and that motivation is mediated by expectancies and efficacy beliefs. Correspondingly from a brain standpoint, Harmon-Jones and Harmon-Jones (2021) described the connection between emotions and motivation, noting that positive emotions, approach motivations, and appetitive behaviors are all coordinated by activity in the left frontal cortical regions of the brain and negative emotions, avoidance motivations, and avoidance behaviors are all coordinated by activity in the right frontal cortical regions. While Skinner did not address motivation or rewards in outlining operant conditioning theory, both are, however, implied (Ryan et al., 2019). Ryan et al. clarified that the idea of 'reward' implies desirability, although from an emotional and motivational standpoint, avoidance behavior is generally the organism's desirable outcome in the face of emotionally and physically aversive situations. When comparing emotionally and physically appetitive and aversive situations, desirability of the outcome is the reward and drives motivation.

Motivation in a word should not be interpreted only in terms of observable behavior. Harmon-Jones and Harmon-Jones (2021) described Panksepp's emotion motivation perspective, sharing that emotional motivation can result in either unobservable responses, such as interest, urges, and curiosity, (internal action tendencies/arousal), or observable responses, such as crying, hitting, and relaxing (external action tendencies/arousal), or both. Emotional motivation can sustain even the most boring, monotonous, and uninteresting matters, along with anticipatory concerns, mental planning, and goal-directed thought processes, which are not externally observable. Harmon-Jones and Harmon-Jones also reported that such underlying emotion motivations are also associated with the frontal cortical regions of the brain, supported by the production of dopamine to implement goal-directed behavior.

Feelings

Schachter and Singer's Two-Factor Theory of Emotion posited that emotional states are a function of physiological arousal that individuals ascribe labels (feeling words) to, based on their current cognitions when the physiological arousal occurs if no more accurate explanation for the arousal exists (MacCormack & Lindquist, 2017; Moors, 2021). If an individual has the same cognitive explanation (feeling word) but not physiological arousal, the individual's reaction is only emotional at the level of physiological arousal he or she experiences with the internal or external cognitive explanation alone. Often people will use the terms emotions and feelings interchangeably, so for the sake of clarity, if confused about the difference, one can consider, emotion is the Electrochemical signal that elicits one to engage in a motion, or motivation, to approach or avoid. Feelings are the words one uses to describe that emotional experience, cognitively.

Somatization and Interoception

Originally termed somatization, somatosensory responses, somatic awareness, and body awareness, recent research highlights the importance of what is now known as interoception. Historically, somatization, as represented in the literature, includes emotional awareness and somatic awareness. Kanbara and Fukunaga (2016) stated:

Emotional awareness and somatic awareness are essential processes for human psychosomatic health because disturbance of these types of awareness leads to unhealthy conditions through obstruction of homeostatic processing. Emotional/somatic awareness is the state in which individuals have access to their own emotional/somatic condition. A typical trait of lacking emotional awareness related to psychosomatic symptoms is called alexithymia. In contrast, somatic awareness is physiologically based on interoception,

which is defined as the homeostatic afferent neural system that represents the physiological condition of the body in humans. Alexismia is a term that, in contrast with alexithymia, refers to a trait of lacking somatic awareness. The mechanisms that link these traits to unhealthy conditions include implicit emotional processing, disconnection between neocortical and subcortical systems, and homeostatic inadequacy by blunt interoception... (p. 1)

Somatization is defined by Mehling et al. (2009) in asserting that body awareness is the subjective lived experience of activating conscious proprioceptive awareness and interoceptive awareness and modifying them through mental activity. Proprioception is knowing where one's body parts are without looking at them. Interoceptive awareness involves subjective sensing, interpreting, and integrating internal conscious and unconscious stimuli arising from within the body through nervous system activations that originate from innate and conditioned reflexes, urges, drives, and adaptive responses, grounded in culture, language (feelings), and both cognitive and emotional experiences (Critchley & Garfinkel, 2017; Khalsa et al., 2018; Mehling et al., 2018). The processing involved with interoception contributes to homeostatic maintenance of the body and survival states. A fortunate side effect of somatosensory and emotional awareness (interoception) is that body awareness and mentally modifying it has been shown to diminish and alter sensations in the body and has been identified in recent research as being a component of anxiety, mood, addiction, eating, and somatization disorders when interoception is also disordered (Khalsa et al., 2018; Mehling, 2009, Mehling et al., 2018; Okur Güney et al., 2019; Price & Hooven, 2018).

Collective Components of Emotionally Motivated Approach and Avoid States

Wasserman and Wasserman (2020) report that emotions are stored in motivational networks in the brain and engage organisms to respond to appetitive or aversive environments. This view aligns with Lange et al.'s (2020) psychometric network theory of emotion. For example, approach and avoid states are a collective process of responses based on activation of the psychometric network by environmental stimuli that trigger activation in associatively stored prior experiences (*encoded memory*), which activates hormone networks and emotional response signals that travel across synaptic connections and *motivate* an individual to take an action based on presented internal or external stimuli to move toward pleasure or away from pain (action tendencies/arousal), sometimes experienced as a somatically felt sense (interoception), and are often followed by cognitions that label the experience using *feeling words* (i.e., happy, calm, angry) based on current cognitive appraisals, and which can increase or decrease the valence, or intensity of an experience and influence the response to the stimuli (Okur Güney et al., 2019).

To simplify, approach or avoid states have four components: an encoded network (experiential memory or biological encoding), an internal or external stimulus that elicits a physiological change based on a brief reactivation of the encoded network, a cognitive appraisal, and a response (mentally and/or physically approaching or avoiding a stimulus). Transitioning between avoid and approach states can be accomplished through the modification of interoceptive, emotional, and sometimes behavioral or cognitive signals and can result in emotional regulation, so adding a fifth component, *regulation*, to this summary allows for the development of an individual's down-regulating skills and thus more effective responding to perceived threats, when survival is no longer a concern and discomfort becomes tolerable.

Emotional Learning

As noted previously in this literature review regarding emotion and motivation, approach motivation is the “energization of behavior by, or the direction of behavior toward, positive stimuli (objects, events, possibilities), whereas avoidance motivation may be defined as the energization of behavior by, or the direction of behavior away from, negative stimuli (objects, events, possibilities)” (as cited in Monni et al., 2020). Consolidated procedural memories are stored with the emotional context with which an organism experienced original learning, much like a rule about how the world works or a usable algorithm for decision making, that becomes stored for future use (Bach & Dayan, 2017; Carew et al., 1983; Gainotti, 2019). Such subconscious rules, or schemas, may become generalized to enhance safety in subsequent associative experiences and are the primary cause for therapeutic psychological stressors (Ecker & Bridges, 2020). If a boy is bitten by a dog (an actual threat), future exposures to a dog barking (a perceived threat) may result in the boy having similar emotionally motivated states as he did when he experienced being bitten. Such reflexive, emotionally learned, responses serve the purpose of protecting him from similar potential survival threats, or predictably aversive experiences.

Reciprocally, emotional learning engages the body to take action to approach predictably appealing experiences, such as liking one’s first taste of ice cream and wanting to eat ice cream in the future. Such learning supports actual and perceived survival. The organismic interest in storing emotional learning is to enhance potential for survival and away from threat (Pine et al., 2021; Bach & Dayan, 2017). Certainly, having ice cream does not in itself ensure survival, but when an experience is appealing the dopaminergic response at the neural level engages the brain to a thriving state, where not just survival is maintained, but so too is well-being, satisfaction,

comfort, and an overall sense of safety (Rossouw, 2014; Ledoux, 2017; Solms, 2021). Studies report that positive emotions support learning and academic achievement (Tyng et al., 2017), both of which are goal-directed (approach) behaviors. Positive emotions also enhance attention and strengthen memories (Li et al., 2020). Positive emotional learning engages approach behaviors, such as food seeking and attachment seeking, which also contribute to survival. In addition, because blood flow to cortical regions of the brain increases during approach states, approach state emotions expand problem solving abilities in the brain and supports survival through enhanced living and minimizing risk (Rossouw, 2014). Alternately, in the presence of threat (actual or perceived, as in internal activations through prior emotional learning), the Hypothalamus-Pituitary-Adrenal Axis (HPA Axis) contributes to decreased problem solving abilities because blood flow to cortical regions, specifically the prefrontal cortex, is decreased (Kanbara & Fukanaga, 2016; Rossouw, 2014). The result, then, is less effective or accurate responding and increased fight, flight, freeze, and fawn (FFFF) responses to avoid the threat.

Overall, emotional learning serves the purpose to motivate individuals toward survival, well-being, and goal orientation; either approach or avoid states (Kobylińska & Kusev, 2019; Monni et al., 2020). Human brain structure engages humans to take actions to defend or take appetitive action (Wasserman & Wasserman, 2020; Pine et al., 2021). Important memories, those that ensure that humans survive and thrive are electrochemically encoded at the neural level through a complicated process of chemical and brain region interactions to enhance emotional arousal, or motivational responses and are continually updated and regulated through circular causality, or feedback loops (Ledoux et al., 2017; Ledoux, 2020b; Bach & Dayan, 2017; Okur Güney et al., 2019). This process is called predictive coding (Spratling, 2017; Klarić, 2019). The predictive coding hypothesis states that the brain is always updating to higher-level models for

responding based on sensory input and its effect on arousal. The more aroused a person, the greater role arousal plays in enhancing the storage of memories (Sutherland & Mather, 2018).

Ledoux et al. (2017) argued that when considering subjective emotions, “fear” should not be the accurate terminology, but instead “avoidance”. He clarifies also, fear is a subjective term and avoidance is an observable behavior that results from amygdalae stored intrinsic conditioned memories that engage valued behavior (Ledoux, 2020a). Because of this, behavior, not just a subjective description, in this project will be a measure considered to address approach state change with an avoid state pairing. (e.g., does the subject become more likely to maintain an approach state while addressing his or her trauma or emotionally distressing memory?). Subjective descriptions do however play a role in how one experiences emotions because the label one gives to an experience generally influences the valence and salience in which the emotion is perceived (Ledoux, 2020a). Ledoux added, that *why* one feels what they do and explanations about how one felt in the past are often not contextually accurate, but what is reliable is only that one *is* feeling a certain way in the current moment.

Trauma and Distress Encoding

The American Psychiatric Association’s Fifth Diagnostic and Statistical Manual (DSM5) (APA, 2013) requires that to meet criteria for a diagnosis of Posttraumatic Stress Disorder (PTSD) an individual must have an exposure to a traumatic event which it defines as exposure to “actual or threatened death, serious injury, or sexual violence” (p. 271) the result of which is variation in elements of intrusion symptoms (e.g., re-experiencing), avoidance symptoms (e.g., numbing), negative alterations in cognitions or mood, alterations in arousal and reactivity, for at least a month. The unfortunate outcome of this trauma regulating diagnosis is that a substantial portion of the population is not considered in the required criteria, as many who struggle with the

symptoms of trauma did not experience a life-or-death situation or sexual violence. Many traumatized individuals experience intense or long-term emotional abuse or neglect, among many other potential traumatic events. Boals' (2018) research also illuminated how many individuals do not meet criteria for a diagnosis because their traumatic experiences are subjective. An added factor to that result is that those with subjective trauma also scored higher on levels of distress from PTSD symptoms.

Giotakos (2020) described the similarities and differences in brain function for human subjects who meet criteria for a PTSD diagnosis and those with exposure to emotional trauma. A most notable difference between the neuroanatomy of individuals who have experienced emotional trauma and those meeting criteria for PTSD is that emotional trauma sufferers show more dense synaptic formations and dendritic growth in the basolateral amygdala, the amygdala being the survival notification structure in the brain, which notifies the body to respond to approach needs (food and reproduction opportunities) and avoid needs (FFFF needs). In humans, the amygdala is also responsible for encoding (consolidating) and processing emotional memories and for extinguishing fear (Chaaya et al., 2020; Quinones et al., 2020). Another notable difference reported by Giotakos (2020) in individuals with emotional trauma versus PTSD is that emotional trauma results in the retraction of dendritic spines from the hippocampus, which manages the maintenance of emotional episodic memories in humans (Chaaya et al., 2018; Dahlgren et al., 2020). In humans with emotional trauma exposure and PTSD, increased synaptic formations and dendritic growth in the amygdala and retraction of the dendritic spines results in larger amygdala volume and smaller hippocampal volume, which is indicative of respective neuroplastic changes (Giotakos, 2020). Beyond the amygdala and hippocampus, multiple cortical regions are also connected to emotional memory formation, maintenance, and

regulation (Chaaya et al., 2018; Dahlgren et al., 2020; Giotakos, 2020; Quinones et al., 2020).

This vast and growing knowledge about emotional trauma should, at the least, result in the inclusion of emotional trauma exposure as a met PTSD diagnostic criterion. As such, in moving forward this project uses the term ‘trauma’ and/or ‘emotional distress’ to address inclusively those with emotional trauma and PTSD.

As indicated above, feelings were defined as the words humans use to label and describe subjective perspectives of physiological approach and avoid state emotions. ‘Trauma’ is the word typically used to describe an enduring avoid state where encoded avoid states continue to engage the body to act, in the presence of a perceived threat. The actual threat encodes a rule the body uses in the future to determine immediately how to act if a threat is perceived, although perceived threats are not all actual threats (Gainotti, 2019; Ledoux et al, 2017). For example, as a result of a traumatic event individuals with PTSD can experience contextual fear conditioning (CFC), the result of which is a fear response to specific locations, similar people, or other contextual reminders of their traumatic experience, often called triggers or threat cues (Chaaya et al., 2018). A woman who was sexually assaulted by someone she knew (actual threat) may later be triggered by the offender’s name (perceived threat). A man abused as a child (actual threat) in the home he grew up in may experience fear when driving near the street he grew up on (perceived threat). The context in which one experiences trauma plays a strong role in how easily one can overcome one’s trauma (Chaaya et al., 2018). Continuing to avoid contextual threat cues reinforces them, but also prevents an individual from learning that contextual cues are not truly threatening, but rather they are perceived threats and therefore safe (Ledoux et al, 2017). Seemingly, such threat cues are normal within the context of the individual’s life, although normal is not effective in these cases.

Memory Reconsolidation

As described, memory consolidation results in a memory that becomes stable. When activated again a memory becomes labile and open to change (Cahill, 2019; Ecker, 2020; Ecker & Bridges, 2020; Elsey et al., 2018; Fernández et al., 2017; Junjiao et al., 2019; Papalini et al., 2020; Sinclair & Barense, 2018; Thiele et al., 2021). Specifically,

The reactivation of a synaptically stored memory in the brain can make the memory transiently labile. During the time it takes for the memory to re-stabilize (reconsolidate), the memory can either be reduced by an amnesic agent or enhanced by memory enhancers. The change in memory expression is related to changes in the brain correlates of long-term memory. Many have suggested that such retrieval-induced plasticity is ideally placed to enable memories to be updated with new information. This hypothesis has been tested experimentally, with a translational perspective, by attempts to update maladaptive memories in order to reduce their problematic impact (Lee et al., 2017, p. 1). Once a memory is rendered labile, learning can be updated and even erased, or reconsolidated (Ecker, 2018; Ecker & Bridges, 2020; Han & Xu, 2018; Gershman et al., 2017; Krawczyk et al., 2017). The subconscious procedural memory model may thus no longer exist (Ledoux, 2017, 2020a, 2020b; Ledoux & Brown, 2017).

So, continuing to avoid contextual threat cues has another disadvantage to trauma recovery. Remember, the Hebbian Principle states that neurons that fire together, wire together, and neurons that fire apart, wire apart. This means firing must happen first, but only briefly (Treanor et al., 2017). Avoidance prevents the firing of neural networks so that increased synaptic growth in the amygdala cannot wire to other associate memories and emotional

learnings. Avoidance also prevents traumatic memories from wiring apart, which removes opportunities for successful memory reconsolidation to occur.

Activating a memory is not enough to change or update a memory, however. For updating or erasure to occur, the subject must experience a prediction error (Cahill, 2019; Ecker, 2020; Ecker & Bridges, 2020; Elsey et al., 2018; Fernández et al., 2017; Gershman et al., 2017; Junjiao et al., 2019; Lee et al., 2017; Papalini et al., 2020; Krawczyk et al., 2017; Sinclair & Barense, 2018; Solms, 2021; Thiele et al., 2021). A prediction error is a mismatch, or a disagreement, between what is expected and current events, or what actually occurs (Krawczyk et al., 2017) and is a result of dopamine production when an expected outcome does not occur and a greater increase of dopamine firing with the element of surprise (Diederer & Fletcher, 2021; Gershman, 2017). Papalini et al. (2020) wrote that dopamine production is the primary neurochemical involved in “the coding of prediction errors that govern reward learning as well as fear extinction learning” (p. 1). Bazzari and Parri (2019), Kalisch et al. (2019), Mohebi et al. (2019), Gerlicher et al. (2018, 2019), Gershman (2017), Rice (2019), and Solms (2021) concur that dopamine is essential to motivation for reward-driven learning and successful fear extinction.

A prediction error alone is also not enough for updating a consolidated memory. The prediction error must occur within a specified span of time. Research specifies that the reconsolidation window, the period while the memory remains in the labile state before restabilizing, is only open for about five, but no more than six hours (Cahill et al., 2019; Ecker, 2015, 2017, 2020; Ecker & Bridges, 2020; Elsey et al., 2018; Elsey & Kindt, 2017; Iyadurai et al., 2019; Kida, 2019; McLean & Foa., 2011; Schiller et al., 2010). If the prediction error does not occur within that window, memory reconsolidation cannot occur.

Extinction versus Erasure

For a prediction error to occur a subject must experience an emotional, or electrochemical, disagreement with prior emotional learning rules. Such disagreement comes as a result of reward, a dopaminergic increase to motivate new learning (Baixauli, 2017; Diederer & Fletcher, 2021; Gershman, 2017; Kalisch et al., 2019). Kalisch et al. (2019) wrote:

The [dopamine]ergic [prediction error] thereby constitutes the critical learning signal that allows reward contingent neutral stimuli to become reward predictors, that is, conditioned stimuli (CSs) that by themselves evoke reward-anticipatory behaviors. In fear extinction, a CS that was previously paired with an aversive stimulus (unconditioned stimulus, US) is repeatedly presented in the absence of that stimulus, such that the subject eventually recognizes the CS as safe and ceases producing conditioned fear responses (CRs). Hence, extinction constitutes an instance of new learning, in which the CS is associated with information about its safety (the absence of the US)...Extinction learning does not simply lead to forgetting or erasure of the fear (CS US) memory, but generates a new safety (CS-no US) memory that competes with the original fear memory for behavioral expression when a CS is later encountered again. (p. 274)

Baixauli (2017) noted that not only does dopamine contribute to prediction error, but it also disengages the amygdala, thus reducing avoid state emotions.

That said, it is not enough for a subject to merely experience something different, as in a rat not experiencing a shock when expected after conditioning. The rat, in extinction scenarios, only learns there are two possible outcomes (Ecker & Bridges, 2020; Gerlicher et al., 2019; Kalisch et al., 2019; Salinas-Hernández & Duvarci, 2021). Instead, for successful memory reconsolidation to occur, erasure of the previous emotional motivation (electrochemical) must no

longer exist. The prediction error that results from new learning experiences must fall within the reconsolidation window and must be salient, or noticeably rewarding (dopamine producing) to establish updated learning and erasure of aversive emotional learning (Keller et al., 2020; Ecker & Bridges, 2020). For example, a grown man who was physically abused by his father in childhood realizes his full-grown body is such that physical abuse at the hands of his aged father is no longer a threat. He becomes saliently physically, emotionally, and cognitively aware of enduring safety because he is now bigger than his father; an emotionally rewarding approach state that disagrees with his previous avoid state synaptically encoded from prior emotional learning experiences when he was unsafe. Dopaminergic changes support the new response. Research with rats showed that dopamine increases when a reward is signaled and continues up until the point the rat receives the reward. Similarly, dopamine also increases when a rat hears a warning tone before a shock indicating it avoided a shock (Ledoux et al., 2017). Ledoux also states that human research revealed similar circuits in the human brain that respond the same ways.

Emotion and Interoceptive Pairing

Research has demonstrated the rationale for emotion pairing to establish conditioned responses through evaluative conditioning (Hasford et al., 2018; Hughes et al., 2019; Siedlecka & Denson, 2019; Ponari et al., 2019; Weber et al., 2020). Evaluative conditioning (EC) is a learning process whereby a subject experiences repeated pairing of an opposing stimulus, which results in a new opposing preference for that stimulus. Inducing targeted emotions through pairing to establish conditioned responses has also been explored and validated in research (Siedlecka & Denson, 2019). Research shows that arousing positive emotions enhances learning and so will be accounted for in this project's transcript evaluations (Sutherland & Mather, 2018)

and when engaging one's energization to self-concordant goals, which both energize a subject and direct their attention toward a specific outcome through inspirational and strategic planning (Harmon-Jones & Harmon-Jones, 2021; Reeve, 2018). In addition, confusion has also been shown to increase learning because it increases client attention, likely increasing the dopaminergic prediction error potential, so will also be considered in transcript evaluations (Tyng et al, 2017).

Interoception research also exposed another potential emotional mismatch opportunity. Khalsa et al. (2018) wrote, "Examples include targeting numerous interoceptive features simultaneously and employing different tasks that converge on the same feature (e.g., combining top-down assessments of interoceptive attention with bottom-up perturbation approaches in the same individual" (p. 503). This explanation is the closest description of what this project defines as emotion pairing. Specifically, using emotional approach states and pairing them with conditioned emotional avoid states can result in the necessary emotional prediction error, rapidly, and within the reconsolidation window. For example, if a woman seeks to avoid flying, because of her fear, and she experiences 'butterflies' when thinking about flying, but rather than focusing on the "fear" and instead is asked to consider an experience when she was excited a vacation she might remember being excited for as a child, and to imagine that interoceptive 'butterflies' feeling in her stomach as being the same 'butterflies' as excitement of her childhood experience, her labeling and interoceptive modification may result in a new enduring approach state and an erasure of the avoid state.

As stated, for a subject to experience erasure of a contextual fear the subject must experience a prediction error, a mismatch, or what is a disagreement between what is expected and what happens (Krawczyk et al., 2017). However, Ecker (2015) stated, there is a mismatch

requirement, but there must also be a mismatch in relativity. If an attempted reconsolidating experience is too dissimilar from the original experience, the original memory will not destabilize and the result is extinction instead, or a new parallel learning experience because the new CS will not be reinforced (Yoo et al., 2017). For instance, if a man has a fear of dogs after being bit as a child, pairing the memory with someone else saying dogs are nice, is not relative, as the individual's experiences are completely different, so the prediction error does not occur, and agreement in his emotional experience and response endures. Asking him if he had ever petted a dog that did not bite him offers a greater element of relativity.

Prolonged Exposure as a First Line Treatment

The first line treatments recommended for PTSD and Acute Stress Disorder (ASD) by the American Psychological Association (APA) and the United States Veteran Association (VA) include Prolonged Exposure (PE), Cognitive Processing Therapy (CPT), Eye Movement Desensitization and Reprocessing (EMDR) and certain specific Cognitive Behavioral Therapy (CBT) approaches, empirically evidenced for PTSD including Brief Eclectic Psychotherapy (BEP), Narrative Exposure Therapy (NET), and written narrative exposure (APA, 2021; Berke et al., 2019; Courtois et al., 2017; Domingue & Lee, 2017; Gray et al., 2017a, 2017b, 2021; VA, 2017; Watkins et al., 2018). This project focuses primarily on PE. While the other named treatments may be effective, the re-exposure to trauma used in PE was explored and compared to the requirements established as effective for successful memory reconsolidation for trauma and stress.

There is a standard manualized treatment protocol for PE (Brown et al., 2019; Peterson et al., 2018; VA, 2017). The protocol involves the subjects experiencing repeated prolonged re-exposures (i.e., visual, aural, verbal, physical) to the original traumatic memory using imagined

and in vivo exposure sessions. PE follows systematic desensitization moving through the distress provoking elements of the traumatic memory and progressing from the subjects least traumatic elements to the worst. Treatment also involves psychoeducation about topics, such as effective and ineffective coping strategies, and breathing retraining. A narrative is also created to address emotion processing. PE treatment generally follows a structured 90-minute a week format for eight to 12 sessions (Peterson et al., 2018). Each component of the protocol is designed to help subjects learn to suppress avoidance responses that increase trauma rather than decrease it, as subjects often hope.

The National Center for Posttraumatic Stress Disorder (2017) reported, of those with PTSD who are treated with PE, 53% no longer meet criteria for PTSD after three months. Peterson et al. (2018) reported that 80% of civilian victims of rape experienced a reduction in PTSD symptoms after treatment and reported much different numbers by comparison to PE treatment in military service members and veterans. Peterson et al. stated that post-treatment only 40-50% of military service members and veterans successfully reach a reduction in PTSD symptoms to the point they no longer meet criteria for a diagnosis of PTSD. Because of the reduced level of success achieved with military populations, studies have been conducted to assess for changes in the protocol to support military service members and veteran's needs. One study used more frequent sessions spacing over a shorter period (daily 90-minute sessions for two weeks [Massed-PE] compared to 90-minute sessions one to two times a week for eight weeks [Spaced-PE]) to comply with demanding military work requirements that can interfere with treatment (Foa et al., 2018; Peterson et al., 2018).

PE is considered an empirically supported trauma-focused approach to treating trauma (Watkins et al., 2018). Trauma-focused interventions are those that focus on a subject's traumatic

experience (event) or the meaning of the traumatic event. PE requires a “significant level of re-exposure to the traumatizing event, which may put the patient at risk of re-traumatization” directly and indirectly through imaginal exposure (Gray et al., 2017b). Hundt et al. (2017) shared subject reports of their PE experiences being emotionally challenging and causing an increase in symptoms (36%), so much so that many considered dropping out of treatment prematurely. Brown et al. (2019), along with Edna B. Foa, the developer of the PE protocol, reported PTSD symptom exacerbation in 3-15% of subjects. Berke et al. (2019) noted that when compared to non-trauma-focused interventions, dropout rates are higher for trauma-focused interventions (36% versus 18%). Dropout rates plague this treatment modality (Kida, 2019) and when all dropouts (e.g., substance use, stigma, confidentiality concerns, re-traumatization) are considered from the beginning of each trial, the recovery rates reach only about 40% (Najavits, 2015). Dropout rates vary between 28% and 68% in various studies (Berke et al., 2019; Levinson et al., 2022; Ghafoori et al., 2022; Gray et al., 2017a, 2017b, 2021; Sciarrino et al., 2021; Szafranski, et al., 2017; Watkins et al., 2018). Gray et al. (2017) wrote,

Treatment efficacy in most studies is measured in modest reductions in symptoms scores with treatments providing low rates of recovery from the PTSD diagnosis. In many studies, the number of persons who have lost or retained the diagnosis is not reported (p. 2).

One benefit observed in the Peterson et al. (2018) study, however, was a lower dropout rate; 13.6% for Massed-PE and 24.5% for Space-PE. The Levinson et al. (2022) study also determined that sessions at least twice weekly presented improved dropout rates. Dell et al. (2022) reported comparable results for massed and standard sessions noting improved symptomatology and lower dropout rates. Foa et al. (2018) reported improvement in

symptomatology in the shorter massed PE session outline, as well. This pattern indicates a need for first line PTSD treatment researchers and providers to consider novel approaches to the standard PE treatment protocol to decrease exposure frequency and length of treatment.

Dropout rates are not the only concern with PE therapy. The Department of Veteran Affairs (VA, 2017) released a VA/DOD Clinical Practice Guideline for The Management of Posttraumatic Stress Disorder and Acute Stress Disorder which stated, “meta-analyses strongly indicate that trauma-focused psychotherapies impart greater change with regard to core PTSD symptoms than pharmacotherapies, and that these improvements persist for longer time periods” (p.45). Perpetuating an idea that there is a gold standard for treatment is risky for individuals who need care. Ostacher and Cifu (2019) wrote regarding the push for a gold-standard treatment that it is potentially harmful because if individuals do not improve in response to evidence-based, first-line treatments, those patients may not know about or be exposed to other newer and alternative treatments that may be more effective, but do not yet have an established empirical paper trail. Novel approaches to treatments are necessary as not all subjects will respond to the gold standard treatments.

Brown et al. (2019) doesn't mention dropout as a common barrier to successful treatment using PE. Instead, Brown listed “under engagement [sic], insufficient homework compliance, and the presence of PTSD-related negative cognitions” (p. 6). These are clear limitations in the treatment protocol. The design of the protocol is for the treatment of PTSD, yet it is plagued with barriers that include the treatment protocol itself and the symptoms for which it is designed to treat. Further barriers to successful PE treatment include young age (35 years and below), substance use, life, family, and work responsibilities, along with the severity of patient symptoms and the presence of traumatic brain injury (Sciarrino et al., 2021). Sciarrino et al.

(2021) concurred that speeding up the standard PE timeline could remedy many treatment limitations. Watkins et al.'s (2018) study also agreed, especially for military populations with higher PTSD symptom retention scores post-PE treatment and added that pharmacological-enhanced treatment options should also be considered. Lewis et al.'s (2020) meta-analysis was in support of continued treatment using trauma-focused treatment models such as PE, CPT, NET, and EMDR, but added there is emerging evidence for the use of RTM among other novel approaches.

Emotion State Mismatch as a Prediction Error

The reconsolidation phase begins with a brief reminder of the trace memory which activates the memory (Treanor et al., 2017). Once active, reconsolidation requires more than just a noticeably rewarding new experience, as discussed earlier (Keller et al., 2020; Ecker & Bridges, 2020). Reconsolidation also requires novelty and a change in context (Zyuzina & Balaban, 2017). In addition, Treanor et al. (2017) describes that reconsolidation reminder trials must be longer than those used during conditioning to engage memory reconsolidation as opposed to extinction, but the translation to clinical value in this setting is unclear, as this project did not assess conditioning, only reconditioning of already encoded emotional learnings.

Also stated above, prediction error is a mismatch, or disagreement, between what is expected and what occurs (Bazzari & Parri, 2019; Cahill, 2019; Cools, 2019; Diederen & Fletcher, 2021; Ecker, 2020; Ecker & Bridges, 2020; Elsey et al., 2018; Fernández et al., 2017; Gerlicher et al., 2018; Gershman, 2017; Junjiao et al., 2019; Kalisch et al., 2019; Krawczyk et al., 2017; Lee et al., 2017; Mohebi et al., 2019; Papalini et al., 2020; Rice, 2019; Sinclair & Barense, 2018; Thiele et al., 2021). Dopaminergic activation is where operant and classical conditioning collide. Dopamine firing underlies both classical and operant conditioning memory

formations (Baxter & Byrne, 2006). When an outcome is predicted, neurons responsible for dopamine production do not fire, instead there is a reduction in firing (Diederer & Fletcher, 2021). When an unexpected outcome (reward, for example) occurs, dopamine firing increases, thus encoding new learning. The firing pattern increases with subjectively more “physically salient sensory stimuli” and novel stimuli, thought to be because of the potential increased value of one or both to the subject (p. 36). The increase with novelty is thought to potentially encourage exploration for increased value to the subject.

Because traumatic and emotionally distressing events involve highly emotionally arousing experiences, they are more likely to be stored as up-regulating, rather than calming, or down-regulating, memories (Sutherland & Mather, 2018). Reconsolidation research reports that successful reconsolidation requires a brief memory activation, novelty, context change, a salient reward, and relativity (Keller et al., 2020; Ecker, 2015; Ecker & Bridges, 2020; Treanor et al., 2017; Zyuzina & Balaban, 2017). As such, the hypothesis is that this project demonstrates that successful reconsolidation can occur by pairing contextually different emotions, novel to most understandings of therapeutic approaches and novel to the stored emotional avoid state memory to result in emotional memory erasure. The interoceptive awareness of a new emotional state in response to the original traumatic memory offers the saliently rewarding prediction error and to further enhance the process, the salience of emotional arousal offers novelty to the reconsolidating experience, as well. “Emotion is a particularly potent way to update memories because synaptic plasticity, which is the molecular basis for encoding memories, is enhanced by the neurotransmitters and hormones (e.g., norepinephrine, cortisol) that are activated by emotional arousal” (Lane, 2020, p. 189).

Emotion researchers have already noted the possibilities for erasing fear. In fact, Schiller et al. (2010) noted that avoid state memories can be permanently modified by integrating neutral, novel, and positive information while the memory is labile. Creating emotional disagreement between original and subsequently recalled memories changes the emotional response that arises with a memory, because activated memories only consciously reflect our most recent recall of the original experience, which is modified to varying degrees with each subsequent recall of the memory. Erasing emotional responses comes by more than just extinction learning where “repeatedly presenting a CS in the absence of the US...results in a reliable decrease in fear responding to the CS due to changes in CS–US expectancy” (McLean & Foa., 2011, p. 1153). There must be a mismatch in emotion states. One might argue that an absence of emotional stimuli is enough, but for the required prediction error (dopaminergic increase) to occur in human subjects the emotion should be in stark contrast (e.g., pairing fear with laughter, pairing anxiety with calm, pairing food craving with emotional experiences while vomiting) to exchange subjective feeling states.

The goal of encouraging the changing of emotion states from an avoid state to an approach state is to affect more than just the subjective feeling state, but also the chemical transition in the body to enhance learning potential through synaptic firing and rewiring (Butnariu et al., 2019; Tyng et al., 2017; Wang et al., 2020). By changing what the individual is cognitively focused on until he or she can sense a physiological change in the body (a subjective indicator of a chemical shift), one can be likely sure there has been a chemical change in the body that improves the neurological learning environment. Reconsolidation requires a prediction error, prediction error increases dopamine production, and dopamine is required for an effective learning environment (Cools, 2019). More specifically, “organisms only learn when events

violate their expectations” (as cited in Krawczyk et al., 2017, p. 2). It is prediction error that generates the updating of originally consolidated memories through the reconsolidation process and can be updated in strength or content (Krawczyk et al., 2017).

Ecker (2015) shares a vignette denying that emotional arousal is necessary for erasure of the target learning. His example infers that emotion in this vignette was absent, perhaps because he did not witness any specific outward emotional behavior, however, there was a clear shift from an avoid state to an approach state when the prediction error occurred, which as noted previously is indicative of an increase in dopamine, thus reinforcing her new perspective. Because emotion has no single definition (Tyng et al., 2017), when using the definition for emotion used in this project, that emotions have a prior experience stored at the synaptic level, a stimulus that elicits a physiological change based on some degree of reactivation of the prior experience, emotion-motivation (somatic or unaware), and potentially a cognitive label (feeling word), it is clear that behavior is not necessary and emotional change is subjective in the client. Ecker (2015) reported that subsequent to that sessions end, her depression was permanently and effortlessly erased. He added that through continued sessions her sexual aversion and panic attacks also stopped, both of which are clearly avoid states that had transitioned to approach states.

PE uses imaginal exposure in its protocol, along with in vivo exposure. Agren et al. (2017) reported evidence that in vivo exposure is not necessary for reconsolidation and that imaginal exposure alone was enough for successful reconsolidation to occur. Fortunately, Pine et al. (2021) elaborated on the unique ability humans possess to engage emotionally and imaginally with remembered as well as future events. Solms (2021) agreed when stating, the brain uses past and present data to consider and produce predictions about future situations and outcomes.

Herein lies an opportunity for prediction error, where the outcome becomes other than expected for those with trauma and distressing memories. RTM uses such imaginal exposure in its protocol.

Erasure and Prolonged Exposure

Erasure assumes there is a permanent loss of the emotional components of a memory that triggers an individual to approach or avoid situations out of context with an actual experience, but in context with earlier experiences. The emotional components of a memory are “held in implicit memory, outside of conscious, [and] explicit awareness” (Ecker, 2018, p. 3). As noted previously, those generalized subconscious rules, or schemas, are the primary cause for therapeutic psychological stressors (Ecker, 2018; Ecker & Bridges, 2020). So, by helping individuals erase, or break their unconscious rules, their avoid states can also be erased and generalized.

Studies show that PE does promote change from avoid states to approach states through extinction (Peterson et al., 2018), but as described previously extinction and erasure through experiential memory reconsolidation are not the same. Extinction leads to a new parallel network and reconsolidation creates a rewired network from the site of the original memory (An et al., 2017; Becker & Kindt, 2017; Ecker 2015, 2017; Ecker & Bridges, 2020; Ecker & Hulley, 2019; Gerlicher et al., 2019; Kalisch et al., 2019; Salinas-Hernández & Duvarci, 2021; Yoo et al., 2017). As such, the manualized protocol for PE using the extinction process indicates that PE cannot erase trauma (Brown et al., 2019; Foa et al., 2018; Peterson et al., 2018), but it may inhibit it by helping to create a new neural network in the brain that an individual can alternatively use in triggering situations.

The PE treatment protocol, which consists of continually reactivating a consolidated memory while attempting to desensitize an individual's response to it, has been shown to strengthen the consolidated memory's neural network (Forcato et al., 2014; Krawczyk et al., 2017). The more frequently a consolidated memory is activated without being changed the more persistent the memory becomes and the more resistant it becomes to change. Thus, PE in theory, is only creating new memory circuits that an individual uses to overcome an avoid state and that new network is what is being strengthened through repetition. Additionally, fear-based memories resist extinction, particularly under high stress conditions (Maren, 2022), as many subjects reported they experienced (Hundt et al., 2017), which may explain why multiple sources reported that PE is short-lived and susceptible to relapse (Goode, 2018; Goode & Maren, 2018; Gray et al., 2017a, 2017b, 2021).

PE uses an extinction process, but because reconsolidation is a learning process where memory updating changes an existing memory, the brain must be in the most effective learning state. Tyng et al. (2017) stated,

studies report that positive emotions facilitate learning and contribute to academic achievement, being mediated by the levels of self-motivation and satisfaction with learning materials... Moreover, stress, a negative emotional state, has also been reported to facilitate and/or impair both learning and memory, depending on intensity and duration... More specifically, mild and acute stress facilitates learning and cognitive performance, while excess and chronic stress impairs learning and is detrimental to memory performance. Many other negative consequences attend owing to overactivity of the hypothalamic-pituitary-adrenal (HPA) axis, which results in both impaired synaptic plasticity and learning ability (p. 3).

Based on neural research, the lack of long-term outcome data, the presence of poor and inconsistent short-term outcome data for PE, and the risk of relapse, using PE appears counterproductive. PE is one of the gold standard treatments for PTSD and other anxiety disorders and over waitlisted studies there is no questions outcomes are improved, so the availability of PE to PTSD and anxiety sufferers is beneficial overall. However, novel treatment modalities that employ reconsolidation techniques need also find empirical support, especially when erasure of the original emotional learning can happen in a few short pairings, is permanent, and may minimize risk to subjects (Ecker 2015, 2017, 2020; Ecker & Bridges, 2020; Ecker & Hulley, 2019).

Reconsolidation of Traumatic Memories (RTM)

RTM is a novel, brief, and structured therapy that uses dissociation to establish indirect exposure for the treatment of posttraumatic stress that subjects describe as causing fear, terror, or helplessness. Gray et al., (2021) shared the RTM process outline.

1. The client is asked to briefly recount the target trauma.
2. As soon as they show signs of autonomic arousal, the clinician stops the narrative and reorients them to the present.
3. Elicit SUDS (subjective units of distress) rating.
4. The clinician aids the client in choosing a recognizable but neutral name for the event.
5. The clinician assists the client in choosing “bookends,” times before and after the event: a time before they knew the event would occur, and another when they knew that the event was over and that they had survived.
6. The client is guided to imagine being in a movie theater in which the pre-trauma bookend is displayed in black and white on the screen.

7. They are instructed how to remain dissociated from the material on the screen.
8. As if from behind and above, the client watches their own responses as a black-and-white movie of the target trauma plays from bookend to bookend. The movie is repeated with structural alterations as needed until the client is comfortable.
9. The client steps into the last frame of the movie, turns on the sound, color, and dimensionality, and experiences the event backwards, as a fast rewind lasting 2 seconds or less. It begins with the post-trauma bookend and ends with the pre-trauma bookend. This is repeated as needed until they are comfortable and show little or no autonomic arousal.
10. The clinician elicits the trauma narrative and probes for responses to stimuli that previously elicited a fast arising, autonomic response. If the response is significant, earlier steps of the process are repeated.
11. SUDS ratings are elicited.
12. When the client is free from emotions in recounting the event, or sufficiently comfortable (SUDS = 1 or 2), they are invited to proceed to the next phase of treatment. If SUDs ≥ 3 , trending upward, the client is directed to repeat elements of the protocol beginning either with the rewind or the black-and-white movies.
13. The client is invited to design and experience several alternate, non-traumatizing versions of the event, and rehearses these several times.
14. The client is again asked to relate the original trauma narrative, and their previous triggers are probed.
15. SUDS ratings are elicited.

16. When the trauma cannot be evoked, and the client can recount the event without significant autonomic arousal, the procedure is over (p. 2).

The highly structured script walks subjects through exposure to their traumatic event(s), although they experience it through dissociation rather than in first person (associated). Outside the script, the RTM protocol does allow for short integrations with Neurolinguistic Programming techniques to ground a client back to a down-regulated state, which based on the literature, likely activate hippocampal and PFC regions and deactivate the amygdala.

By imagining the movie being outside themselves they experience a contextual shift using a novel storyline to offer some prediction error elements to the subject's narrative. By maintaining a down-regulated state with little emotional arousal the subject again experiences a likely emotional and interoceptive prediction error. The emotion pairing used while enhancing the imaginal environment in the projection booth uses already established approach state memories of the subject, which likely shifts the predicted hormones and neurotransmitters typically activated with the recall of an enduring trauma.

RTM research has shown sizeable improvements over PE. In one study of military service women 90% had subclinical scores post-treatment and maintained subclinical scores for a year following, with only a 3% dropout rate (Gray et al., 2021). Similar results were reported in three previous studies of RTM.

Rapid Resolution Therapy (RRT)

RRT is another brief, but highly unstructured and even random approach to treating trauma and emotionally distressing memories (Connelly, 2019). The techniques used in RRT vary wildly. In reviewing multiple transcripts of original sessions for emotion pairing, one can

see Connelly's techniques begin with a brief memory activation, are extremely novel, are often humorous (always approach state driven), offer salient emotional rewards and contextual alterations to the trauma narratives, encourage sustained curiosity, temporary confusion, and overflow with prediction errors.

Connelly (2019) often pairs threat cues with previously consolidated approach state emotional memories and approach state contextual cues. Doing so, changed the context that a subject reviewed his or her trauma in, which forced the necessary prediction error. For example, one of the transcripts in his book, Connelly was working with Kristin Rivas, who also presented a popular Ted Talk about her experience with RRT. Connelly (2019) used multiple metaphors to indirectly expose Kristin to the disagreement she had not been able to grasp with the traumatic rules her mind formed through her traumatic experience. Connelly (2019) was trying to help her understand the way humans portray the context of time in traumatic experiences as if those moments are somewhere, such as "in the past".

Jon: A guy with a long red beard approaches the wolf and says, "Miss Wolf, you should have been more careful when you were walking. If you had been more careful, you wouldn't have slipped into that hole." Wolf is confused and asks, "I should have been more careful when?" "in the past, on the way to the hole," he answers. And she says, "Where is 'on the way to the hole'?" And he says, "You know, in the past!" Wolf says, "What are you talking about? Where is this thing you are calling the past? I don't see it." Then she kills him because he doesn't make any sense and has no value. She can't think it because it actually doesn't exist. Make sense?

Kristin: (Laughter) Uh huh.

Jon: One day I brought some bread to the duck pond. Do you like to feed ducks, sometimes?

Kristin: Yes, it can be fun and relaxing.

Jon: Oh, it's great. I had this piece of bread. I lob it out and Mr. Duck grabs it in his mouth. He's so happy for about a second until this other duck, Duck #2, pulls up alongside him, yanks that piece of bread out of his mouth and quickly swallows it. You know what Duck #1 did? He sailed away peacefully. I found that so interesting because I don't know anybody who would do that. I wanted to discover what it was about, so I swam out to Duck #1 and said, "Mr. Duck! What about the bread?!" Mr. Duck said, "What bread?" (p. 43-44).

The new narrative Connelly offered allows Kristin to consider a new way of thinking about her traumatic experience, but without intense exposure and instead by using logic, novelty, reason, relativity, and approach state metaphors to encourage her approach state from an avoid state.

Discussion

All said, there are multiple approaches designed for the effective treatment of trauma, each having varying levels of outcome data and empirical support, with all being well intentioned toward helping individuals arrive at a thriving state. PE has empirical support and a long track record of being the go-to treatment for PTSD and ASD. CPT, EMDR, certain CBT approaches, including BEP and NET are also empirically evidenced as second-line approaches for the treatment of PTSD. Fortunately, rapid, and non-retraumatizing methods, like RTM and RRT are also gaining ground, although establishing empirical support takes many years. Nonetheless, novel, and alternative approaches exist and should be considered as treatment options when gold-standard treatments fail.

Regardless of the method, evidence points to the need for down-regulation activation for effective learning, or memory formation. Reconsolidation is new learning and requires the same. There are also multiple learning models and multiple techniques available to enhance learning, but there are specific components that must be established to update learning. To begin with, one cannot change a network without using it first. It must be fired. Once activated, or unlocked (Ecker, 2015) the lability window opens and the opportunity to help an individual emotionally disagree with what he or she emotionally knew before begins. Ultimately, subjects get to experience physiologically feeling better immediately when they recognize cognitively that they were wrong about what they knew before. Just as Pavlov's dog salivated to a bell when paired with food in a few short pairings, humans too can experience a physiological change interoceptively measured pre- and post-pairing.

By clarifying that emotions are electrochemical signals that engage the body toward an approach or avoid state, subjects are less likely to label a negative emotion state using a feeling word, which is demonstrated in the literature review to enhance emotional states, not diminish them. Using only "approach and avoid state" terminology in this project can limit up-regulation, maintaining the trajectory toward perceiving and learning new approach state possibilities that when somatically sensed can result in the necessary emotional prediction error. Alternatively, labeling positive emotion words is more likely to enhance the subject's perceived approach state, thus increasing the production of dopamine in the PFC and reducing the production of adrenaline and cortisol, active with a FFFF response. Guiding a patient to experience an immediate and rewarding redirect from a FFFF response to a perceived threat by playing their favorite video online that can always engage a laugh for an individual can be the rewarding prediction error that

establishes new learning in how to cope with unexpected emotional FFFF responses in the future.

Language used in interoceptive research suggested that mentally modifying perceptions of physiological activity is the mechanism for change. Based on the literature, however, the emotional experience resulted in emotional learning. When a subject experiences a new unpredicted emotional experience an encoded emotional avoid state memory is labile and the dopaminergic change encodes new learning. In that light, the literature shows that it is the pairing of emotional alternatives that underlies permanent change and erasure, not only because of the experience, but because the electrochemical changes encourage an internal environment that is ripe for synaptic linking and growth.

By following the required steps for successful memory reconsolidation in humans, this project seeks to establish an applied memory reconsolidation approach that is guided by long-standing, valid, and reliable neuroscientific research (Elsey et al., 2018). By theorizing that the prediction error that a subject experiences in applied memory reconsolidation techniques is an emotional (electrochemical) one, it is possible to consider that approach motivation can improve exponentially when that experience becomes generalized to other emotional learnings.

Methodological Problems with Past Studies and Controversy in the Literature

There is a gap in the research addressing the difference between erasure and extinction, likely because “extinction” has been a word established in psychology to identify behavioral change. “Erasure” is new and timely longitudinal studies have not yet verified that relapse after memory reconsolidation absolutely does not occur. In addition, the research content is often confusing, as many refer to extinction when reporting on successful memory reconsolidation while others deny that extinction trials result in successful memory reconsolidation. I suggest this

project's results fill some gaps and offer some clarification about what more may be required for successful applied memory reconsolidation, minimizing confusion about the differences between the two characteristics of psychological and neural change.

As noted in this review, research outcomes and data for PE do not always include dropout rates or the outcomes in certain populations. For instance, the VA and APA recommending PE for the treatment of PTSD before recognizing the limited success of PE in veterans and active-duty service members is controversial. Additionally, calculating outcomes but omitting dropouts that occurred early in the study does skew the results in favor of a method designed by one of the authors of most PE studies.

Differences and variability in emotion theories and the required components play a major role in potential methodological problems in this project. Network theory was chosen as it aligned more with Hebbian theory that aligns with operant and classical learning theories. However, there are multiple variations in emotion theories and wide variations in the potential circular causality views of emotional components.

There is little evidence in the way of validating RRT outside of a TedTalk® presentation Connelly's client Kristin offered and a transcript of her session. Some components of RRT are also currently in the testing phase at Colorado State University. I am certified in RRT, use RRT techniques daily, and as a therapist in private practice I witness the erasure of client's emotional learnings daily, and have experienced the erasure of multiple emotional learnings myself. Clearly, this does not offer this method of treatment full credibility, but I am hopeful this research will spark interest in furthering RRT, and that empirical evidence will begin to mount that trauma treatment does not need to be emotionally painful. It is my belief that these rapid non-retraumatizing and indirect exposure treatments will result in a reduction in untreated

trauma, deaths by suicide as a result of untreated trauma and comorbidity, stigma around how therapy is painful and retraumatizing, and overall that individual's will have greater access to their prefrontal brain regions so more effective responding results. Furthermore, when family systems become void of encoded perceived fears, children become safer and more able to learn, changing the intergenerational trauma landscape.

RTM, on the other hand, which I am also certified to use, does have growing credibility through research. How it varies from RRT is largely in its structured approach, although similar in some ways as a version of a movie theater script is used in an RRT technique. RTM establishes more of a lack of emotional engagement, as opposed to RRT, which uses more humor, which the literature review shows that positive emotions facilitate and coordinate learning and enhance attention and the strength of memories (Li et al., 2020; Tyng et al., 2017).

Discussion

From consolidation to reconsolidation, the components that create a memory are the same and both engage the body to act if the memory is emotionally encoded. However, the mechanism for change is different. What is not clear, though, is the target component that will engage a body to remove its FFFF response when it is no longer necessary to retain it to ensure safety or survival. It seems, based on this review, that emotion is the logical target and that emotional disagreement, or emotional mismatch, is the appropriate focus for this research. Positive emotions seem the obvious reward when a FFFF response is removed. Causing the emotional disagreement with a consolidated memory that required a FFFF response also seems a daunting task, as the number of experiences stored in a human brain is extraordinary. Considering the components of memory storage in this literature review, finding the appropriate target for

mismatch will be the first necessary step, possibly of many, to establish an understanding of effective applied memory reconsolidation theories with humans.

Theoretical Framework

This project followed a combination of theoretical frameworks throughout. One framework, specific to the application of memory reconsolidation experiments with humans provided a direct map of necessary steps for successfully erasing an emotional memory. The other theoretical framework guided this project's understanding of approach and avoid state emotions and all their components. The last is a model for measuring emotional change in subjects. All combined, these frameworks offered the clarity necessary for measuring the outcome of this project.

Theoretical Framework for Human Memory Reconsolidation

As mentioned previously, this doctoral project was grounded on multiple theoretical frameworks. Early research by Donald Hebb (1949) established that cells [neurons] that fire together, wire together and cells that fire apart wire apart. The Hebbian Principle informs the underlying mechanism for learning established by Pavlov's Theory of Classical Conditioning (pairing) and Skinner's Theory of Operant Conditioning (Akpan, 2020) (positive and negative punishment and reinforcement). Memory consolidation is the initial step in learning that establishes a stable neural network (Langille & Brown, 2018). Studies later found that electroconvulsive shock (ECS) prevented memories from consolidating, but only when reactivated (Else et al., 2018; Else & Kindt, 2017). Later animal research on rats addressed how memories, when reactivated, can become unlocked (labile) and open for change (Iyadurai et al., 2019; Kida, 2019; Sara, 2000). Researchers used a protein synthesis inhibitor injection into the amygdala after fear conditioning and discovered the reconsolidation window (lability) is only

open for six hours or less. Memory erasure did not occur six hours later, when the memory was again stabilized and did not occur if the memory was not reactivated first, making it labile.

Evidence of memory reconsolidation in animals has been established and evidence of memory reconsolidation in humans with similar results is mounting (Elsey et al., 2018). While research has provided empirical evidence of change at the neural level in animals, evidence of change at the neural level in humans is only inferred and termed here as applied memory reconsolidation. Gershman et al., (2017) used the term post-retrieval memory modification instead to avoid terminology that infers an empirical phenomenon.

This project followed Elsey et al.'s (2018) steps established in their theoretical framework for human memory reconsolidation, which are reactivation and manipulation, time dependency, memory specificity, and dissociation of immediate and delayed effects. Clarified, reactivation and manipulation of the original memory trace requires that the original memory trace be active, followed by manipulation of the memory, which is an attempted introduction of a prediction error relative to the original memory trace. Time dependency ensures that prediction error occurs within the six-hour memory reconsolidation window while the memory is in a labile state and before re-stabilization (reconsolidation) (Ecker, 2018; Elsey et al., 2018; Elsey & Kindt, 2017; Cahill et al., 2019). Memory specificity requires that the original memory trace has been manipulated and results in dissociation from the original measure of memory activation immediately and over time.

Elsey et al., (2018) described using a three-day testing design used in animal research when conducting research on human subjects. Day one in animal research occurred when animals established the original memory, day two required memory reactivation and manipulation of the original memory trace, and on day three animals were tested for memory

updating or erasure. Testing days did not need to be consecutive but would only take place after 24 hours or more to safeguard the establishment of a long-term memory trace. In this project, the memory was already established in the subject before day one and memory reactivation and manipulation occurred longer than 24 hours or more later, as were follow ups to assess for emotion erasure and/or possible spontaneous recovery; dissociation of immediate and delayed effects.

Some of the studies that were guided by Elsey et al.'s (2018) and Elsey and Kindt's (2017) theoretical framework include Ecker (2017) who reported that he and his colleagues have successfully used the neuroscience founded framework with several thousands of subjects. Borgomaneri et al. (2020) also used Elsey's theoretical framework in testing 84 human subjects using fear conditioning and transcranial magnetic stimulation (TMS) of the dorsolateral prefrontal cortex. Results showed that stimulation of the repetitive TMS (rTMS) was successful in removing the return of fear. Specifically, their testing resulted in agreement that human memory reconsolidation for removing conditioned fear was successful if the prediction error occurred within the reconsolidation window. Elsey et al. (2020) also used this model to evaluate the use of propranolol during the reconsolidation window as a means for erasing the fear of public speaking in 60 participants. Results showed that propranolol did not perform better than placebo, even when administered within the reconsolidation window. The researchers did not have a clear explanation for their null results, although based on the study's methods, it appears they may not have reactivated the original memory, only attempted to treat the emotional (fear) symptoms.

Approach and Avoid State Emotion Theories

Specifically, Moors (2021, 2022) described the network theory of emotions, which originated with Bower and moved into biological network theories with Lang and Leventhal. Psychometric network theory is also called the biological network model (Lange et al., 2020). Psychometric network theory of emotions aligns with this project in that it is based in the Hebbian Principle and associative learning models for classical conditioning, as well as semantic memory network models, which posits emotional components interact as a network, and influence each other component bidirectionally and are modifiable, distinct, and vary in strength (Moors, 2021, 2022). Innate biological emotion networks develop within an organism and through learning experiences those networks get refined and updated. Moors (2021) stated that each specific emotion has its own individual network and that updating through learning can make those networks more profoundly emotional.

Psychometric network theories identify five generally held components of emotion; cognitive (appraisal of approach or avoid), motivational (action tendency toward approach or avoid), somatic (physiological awareness), motor (overt behavior), and subjective (descriptors of feelings or experience) components, although multiple internal and external stimuli can exert pressure on the network influencing other components (Lange et al., 2020; Moors, 2021). Psychometric network theory aligns with this project in that a stimulus is followed by several responses (appraisal, motivational response, physiological responses, feeling labeling, and appraisal of societal norms). Each biological (psychometric) network theory component exists because an original emotional memory network was biologically encoded with contextual emotional information that the brain uses later to secure survival and thriving needs (Gainotti, 2019). Emotional network activation can result from any of these components, but also by

physiological and motor stimuli. Emotions can also be artificially induced through social interactions, such as when one sees a facial expression (e.g., a frightened look on one's face) so then becomes afraid. When one uses feeling labels to name emotion states, they tend to also increase their felt sense of those emotions (Fan et al., 2019).

Biologically, emotions are the result of electro-chemical changes at the synapse that activate an individual to take an action based on given internal or external appetitive or aversive stimuli to illicit approach or avoid states established through development and refined through prior learning experiences (Miller, 2018; Moors, 2021; Reeve, 2018). In this project, the subjective perspectives of the emotional approach and avoid states encoded through each subject's prior learning experiences was the stimuli paired together to establish new classically and operantly conditioned approach responses to original emotional memory trace stimuli (Akpan, 2020). Specifically, the measure used for original memory activation was the subjective emotional somatic/interoceptive sensation (CR), described as an avoid state (active or passive) produced with reactivation of the original memory trace (CS) (Hofman & Hays, 2018). After pairing the CS with a novel emotional somatic/interoceptive sensation (either one already conditioned in the subject or introduced and subjectively agreed to as an approach state emotion) (CS2) as the counter-learning component described by Ecker (2017), the result will be a reconsolidated CR. With immediate repetition of the emotion pairings, the new CR will be immediate and last over time.

The network theories of emotion as described by Moors (2021, 2022) have been used in multiple studies. Emotion theory comparisons comprise most uses for network theory components, including studies by Lange et al. (2020). Lange et al., in evaluating components of

all theories stated that psychometric network theory accounts for all the necessary components of all emotion theories, including appraisal, affect-program, and constructionist theories.

LeDoux and Hofmann (2018) stated that a subject's verbal report is the most direct way of assessing his or her emotional state, but labeling feelings does risk increased activation of an individual's emotional experience (Fan et al., 2019). Tyng et al. (2017) also suggested other methods for assessing subject's emotion states including the subject's facial expressions, vocal changes, body language, heart rate, heartrate variability, and respiratory rate may be monitored and recorded. Tyng et al. also monitored skin temperature and conductance, blood volume pulses, and objectively assessed physiological nervous system responses using neuroimaging and biosensors. These measures, although sometimes noted in the transcripts, are not noted consistently enough to be considered and analyzed in this project, which limits the ability to assess a subject's emotional state. So, while there are many options for monitoring emotional experiences, the weight of this study rested primarily in the subjective pre- and post-treatment perspectives as defined verbally. However, labeling of emotions and descriptions of each subject's bodily state were contextually considered when making determinations of pre- and post-treatment emotion states for each transcript subject.

Ecker (2017) offered a few more important outcome measures for erasure to consider including, non-reactivation, an end to any symptomatology, and effortless permanence. This means the subjects no longer have an avoidant reaction to the memory cue. They also no longer use or need coping mechanisms to manage exposure to the memory and they do not need to take any further action to ensure erasure is the outcome. This is what Ecker calls effortless permanence.

Lastly, Monni et al. (2020), when defining approach-avoidance motivations, stated that “Approach motivation may be defined as the energization of behavior by, or the direction of behavior toward, positive [desired] stimuli (objects, events, possibilities)” and “avoidance motivation may be defined as the energization of behavior by, or the direction of behavior away from, negative [undesired] stimuli (objects, events, possibilities)” (p. 2). Monnie et al. also detailed that a *state* indicates the status of an individual’s emotions, thoughts, and behaviors. An *end state* is the outcome state an individual seeks to arrive at when energized by approach and avoidance motivation. Fridland and Wiers (2018) reported multiple studies have demonstrated that people have stronger and quicker avoidance tendencies when exposed to negative stimuli as opposed to positive. These definitions guide this project, although rather than overt behavior, these definitions will be applied to each subject’s emotionally motivated approach state (thriving) or avoid state survival (FFFF) interest goals (Moors et al., 2019).

Summary

In this project, as stated, published clinical treatment transcripts were explored for avoid state emotion (aversive CS) pairings to approach state emotions (appetitive CS) with the hypothesis in mind that when emotional learnings are salient, rewarding, inspiration, goal directed, and often encoded through previously emotional experiences (preexisting), the result is a new subjective approach state (CR). What follows is the new memory’s return to stability. The original memory is erased (reconsolidated) and new learning takes its place, no longer engaging the avoid state. The alternative scenario for pairing of avoid with approach states (as in addiction scenarios) were not explored in this project.

To follow is the evaluation of transcript subjects who report having a distressing or trauma cue that when triggered resulted in an avoid state reflex. The subjects were either

immediately somatically aware or able to describe the discomfort. The somatic sensation was subjectively re-measured for success after post memory reconsolidation through emotion pairing.

CHAPTER THREE

METHODOLOGY

This chapter addresses the research methodology for this project. This project intended to combine historical research (classical and operant conditioning) and recent neuroscientific research (memory reconsolidation) to apply it to humans in hopes of separating what works from what does not work in psychotherapy. This project attempted to further clarify the target for successfully reducing the need for mental health treatment, improving mental health treatment, clearing the path for utilization of the most effective therapies, and weeding out the techniques that plug up the mental health system creating confusion and increasing mental health stigmas rather than decreasing them. The project also addressed three research questions. How do operant and classical conditioning relate to the neuroscientific understanding of memory consolidation and reconsolidation (RQ1)? Is emotion a possible target for successful memory reconsolidation in humans (RQ2)? How successful is emotion pairing alone at reducing discomfort from trauma cues (RQ3)?

Research Method

For this research project I used a qualitative phenomenological approach. This method is the fitting research methodology because data collection involved a review of published transcripts from actual RRT sessions, the RTM script, and I attempted to include other single session and rapid treatment session transcripts, although none were located. When possible, from each transcript, each subject's pre- and post-session somatic sensations or SUDS scores were considered (Wolpe & Lazarus, 1966; Wolpe, 1969; Hensley, 2020; Tanner, 2012). Like Fugate and Franco's (2019) qualitative study, where subjects selected colors that each subject perceived as being a representation of an emotion, each transcript was be evaluated for such emotion

pairing, where emotional avoid states transitioned to approach states as representations of each subject's level of distress.

Qualitative methods are appropriate in this project for many reasons (Creswell & Creswell, 2017). One reason for this is because the Institution Review Board (IRB) would not allow experiments, so a review of already published transcripts offered some perspectives on the presence and effectiveness of emotion pairing in the therapeutic setting. Access to these transcripts came from existing publicly published literature. A search for peer reviewed case study transcripts published in scholarly journals and libraries was also conducted, although none were located. In this research project I chose to use a phenomenological research approach. This is the appropriate research approach to use in this project because I am seeking to understand the lived experiences of individuals who experienced the phenomenon of emotion pairing in RRT and RTM sessions (Chamberlain, 2009; Sheppard, 2020).

Participants, Selection Criteria, and Location

Sampling for this study was published transcripts from actual RRT and RTM therapeutic sessions and any other available single and rapid session therapy transcripts. Each available transcript was evaluated for the presence of content that confirms or denies the presence of possible emotion pairing in the therapeutic interactions between subjects and therapists. In addition, session transcripts were evaluated for each subject's outcome status, including from follow-up interviews if available. Transcripts were pooled using several methods. First, Connelly's (2019) book 'Life Changing Conversations with Rapid Resolution Therapy: A Single Conversation can be a Life-Changing Event, which has 21 published RRT transcripts were used. No other available published RRT transcripts were found that could ethically be considered. The same was true about access to any published RTM transcripts and other single and rapid session

transcripts, so none were evaluated, but the RTM protocol treatment script was available in a peer-reviewed scholarly article and was evaluated. I, alone, conducted the selection and analysis for this project from my home office.

Instrumentation

For this project, I used document analysis. Analysis of each transcript involved coding for answers to the following questions:

1. Does the presence of emotion pairing exist in the transcript (e.g., labeling of emotions, descriptions of subject's bodily state)?
 - a. Is the approach state emotion one that is already present in the memory of the subject or is it one suggested by the clinician?
2. Can the paired approach state emotion be described as one that likely elicits emotion in the subject?
3. Does the transcript subject note an initial and a subsequent SUDS rating and/or an initial somatic sensation that subsequently changes?
 - a. Can the noted changes be described as avoid states that transitioned to approach states?
4. Can emotion pairing in this transcript be considered the mismatch between what is expected by the subject and what happens, which is required for successful memory reconsolidation?
 - a. Do the components of memory reconsolidation according to Elsey et al. (2018) exist in this transcript?
 - i. Original memory reactivation
 - ii. Original memory manipulation (mismatch)

- iii. time dependency
 - iv. memory specificity
 - v. dissociation of immediate and delayed effects
5. Is there a follow-up interview?
- a. What is the subject status at follow-up?
 - b. What is the time span between initial session and follow-up?

The analysis phase included the collection of demographic information about each transcript subject. Demographics gathered, when available, included age and gender.

Analysis coding question one linked to research question one, ‘How do operant and classical conditioning relate to the neuroscientific understanding of memory consolidation and reconsolidation?’ Analysis coding questions two and four linked to research question two, ‘Is emotion a possible target for successful memory reconsolidation in humans?’ Analysis coding questions three, four, and five linked to research question three, ‘How successful is emotion pairing alone at reducing discomfort from trauma cues?’

Data Collection

Data collection procedures in this project varied. Connelly’s (2019) 21 deidentified RRT session transcripts were evaluated. The RTM most recently published treatment protocol script was collected along with review of other RTM associated articles that might have contained full or partial transcripts (Gray & Bourke, 2015; Gray et al, 2017a, 2017b, 2021; Gray & Teall, 2016; Tylee et al., 2017). Transcripts from scholarly case study articles that proclaim to be single session and rapid treatment session transcripts were not located. EMDR sessions were also not considered because none were located with treatment transcripts that report improvement within three hours (sessions) or less (Shapiro, 2013, 2014, & 2017; Shapiro & Maxfield, 2002).

Selection of usable data was only considered for use directly from specific modality sites and sources (i.e., RRT, RTM, EMDR) or from scholarly journals and libraries. Documents were only included in this project when the article identified that subject consent was obtained and deidentified when required or the specific modality or author authorized its use and subjects were deidentified.

Analysis Procedure

The selection process for transcripts involved Connelly's (2019) 21 published deidentified session transcripts in his book and any transcripts that can be found using keywords such as 'Rapid Resolution Therapy' in the library and open access articles. Video transcripts available on the Rapid Resolution Therapy website (<https://www.rapidresolutiontherapy.com>) were originally considered but were subsequently removed. RTM transcripts published in the library or RTM website (<https://www.thertmprotocol.com>) were considered, but not present upon searching. There were also no transcripts found using keyword searches such as 'single session' and 'rapid treatment' in scholarly libraries.

This is a qualitative phenomenological research study. Outcomes are provided here regarding each subject's documented perspectives regarding a shift from an avoid state to an approach state. When possible, each subject's ability or inability to recreate the original avoid state somatic sensations or SUDS score were also noted.

Based on each outcome, as Moustakas (1994) described regarding phenomenological research, much of the remaining discussion focuses on connections back to the literature review and how this research is distinguished from previous studies. The results and discussion make distinguishments between approach to emotional awareness through somatization and emotional memory reconsolidation through pairing in comparison to earlier studies. Additionally, it

addresses research question one regarding the operant and classical conditioning components of the original experience being consolidated and then reconsolidated. The discussion also draws connections to the potential that emotion is the mechanism for change in human emotional memory reconsolidation if the transcript subjects can no longer recreate their original emotional avoid state somatic sensations or that the original SUDS score was improved after the emotional approach state pairings. Regardless, because of the inability to witness physical changes in human neural networks, reliability that this analysis is assessing for empirical memory reconsolidation at the neural level is low. However, this project includes views on future research projects to improve this deficit and will discuss “the outcomes of the investigation in terms of social meanings and implications as well as personal and professional values” (Moustakas, 1994, p. 124).

Construct validity in transcripts using the SUDS instrument to measure subjective perspectives of change are good and have been used in previous studies to measure subjective improvements from traumatic perspectives (Gray & Bourke, 2015; Gray et al, 2017a, 2017b, 2021; Gray & Teall, 2016; Tylee et al., 2017). While SUDS scores were not used in the transcripts, subjective descriptions can be similarly considered. The RTM script does use SUDS scores, but because there were no subjects to access, SUDS scores changes can only be inferred.

Validity in this project is a concern because there was also only one researcher conducting analysis of each transcript, so researcher bias can also be a concern. In addition, each transcript could not necessarily offer a clear picture of each subject’s respondent bias to ensure that each subject provided an honest answer to their level of improvement from the beginning to the end of each treatment session. Follow-up interviews were noted for each transcript, though, to increase the validity of each subject’s reported outcome.

CHAPTER FOUR

RESULTS

This project has been exploring the theoretical application of memory reconsolidation through the classical conditioning of emotion states as a mechanism for change in human beings. Published transcripts on case studies using RRT, RTM transcripts and treatment script, and other available rapid or single session transcripts provided the intended content for this research. By focusing on the pairing of emotionally motivated avoid states with emotionally motivated approach states (and converse when available), this project answers the following research questions. How do operant and classical conditioning relate to the neuroscientific understanding of memory consolidation and reconsolidation (RQ1)? Is emotion a possible target for successful memory reconsolidation in humans (RQ2)? How successful is emotion pairing alone at reducing discomfort from trauma cues (RQ3)?

Participants and Locations

Participants in this project are the transcripts from various psychotherapy sessions. Each transcript considered for this study comes from existing published and publicly available transcripts from various sources. Of the 22 participant cases, 21 of the transcripts are de-identified and published in Connelly's (2019) book 'Life Changing Conversations with Rapid Resolution Therapy: A Single Conversation can be a Life-Changing Event'. One case is the RTM Protocol treatment script presented in Gray et al. (2021).

I was unable to locate any publicly available transcripts of RTM, NLP, or EMDR treatment sessions. I was also unable to locate any single or rapid session treatment session transcripts. Any I found only offered summaries of each treatment session. Regardless, each treatment session fell outside the three-hour session time cut-off.

Most transcripts did not mention the setting that each therapist-client interaction took place, with a couple noted exceptions. Connelly noted that one of the sessions was conducted in his office and another was conducted in his friend's office, which was nearby his own. Another RRT session Connelly mentioned was conducted in a county mental health center. Because only the script, and not a session transcript was available in this project, there is no location to note.

Participants in Connelly's (2019) transcripts include individuals with various individually perceived traumatic experiences or beliefs. Events contributing to those traumatic experiences include deaths, bullying, stroke, sexual assault, shaming & guilting by others, panic attack, marital and relational conflict, miscarriage, religious trauma, poverty, weight struggles, compulsivity, addiction, abandonment, domestic abuse, and a traumatic hypnosis experience. RRT treatment session cases include 6 male and 15 female participants.

Results Research Question One

Research question one (RQ1) is "How do operant and classical conditioning relate to the neuroscientific understanding of memory consolidation and reconsolidation?" and is analyzed using analysis coding question 1 and 1a. These coding questions ask, "Does the presence of emotion pairing exist in the transcript (e.g., labeling of emotions, descriptions of subject's bodily state)?" and "Is the approach state emotion one that is already present in the memory of the subject or is it one suggested by the clinician?" Multiple themes are identified from these questions.

Theme One

A major theme identified from research question one was emotion pairing that occurred absent any contextually related or cognitive content using already present emotional approach states to pair with avoid states. Eleven participants out of Connelly's (2019) 21 transcripts

contained content that engaged the participant in an approach state without suggestion about what would be the best symbol for the participant.

For example, one participant, diagnosed with Posttraumatic Stress Disorder, Major Depressive Disorder, and Conversion Disorder with pseudo seizures after the death of her sister in a car accident, had the following interaction with Dr. Connelly as part of her session:

Jon: I am looking toward what I am intending for you. I see you like this. You are experiencing the present each and every moment that you're alive. You are sourced from within with energy, power, clarity, strength, flexibility, joyfulness, grace, and balance... inner mind is responsive to symbols.... Let's create a way to symbolically represent what you are heading toward. What wild bird or animal would be inspirational? **Kristin:** A butterfly. **Jon:** Butterfly is the perfect symbol. It is what your mind has chosen and, therefore, what your mind will respond to. Is the butterfly moving or still? **Kristin:** Flying. **Jon:** What color? **Kristin:** Pink..." (Connelly, 2019, p. 39-40).

The pink butterfly was a symbol selected by the participant, without suggestion about what animal to choose by Dr. Connelly, to represent her intended emotional state best, moving her further towards her intention instead of her mind continuing to respond to her trauma like it had been.

Another participant, Tammy, was asked to come up with a symbol that represents how she'd like to respond to experiences she had about memories of being molested between the ages of five and fifteen and a later sexual assault by a police officer in her twenties.

Jon: I am seeing what I intend our meeting today to do and where I intend for it to take you. And, since our minds are so responsive to symbols, which is why countries use flags, let's find a way to symbolically represent our intention--a wild bird, a wild animal,

something from nature or the sky will symbolize what we are intending for you. What is it? **Tammy:** A flower. **Jon:** Beautiful, I like that. Tell me the color. **Tammy:** I want to say bright yellow. **Jon:** Beautiful, beautiful. that's going to work just fine. You see, I could come up with a symbol, but even though I probably could come up with a good one, yours isn't a good one. Yours is perfect. **Tammy:** Oh, yeah? **Jon:** The lock for itself creates the perfect key and this means your mind created a way to symbolically represent to itself what it is that we intend. You've got the concept and, in checking your response to what I have described, it was clear to me that that is ok with you. So, what we are representing with flower is what we intend for you. Make sense? **Tammy:** Yes. (Connelly, 2019, p. 520-521)... **Jon:** You were shaky, but you were also intent on getting the hell out of there. You did it. You turned the key, you heard it start, and you very carefully pulled out and drove. You looked in the mirror and he wasn't there. **Tammy:** Yes, you're right. **Jon:** And you got it that it's finished. See it on the paper triangles and now it is turning to dust. You look at that design and what do you notice now? **Tammy:** I don't see anything. **Jon:** Yeah, it's not there anymore. As you look at the flower... **Tammy:** It looks really bright yellow. **Jon:** Yeah. it's really vibrant yellow, now. **Tammy:** Yes. The design that represented the problematic way her mind had been processing data has disappeared and the flower has become more prominent. As Tammy sees these things, they confirm how much she has been able to get done. **Jon:** so, what's going to happen is that those two clearings, and you know what I'm talking about now with clearing, the same light is going to be applying to every single thing that ever disturbed you. Ok? **Tammy:** Yes, very much so. (Connelly, 2019, p. 556).

Each participant reported an improvement in his or her symptoms related to the use of the symbol. The differences between what the participant had experienced for years with the recall of their memories and the experiences they had when recalling them during their RRT session is likely the dopaminergic reward that resulted in the required mismatch for successful memory reconsolidation.

Theme Two

There were multiple session transcripts that did not follow prolonged exposure techniques. Instead, 100% of the RRT session transcripts and the RTM protocol used indirect exposure, not prolonged exposure. The participants did not need to relive events and systematically desensitize to their experiences as is required with prolonged exposure. One RRT session transcripts stated,

Jon: We have the same intention; our energy comes together. I'll ask your mind to scan back to a particular experience so that as we look at it together, energy will be freed. This energy will power the shift that untangles the way information has been stuck so that you are clear toward the intention we have for you. Something will come to mind. You found it. How old were you? **Misty:** In my early twenties. **Jon:** Let's put it on a shelf for later. And another one? **Misty:** Seventeen. **Jon:** Good job. Now younger. **Misty:** Twelve. **Jon:** Ok. good. And now something earlier than that. Don't try to find it. Let that just come. **Misty:** Ok, I got it. **Jon:** Yes, and how old were you? **Misty:** Five. **Jon:** There was a thing that you accomplished that there was a sense of real satisfaction when you accomplished it. What was that? **Misty:** I was given an excellent evaluation on my photography class. It filled up and there was a waiting list. That happens regularly now, but I am remembering the first time. It was really neat. **Jon:** Ok, remember that? (snap)

Misty: Yes... **Misty:** It happened a lot. My older brothers acted like I was disgusting. I just wanted them to like me. Sometimes my mother tried to get them to take me with them when they went out, but they acted like they hated me. **Jon:** So, here's what we do. Think of a photograph you were delighted that you took. (She smiles and nods.) Think of a moment that felt good when teaching. (She smiles and nods again.) A time you really enjoyed with your husband. (She smiles a big smile.) Look through those wonderful moments to see the little girl who we know is on her way to some wonderful stuff. **Jon:** Now, how is she doing? **Misty:** She's cool. she gets it. Yes. I feel more peaceful.

(Connelly, 2019, p. 127-130).

When Connelly (2019) later addressed those topics with Misty during the same session, each issue took no more exposure than about 15-30 sentences back and forth between her and Dr. Connelly to help Misty experience relief from those events.

Another participant, Bryan, stated,

When I was in about the fourth grade, the effect was probably anger at my parents. The long-term effect is that I'm not able to get close to animals. We have a dog, and I don't have any feelings toward this animal. (Connelly, 2019, p. 300).

In a five-sentence exchange, Bryan explained he was frustrated as a child with having lost numerous pets and by how his parents intruded on his grief while burying one of his cats that was run over. Through their short interaction, Connelly asked Bryan to imagine speaking to himself at various younger ages about various ways creatures change and how people perceive situations differently. Connelly (2019) used various metaphors and examples to encourage Bryan's younger brain to learn what Bryan's adult brain knew. Bryan responded,

That was amazing. I feel so much better. I can go to the scenes, especially where the cat's death was, and not feel like crying or anything like that. I am able to experience things for what they are and move on. It feels natural (Connelly, 2019, p. 315).

Theme Three

Laughter is a rewarding emotion and may result in operant conditioning, just as food can be the reward for a mouse pushing a lever. The presence of laughter occurred often in the evaluated sessions. The presence of laughter in sessions occurred in 14 of the 21 RRT sessions and can also potentially occur when using the RTM script.

One participant Kristin interactions went as follows:

Jon: Good job. Get Dad to treat Bethany differently five years ago. **Kristin:** it doesn't exist. **Jon:** Good. You have to stop Dad from criticizing Bethany five years ago. Hurry! **Kristin:** I can't. it doesn't exist. **Jon:** Again. Get him not to do that five years ago. Hurry up. (Slapping sound). **Kristin:** I can't. it doesn't exist. **Jon:** Good job. Now, check for the anger. **Kristin:** (*Laughter*) I am not angry at all. Oh, my goodness. I am not angry (Connelly, 2019, pp. 73-75).

Another participant stated,

Cheri: I'm so embarrassed! **Jon:** Embarrassed? You didn't even say anything yet! I mean, if you are going to be embarrassed, let me in on it so that I can enjoy it. (Cheri begins to laugh.) **Jon:** That's better. Just tell me about it, don't re-live it (Connelly, 2019, p. 348).

In the RTM script (Gray et al., 2021), step two calls for reorienting the client to the present after they recall their target trauma. This is done immediately when the clinician sees signs of autonomic arousal. This can be a time to use some mild humor to elicit laughter.

Results Research Question Two

Research question two (RQ2) asks, “Is emotion a possible target for successful memory reconsolidation in humans?”. This question is coded using analysis coding questions two and four. Analysis coding question two asks, “Can the paired approach state emotion be described as one that likely elicits emotion in the subject?”. Analysis coding question four asks, “Can emotion pairing in this transcript be considered the mismatch between what is expected by the subject and what happens, which is required for successful memory reconsolidation?” and includes the sub-question, “Do the components of memory reconsolidation according to Elsey et al. (2018) exist in this transcript?”, which in order to have an affirmative answer requires a positive response to all of the following five categories, original memory reactivation, original memory manipulation (mismatch), time dependency, memory specificity, and dissociation of immediate and delayed effects.

Theme One

Another major theme seen in this project is that Elsey et al.’s (2018) five required components were present in all cases. All 21 RRT transcripts and the RTM treatment protocol script, if used properly, contained all five components of memory reconsolidation. If the RTM protocol is not followed as designed, any of the five required memory reconsolidation components could inadvertently be omitted. Because there were no RTM transcripts to evaluate, this could be an exception, although RTM when followed is specifically designed to meet memory reconsolidation components.

Table 1

Components of memory reconsolidation according to Elsey et al. (2018)

<p>original memory reactivation</p>	<p>Janet: I miscarried two and a half years ago and, since then, I haven't been able to get pregnant. it's not a matter of not really being able to. it's more that I'm afraid to. When I'm ovulating, I can't go through with it. I'm blocking it, I guess, in my own way... I was very depressed and upset about it. I kind of flipped out there for a while...I guess because I don't know if there was something I did that caused it. Jon: Why? Janet: I'm an athlete and I was playing volleyball after I found out I was pregnant. The doctor said that it would be all right that I continued doing things that I was already doing, but he did suggest that I not dive. I've played pretty serious ball. I went right over a chair that I didn't know was there. I was playing in the sand. It was a white chair and it blended right in. Jon: (Incredulous) You have been blaming yourself? For what? Janet: Well, he told me not to dive and I obviously wasn't following the doctor's orders... (Connelly, 2019, p. 317, 319).</p>
<p>original memory manipulation (mismatch)</p>	<p>Jon: He said, "don't dive." he didn't say don't trip (Connelly, 2019, p. 320). Jon: I'd like you to think of a particular moment, a wonderful moment, and tell me about it. Janet: When I was a little girl, probably about seven years old, I was camping with my parents and I woke up. There were these sounds. Jon: What were the sounds?...Janet: The birds were singing. The light was just coming up and I jumped up immediately, as quietly as possible. Very quietly, I unzipped the door of the tent. When I stuck my head out, I was growled at. (Laughter) So, I jumped back in really quickly. Jon: What was growling? Janet: It was a raccoon. (Laughter)...Janet: No. There was also a deer. Jon: What was the best part of that? Janet: That I was a part of it. Jon: Yes, you are peaceful and excited. Janet: Oh, yeah! Jon: Let's think the beauty that surrounded you caused your awareness to move in toward your center where you are always excited and at peace (Connelly, 2019, pp. 323-324). Janet: (pause) I felt relaxed, very relaxed. Jon: Let's think that you become aware of your center where you are always at peace. People think it is important to feel good. Would you agree?...Jon: People believe that doing well is important in order to feel good. They also believe it is useful to make people feel badly so they will do better when they are not doing well. it's how the school system works. That's why they give people detention. It's how the prison system works and that doesn't work at all. Millions of dollars go into it trying to get people to feel badly so they act better... it's important to do good in order to feel good and people make other people feel bad in order to get them to do better. Our own minds make us feel bad in order to get us to do better. Am I making any sense? Janet: You're making sense. it's sad, but you're making sense...Jon: Listen to it and notice what it's trying to</p>

	<p>accomplish. Listen to it while keeping in mind that it's attempting to cheer you up. (Pause) What happens as you hear it that way? Janet: it's always telling me I should have done better or been more careful or tried harder. Jon: It is trying to cheer you up by telling you you're inept. It's inept and nothing it says makes sense. Janet: Right. Exactly. You don't tear someone down to build them up. Jon: What does the soundtrack want you to feel? Janet: If I look at it the way you have explained it to me, the soundtrack wants me to feel good. Jon: Imagine feeling like the soundtrack really wants you to feel, like in the woods feeling excited and peaceful. Hear it and imagine feeling the way it wants you to feel. Janet: I feel better. I don't feel scared (Connelly, 2019, pp. 326-330).</p> <p>“Jon: Your beliefs were because of things that happened and things you were told. So, your beliefs actually happened to you just like your experiences happened to you” (Connelly, 2019, p. 331).</p>
time dependency	While the session time was not noted, the transcript as written could easily have occurred within the six-hour window required for successful memory reconsolidation.
memory specificity	The mismatch offered was a manipulation of her original memory trace (her experience and belief about her miscarriage experience) and resulted in dissociation “from the original measure of memory activation immediately and over time” stated originally as, “depressed,” “afraid,” and unable to get pregnant because she “can't go through with it” (Connelly, 2019, p. 317).
dissociation of immediate and delayed effects.	<p>“Janet: I feel so good. Calm and good. Everything is different. I enjoyed your sense of humor. I feel different, completely different” (Connelly, 2019, p. 336).</p> <p>“I spoke with Janet a year later and learned that the depression that had been dominating her mood level before our meeting has never returned. She and her husband now have a son” (Connelly, 2019, p. 337).</p>

Table 2

Components of memory reconsolidation according to Elsey et al. (2018)

original memory reactivation	<p>“Marc: I can only do so much. I have been a mess. There are so many simultaneous layers that I am just struggling to get through each day. I am pressing charges against the man who raped me... Because it was a crime...Because it shouldn't be allowed to happen. It suddenly hit me that I have a fifteen- year-old daughter and if it was her, not me, would I be walking around going, “gee, I wonder what I should do about this”...I went to a therapist after this happened to me. She told me that if I</p>
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	<p>reported the rape it would be horrible for me and that it wouldn't do any good. she said it would be even harder because I was a man and I agree with that. I decided not to for a while but finally I went ahead and did it (Connelly, 2019, pp. 560-561, 563).</p> <p>Marc: I think that Sunday in the police station I got my first taste of what I've always heard about. it was like I was being interrogated. I said, "We had a few drinks together. Even though he was my trainer, sometimes we would have a few drinks and just talk. I liked him. I trusted him. there was no reason not to." the detective asked me if I had had sex with him previously. He asked me if I was attracted to him (Connelly, 2019, pp. 564-565).</p>
<p>original memory manipulation (mismatch)</p>	<p>Jon: if the detective just listened to you and didn't do anything, you still did your job by coming forward. Is your job to make the arrest? Marc: No. Jon: Was it your job to make the report? Marc: Yes. Jon: So, if you made the report and there was no arrest, then you did what your job was. Your job wasn't to make arrests or convictions. That's not your job. You did your job. You did your job and, after doing your job, they did some stuff and then they said, "Now there's other stuff for you to do." What there is for you to do is to describe what took place. Is there any other job? Marc: No. I guess not. Jon: Is it your job, therefore, to cause him to be convicted of that? Marc: No. Jon: Ok. Is it your job to imprison him? Marc: No. Jon: Your job ends, and the world does what it does (Connelly, 2019, p. 564).</p> <p>Jon: He believed you since there was an arrest, but your job was not to be believed. His job is to determine when there's an allegation whether or not it has the validity for him to proceed. In order to do that, he does various things to check that. Sometimes those things are even designed to rattle the person making the accusation because an accusation could be made for a variety of reasons, right? And if it wasn't being made because the thing actually happened, it would be easier for the detective to ascertain that if the person was rattled. Right?...His job was to ascertain whether or not this thing was accurate enough to proceed, which he then did. But it was not your job to be believed. It was your job to state what it was. So, as you spoke to the detective, you told the story and you were believed, but it wasn't your job to be believed. It was only your job to tell the story. Marc: Right. Jon: so, if you told the story and he said, "You are full of shit," did you do your job? Marc: Yes (Connelly, 2019, p. 566).</p> <p>Jon:...so, she's going to do her job. So, there you are in the courtroom and she says something like this, "Well, sissy slut, isn't it actually the truth that all of this happened in your head because you were pissed off that he didn't have sex with you after you begged him to?"... Marc:</p>

	No, it's not true. Jon: But, don't you have to get her to treat you respectfully? Marc: it's not my job (Connelly, 2019, p. pp. 572-573).
time dependency	While the session time was not noted, the transcript as written could easily have occurred within the six-hour window required for successful memory reconsolidation.
memory specificity	The mismatch presented in this case was a manipulation of his original memory trace (his fear of not being believed in court because he was not believed in his earlier divorce case) and resulted in dissociation "from the original measure of memory activation" stated originally as "I can only do so much. I have been a mess" and "people didn't believe me." (Connelly, 2019, p. 560, 568)
dissociation of immediate and delayed effects.	" Marc: Easier and clearer and detached from the outcome. Yeah, just much clearer in thinking that it's not my job... Yeah, it's a big relief. It's a huge relief. I feel so much better" (Connelly, 2019, p. 578). "The trainer was convicted and sentenced...Now it's behind me and I know I did the right thing" (Connelly, 2019, p. 578).

In this project, RRT appears to have all the components required for successful memory reconsolidation, although the mechanism for change is not clear, so can only be theorized as such. RTM also includes all five components for memory reconsolidation, according to Elsey et al. (2018), when the script is followed as designed. As with RRT, the mechanism for change with the RTM protocol is also unclear.

Theme Two

A theme identified from research question two is that SUDS was only used in the RTM script. However, each RRT session included a measure of some sort. Whether a verbally reported improvement using feeling words, an abstract image shift, or a somatic awareness change each indicated change.

Verbal reports of feeling words and descriptions that indicate a change between avoid states at the beginning of the session to an approach state at the end is used as a frequent determination of treatment success. For instance, Misty stated in her session, "I'm pissed at right

now. They all ganged up on me. Everyone hated me. Every desk had something bad about me written on it” (Connelly, 2019, p. 133). Subsequently, Misty stated regarding the same issue being addressed in her session, “I can think back on it and the hurt is gone. It’s just something that happened” (Connelly, 2019, p. 135).

Other times Connelly (2019) asked a participant to notice a somatic feeling state. For instance, with Misty, Connelly (2019) stated, “Let’s create a baseline so we can keep track of where we are starting, purposely cause the feeling for about four seconds. (She does and there is a shift in facial expression.)” (p. 124). He followed that request with another, asking her to create an abstract design in her mind, which he says is used as a measure of change from the baseline during the session; “Good job. Next, create a design that will represent how your mind has been processing what has caused these feelings. Just make one up. **Misty**: it’s dark with diamonds and zigzags.” (Connelly, 2019, p. 124). Periodically, Connelly asked Misty to reassess the state of the abstract image in her mind. “**Jon**: Look at the design. What’s it look like now? **Misty**: it’s much lighter” (Connelly, 2019, p. 143). “**Misty**: Yes. I get it. I feel so much better. **Jon**: So, check the design, what do you notice? **Misty**: Less, less” (Connelly, 2019, p. 148). In following up on both the feeling state and the abstract image the following final interaction occurred:

Misty: I am okay. I am really okay now. **Jon**: And what’s the sense? What’s the feeling?

Misty: Peace **Jon**: Check the design. What do you notice? **Misty**: it’s gone. **Jon**: Yeah, and so check for the feeling? Here, let me help. People won’t like you. some people already don’t like you. go ahead and try to feel bad. **Misty**: (Laughing) I can’t...can’t get it. it’s not there. **Jon**: I enjoyed talking with you. **Misty**: Thank you. It was wonderful (Connelly, 2019, pp. 149-150).

Sometimes, participants agreed with suggested feelings or emotion states, during and after RRT sessions. For example, the following interaction happened with Pamela.

Pamela: Everything is just right in here. (She points to her chest). **Jon:** Yeah, everything is just right within you. **Pamela:** it's where the whole is. It's warm. **Jon:** It's warm and you are whole, at peace, secure, wise and powerful. **Pamela:** Right, and powerful (Connelly, 2019, p. 501).

Theme Three

Another major theme identified from research question two is the presence of approach states being paired with avoid states. Every RRT case had only short reactivations of avoid states immediately followed by multiple approach state suggestions or prompts. For instance, Connelly (2019) would sometimes suggest a different way to view or experience the consolidated avoid state. Other times, Connelly would prompt a participant to recall a prior memory when he or she experienced an approach state. Whether suggested or prompted, the outcome of each case was a dissociation of avoid states with immediate and delayed approach state responses and the absence of avoid state symptomatology. Because each participant reported improvement, the final approach response to their original avoid state is indicative of an operant conditioning experience, especially considering the outcome was rewarding when compared to their original complaints.

The following are a couple examples of avoid states that approach state pairing was used with as a mechanism for transformational change.

- **Paula:** I did a lot of things to try to off myself and to try and get the hell out of here because there was so much pain. **Jon:** You wanted to stop the pain and experience peace. Makes sense to me... **Paula:** Right. It seemed to make sense. **Jon:** Stopping

- pain and feeling peace. You were so hurt...**Paula:** Yes. **Jon:** During that experience, you fight to survive. **Paula:** During that experience, I made an effort to stay alive. I did a lot of things to try and maintain my life. **Jon:** Yes. You are all about survival. You are strong and tough. When your survival is threatened, you dig in...**Paula:** Yeah, that's true. That's very true. **Jon:** You are a survivor. That's what you do. that's who you are (Connelly, 2019, p. 595-596).
- **Tom:** Every time I even think about it, I get this horrible heaviness in my chest. I have it right now...**Jon:** I need your help. Get back here with me. Sometimes, when I walk through my neighborhood, I can see the television screens inside of other people's houses. Have you ever noticed that? **Tom:** Yeah, sure. **Jon:** Let's imagine we are walking together, and we can see someone's television through the curtains of their home. On the screen, there is the guy with the stethoscope and the two guards. Look at the person's house again and then the television screen can be seen through the window. See what you are describing on the television through the person's window. What's going on? (Connelly, 2019, p. 582).

With Paula, Connelly immediately reframed her suicidal intentions after a brutal assault as her wanting to feel peace and stop pain, along with being a strong and tough survivor. With Tom, he later stated, "As we started talking today, the chest pain returned. I got anxious as we were going to start because I knew it was going to happen and I was afraid to have a flashback." Jon asked, "How are you doing now?" to which Tom replied, "As soon as you asked me to look at the television through the window, the pain went away. I don't have the pain now" (Connelly, 2019, p. 587). While a redirection from the anxiety Tom felt may not be independently considered an approach state, a new and unexpected focus is a reward in comparison to what he had generally

felt in response to recall of his consolidated experience. In each case, Paula and Tom, along with each of the other cases, participants experienced an emotional mismatch between what they had expected and what occurred.

Results Research Question Three

Research question three asks, “How successful is emotion pairing alone at reducing discomfort from trauma cues?” and is analyzed using analysis coding questions three, four, and five. Analysis coding questions three is, “Does the transcript subject note an initial and a subsequent SUDS rating and/or an initial somatic sensation that subsequently changes?” and includes the sub-question, “Can the noted changes be described as avoid states that transitioned to approach states?” As with research question three, analysis coding questions four asks, “Can emotion pairing in this transcript be considered the mismatch between what is expected by the subject and what happens, which is required for successful memory reconsolidation?” and includes the sub-question, “Do the components of memory reconsolidation according to Elsey et al. (2018) exist in this transcript?”, which in order to have an affirmative answer requires a positive response to all of the following five categories, “original memory reactivation, original memory manipulation (mismatch), time dependency, memory specificity, and dissociation of immediate and delayed effects.” Additionally, analysis coding questions five asks, “Is there a follow-up interview?” and if so, “What is the subject status at follow-up?” and “What is the time span between initial session and follow-up?”

Theme One

A major theme identified from research question three is that, from this study alone, it is not possible to gauge if emotion pairing alone is effective at reducing trauma and stress cues. There were many variables that existed in each case to offer a specific causal relationship

between emotion pairing and the reduction in avoid state responses. For example, hypnosis and guided meditations were also used in 15 of the 21 RRT cases. In the RTM script, depending on each participant's needs, components such as the black-and-white movie and color rewind sections of the treatment protocol could be considered guided meditations or hypnotic components.

Additionally, in each case, emotion was addressed, but cognitive and contextual content was also used in each case. There were only a few cases when Connelly (2019) asked a participant to recall an already present emotional approach state (absent contextual or cognitive cues) to pair with an avoid state. Regardless, there were still other parts of those same session transcripts that included discussions about cognitive or contextual content. For instance, as noted in the results section for research question one, Jon asked about an already present approach state idea. Specifically, he asked, "Let's create a way to symbolically represent what you are heading toward. What wild bird or animal would be inspirational?" and Kristin replied, "A butterfly" (Connelly, 2019, p. 40). In Kristin's case, and other's cases, he also used multiple metaphors (e.g., wolf, duck, electrician) to change the context with which they viewed their experiences. With Kristin, to demonstrate how animals respond only to what is happening, not to memories, Jon stated,

I had this piece of bread. I lob it out and Mr. Duck grabs it in his mouth. He's so happy for about a second until this other duck, Duck #2, pulls up alongside him, yanks that piece of bread out of his mouth and quickly swallows it. You know what Duck #1 did? He sailed away peacefully. I found that so interesting because I don't know anybody who would do that. I wanted to discover what it was about, so I swam out to Duck #1 and said,

“Mr. Duck! What about the bread?!” Mr. Duck said, “What bread?” (Connelly, 2019, p. 44).

Anne and Jon had the following interaction:

Tell me a place you saw that was beautiful. It doesn't matter when. **Anne:** Well, we went to the mountains and the water was running down near the brook by the house, and there was snow on the ground and little particles of snow were just running down the stream.

Jon: What was the best part? What was the peak moment?... Please close your eyes. (She does) You know how it looks, how it sounds, even how it smells, and you know how you feel as the little particles of snow run down the stream. Take your own time with it...tell me about it. **Anne:** I smelled the freshness of the air. It was crisp and felt beautiful and I could hear the birds chirping and the water running over the rocks and it was just a sound. It was so peaceful. there wasn't any conflict in my mind. It was just tranquil and peaceful (Connelly, 2019, pp. 251-252).

While this was an already present approach state Anne recalled, Jon continued the discussion with more cognitive content.

People sometimes get confused between who they are and what they've been thinking and believing. “Who are you?” “I'm a republican.” Well, that's the way you're thinking about things or maybe what you have been doing, but that isn't your essence either. some people confuse themselves with their emotions. someone might say, “oh, I'm sad.” Well, that might be something he has been feeling, but that isn't who he is (Connelly, 2019, p. 255).

Although the last quote was a cognitive interaction with Anne, it is possible the information was dopamine producing (rewarding) and resulted in an emotional approach state, but the biological mechanism cannot be seen to know for sure.

Theme Two

In every case throughout this project, the only way to know about the delayed effects of treatment was to use follow-up interviews. Each RRT session transcript included a follow-up interaction anywhere from three months to 7.5 years after the session and demonstrated improvement in all cases. RRT's follow-ups are less structured and less scheduled when compared to the RTM protocol. In Peggy Sue's RRT case,

Three months later, in a follow up discussion with the counselor who referred Peggy Sue, I learned that there has been no further incidence of suicidal thought. She has found work and feels much better about herself. The counselor who arranged our meeting still meets with her, but not nearly as often (Connelly, 2019, p. 299).

And in Cheri's case, Connelly (2019) wrote, "I heard from Cheri a year later. She had ended the relationship with Tom and was dating a new guy" (p. 355). Unlike RRT that has no follow-up session requirement, RTM cases generally use two subsequent follow-up sessions to establish successful treatment and delayed effects.

CHAPTER FIVE

DISCUSSION

The project investigated emotion pairing as the mechanism for establishing the necessary prediction error for successful applied memory reconsolidation in humans. This investigation focused on improving psychotherapy patient outcomes by fine tuning the target for success. This project focused on three research questions.

RQ1. How do operant and classical conditioning relate to the neuroscientific understanding of memory consolidation and reconsolidation?

RQ2. Is emotion a possible target for successful memory reconsolidation in humans?

RQ3. How successful is emotion pairing alone at reducing discomfort from trauma cues?

These questions were developed and answered through the guidance of two established theories. Namely, Elsey et al.'s (2018) theoretical framework for successful memory reconsolidation, Lange et al.'s (2020) Psychometric Network Theory of Emotion. These theories were supported by three other well established theories, The Hebbian Principle (Hebb, 1949), Pavlov's Theory of Classical Conditioning (Pavlov, 1928), and Skinner's Theory of Operant Conditioning (Skinner, 1953). These questions were answered by evaluating 21 RRT transcripts and one RTM treatment protocol script.

Findings

The findings for this project answered or informed possible answers to the research questions in various ways. Some answers were clear affirmations to the research questions or sub-questions, while other answers could only be speculated. Regardless, these findings shed light on, both, the implications for professional practice and the necessary or suggested considerations for future research.

Research Question One

Each research question resulted in multiple themes coming to light. Research question one (RQ1) (How do operant and classical conditioning relate to the neuroscientific understanding of memory consolidation and reconsolidation?) was answered by using coding questions 1 and 1a (Does the presence of emotion pairing exist in the transcript (e.g., labeling of emotions, descriptions of subject's bodily state)?" and "Is the approach state emotion one that is already present in the memory of the subject or is it one suggested by the clinician?). These questions assessed for emotion pairing (classical conditioning) and an emotion state mismatch that, theoretically, results in a new, or reconsolidated, value driven network creation (operant conditioning).

Analysis identified that 11 of the 21 transcripts contained content that demonstrated that after reactivating the subject's original (consolidated) distressing memory by recalling it briefly, the clinician suggested a way to activate an already present approach state within each subject's mind that represented the desired reward. This, in theory, is pairing an avoid state neural network with an approach state neural network, and neurons that fire together wire together to create a new more effective network and more effective future responses.

In alignment with the literature, by the individual only briefly experiencing the discomfort of activating the original memory and immediately experiencing the activation of a new rewarding memory, there was a mismatch between what the subject expected and what occurred, based in comparison to earlier and repeated recalls of that original distressing memory. This was the likely prediction error from what the subject had expected to experience immediately after recalling their distressing memory. If applied memory reconsolidation occurred as theorized for humans, through this pairing of opposing emotion states the prediction

error resulted in a dopaminergic response that resulted in a new more valued neural network being formed at the synapse(s) of what was originally the consolidated memory.

Here, the distressing memory trace (CS), sometimes indicated with subjective emotional somatic/interoceptive sensation, whether passively or actively, as an avoid state (CR) was paired with a novel, agreed upon, approach state (CS2), resulting in the reconsolidated CR (Hofman & Hays, 2018; Ecker, 2017). As Ecker (2017) noted, this is a counter-learning experience, that with immediate repetition the reconsolidated CR will be immediate and last over time.

As noted above, dopaminergic activation is where operant and classical conditioning come together. Dopamine firing underlies both classical and operant conditioning memory formations (Baxter & Byrne, 2006). When an outcome is predicted, neurons responsible for dopamine production do not fire, instead there is a reduction in firing (Diederer & Fletcher, 2021). When an unexpected outcome (reward, for example) occurs, dopamine firing increases, thus encoding new learning. The firing pattern increases with subjectively more “physically salient sensory stimuli” and novel stimuli, thought to be because of the potential increased value of one or both to the subject (p. 36).

What was not coded for in this analysis was the repetition component in each transcript’s content as is part of evaluative conditioning (Siedlecka & Denson, 2019; Ecker, 2017, 2012a, 2012b). This would have been a valuable question to answer as a part of this classical conditioning research question. Future researchers should consider surveilling transcripts for this component.

Findings also demonstrated that 100% of the RRT transcripts and the RTM script (if followed) were void of the standard manualized PE treatment techniques (Brown et al., 2019; Peterson et al., 2018; VA, 2017). Specifically, there was no prolonged exposure to their

distressing memories, no systematic desensitization, no psychoeducation about coping or breathing, no narrative for emotion processing, and subjects did not attend eight to twelve 90-minute sessions (Peterson et al., 2018). Instead, in these cases, RRT sessions were conducted in one session and the RTM protocol is completed, generally, in three sessions, demonstrating agreement with Ostacher and Cifu (2019) regarding the risk of pushing for a single gold-standard treatment, especially one that is not eliciting emotional disagreement.

Erasing an individual's emotional responses requires more than just extinction learning where "repeatedly presenting a CS in the absence of the US...results in a reliable decrease in fear responding to the CS due to changes in CS-US expectancy" (McLean & Foa., 2011, p. 1153). As discussed in the findings for theme one of RQ1, dopaminergic firing is required for new learning. When an outcome is predicted, neurons responsible for dopamine production do not fire (Diederer & Fletcher, 2021). Subjects experiencing PE are likely strengthening their existing avoid state networks (Ecker et al. (2012a) and/or creating parallel networks (Yoo et al., 2017), but not likely erasing established and enduring emotional avoid states.

Other emotional approach states were elicited for subjects using metaphors or stories that engaged the subject to look at their original experience through another lens. This indirect exposure seemed to be a way for subjects to remain downregulated so new learning could happen and only after the subject experienced emotional agreement with the new learning experience (story or metaphor) was the emotionally agreeable learning applied to the original target memory. A good example is the story Dr. Connelly used about feeding bread to the duck. The story was a metaphor for the human drive to take action around situations that no longer exist anywhere in space or time, but contextually are called "in the past", which is often perceived as somewhere. Because dopaminergic firing is required for new learning and because

firing is reduced when an outcome is predicted, by using novel and indirect stories such as these, helps to elicit value seeking by the subject and establishes agreement before the application to the subjects originally distressing memory (Diederer & Fletcher, 2021),

These findings point to further agreement with Ostacher and Cifu (2019) that pushing for a gold-standard treatment is risky. As found here, PE is not the best approach, does not follow the neuroscientific understandings for how new learning occurs, and instead could be doing more harm than good. If individuals are only exposed to evidence-based first line treatments and if that treatment is not successful, individuals may miss out on other effective alternative treatments only because there is not an extensive history that documents their effectiveness, as in this case regarding RRT and RTM. PE has a long paper trail but much of its long paper trail was established before there were clear understandings of how brain change occurs, at the neuroscientific level, or ways to apply that knowledge in a therapeutic setting.

Analysis of question one (*RQ1*) also observed the frequency at which humor was used in the RRT session transcripts (14/21). As previously noted, when an experience is appealing, the dopaminergic response at the neural level engages the brain to a thriving state, where not just survival is maintained, but so too is well-being, satisfaction, comfort, and an overall sense of safety, and therefore the facilitation of learning (Rossouw, 2014; Ledoux, 2017; Solms, 2021; Tyng et al., 2017). Schiller et al. (2010) stated that avoid state memories can be permanently modified by integrating neutral, novel, and positive information while the memory is labile. Eliciting laughter in a subject who has originally and persistently experienced emotional distress with the recall of prior distressing and traumatic memory is clearly creating emotional disagreement between what a subject was experiencing and what he or she expected to experience with the memory recall during treatment. Additionally, “Emotion is a particularly

potent way to update memories because synaptic plasticity, which is the molecular basis for encoding memories, is enhanced by the neurotransmitters and hormones (e.g., norepinephrine, cortisol) that are activated by emotional arousal” (Lane, 2020, p. 189). Thus, laughter is the salient reward reported as a required component for successful memory reconsolidation in multiple studies (Keller et al., 2020; Ecker, 2015; Ecker & Bridges, 2020; Treanor et al., 2017; Zyuzina & Balaban, 2017). Pairing humor, an emotional approach state network activation, with an already active emotional avoid state memory network, is a mismatch, or emotional disagreement between what the subject expects and what occurs after reactivation of the network. In these cases, laughter may have been, or at the least, may have contributed to each subject’s emotion state transition from avoidance to approach.

So, how do operant and classical conditioning relate to the neuroscientific understanding of memory consolidation and reconsolidation? The literature points to classical and operant conditioning as necessary components for memory consolidation. The findings regarding research question one demonstrated that pairing and reward were present and likely effective components of this project’s session transcripts that allowed the subjects to recover from their distressing and traumatic experiences. As such, classical and operant conditioning are also likely components for effective memory reconsolidation, which in animal research appears the same as an original consolidated memory network does, but is created at the same synapses where the original memory used to be formed, thus erasing the potential for the previous emotional response state to occur (An et al., 2017; Becker & Kindt, 2017; Ecker 2015, 2017; Ecker & Bridges, 2020; Ecker & Hulley, 2019; Gerlicher et al., 2019; Kalisch et al., 2019; Salinas-Hernández & Duvarci, 2021; Yoo et al., 2017).

Research Question Two

Research question two (*RQ2*), “Is emotion a possible target for successful memory reconsolidation in humans?”, was coded using coding questions two, “Can the paired approach state emotion be described as one that likely elicits emotion in the subject?”, and four, “Can emotion pairing in this transcript be considered the mismatch between what is expected by the subject and what happens, which is required for successful memory reconsolidation?”. A sub-question was, “Do the components of memory reconsolidation according to Elsey et al. (2018) exist in this transcript?”, which are, “original memory reactivation, original memory manipulation (mismatch), time dependency, memory specificity, and dissociation of immediate and delayed effects.”

During analysis research question two (*RQ2*) showed that of the 21 transcripts and the RTM script (if followed as designed), all included the components required for successful memory reconsolidation as required by Elsey et al.’s (2018) guiding theoretical framework. Specifically, each transcript included interactions that included a reactivation of each subject’s original memory, by each subject briefly recalling their original experience. Each transcript included a manipulation of each subject’s original memory (the required mismatch), such that the subject experienced the original event in a new way. Each subject-clinician session occurred within less than six-hours, the reconsolidation window, demonstrating that the time dependency requirement was met. Memory specificity occurred in that each subject’s original memory trace was manipulated. Speculatively, the manipulations were novel to the subjects and were more rewarding emotional responses to the original memory than previously experienced by the subjects. Further discussion, though, will highlight some continued confusion about whether manipulations were cognitive (contextual), emotional, or contextually activating of emotions.

Each interaction also resulted in each subject's dissociation of both immediate and delayed effects surrounding the original memory (based on follow-ups), so that immediate and subsequent reactivations of the original memories were no longer avoid state motivators, as Elliot (2006) described as, "the energization of behavior by, or the direction of behavior away from, negative stimuli (objects, events, possibilities)" (p. 112). The changes noted were not demonstrative of will power, but instead, effortless permanence, as termed by Ecker (2017), or automatic and reflexive, the same as Pavlov's dog's salivation (Pavlov, 1928; Apkan, 2020). Effortless permanence is indicated when the subject no longer has avoidant reactions and no longer uses or needs coping mechanisms when exposed to the original memory cues.

What was not coded for in answering research question number two (*RQ2*) was whether each subject's recall (reactivation) was contextual, emotional, just the belief surrounding the original experience, or something else. Such information could offer more toward understanding the level of activation each subject experienced physiologically, although contextually, each transcript as written indicates there was only a brief discussion about the original event. Many studies noted that a reactivation only needs to be brief (Thomas et al., 2017; Elsey et al., 2018; Treanor et al., 2017), and were in these cases, so were not likely overly emotional for subjects to briefly recall.

As previously mentioned, confusion remains regarding each subject's memory manipulation; was the mismatch experience cognitive (contextual), emotional, or contextually activating of emotions? As defined here, emotion is an electrochemical signal that motivates a subject to take an action to approach or avoid based on value to the subject (Lange et al., 2020; Wasserman & Wasserman, 2020; Miller, 2018; Moors, 2021; Reeve, 2018; Lane, 2020). If the definition for emotion stands as defined here, the answer is that reactivations and manipulations

were both emotional whether the emotion was initially elicited through contextual content or not. The result of contextual content was an emotional approach or avoid state activation.

While the results demonstrated that all the requirements were met, the successful application of memory reconsolidation at the neural level can only be inferred. Elsey et al. (2018) asserts that all parts are necessary and because neural level change cannot be seen, I can only theorize that a neural change occurred. Walker et al. (2003) similarly described in his finger tapping studies with humans, that results could only be considered ‘inferred memory reconsolidation’ in humans.

Observations regarding research question two (*RQ2*) illuminated that only the RTM script used a numerical SUDS score to measure for change in subjects (Gray et al., 2021). While RRT sessions did not involve the use of a numerical measure such as a SUDS score, every RRT session transcript did include a measure of some sort. Each measure resulted in disclosure by the subject of what can be described as an improvement over their originally reported baseline measure. Each subject reported original and subsequent feeling words, an abstract image shift, or a change in their somatic sensations from what was originally reported.

While not directly related to the discussion about on pre- and post-treatment measures, the shift away from reflexive emotional avoid states, where recall of the events no longer elicits a FFFF response, and to an achievable, reflexive, and permanent approach state, indicates that new learning occurred. Each pre- and post-treatment measure change showed a transition from an original emotional avoid state to an emotional approach state. This change indicates that there was not prolonged exposure, which upregulates the body’s HPA Axis (FFFF response) to the point where effective approach state learning cannot easily occur (Ecker et al., 2012a, 2012b; Elsey et al., 2018). Being able to access approach state content, such as butterflies, flowers, and

abstract images, which represent an intended outcome might have been more difficult for each individual if they were experiencing upregulated FFFF responses. And while there was not a single scale used as a measure, each subject was able to report an improvement and their internal measure does and should carry more weight than what can be recorded as an external observer.

Ledoux (2020a) stated that labels for emotions, such as “scared” or “excited”, are subjective terms that indicate value driven behavior, or motivation. He also noted that, while not generally contextually accurate when subjects describe how they felt during past events, the labels a subject gives to an experience often also influence the valence and salience of how that subject is experiencing a current situation. That being said, each subject’s self-reported improvements may have also been an influencing factor in their improved emotional post-treatment state, merely because each subject labeled his or her end state in some manner.

Research question two (*RQ2*) analysis also highlighted that emotion pairing, as defined in this project, did indeed occur in each transcript. As discussed previously, some paired emotional approach states were activated from prior experiences, and some were suggested by the RRT clinician. Each approach stated is speculated to be emotional in alignment with this project’s definition for emotion. Interestingly though, the RTM script may potentially activate less emotionally charged, more neutral, mismatches between what was predicted by the subject and what occurred after the event was recalled. Perhaps a neutral reactivation has some effect on a memory reconsolidating event and perhaps the salience (noticeability) and valence (emotional value) play a role in the success or failure of the applied memory reconsolidation experience. Schiller et al. (2010) stated permanent modification of avoid state memories can occur by integrating neutral, novel, and positive information while the memory is labile and Lane (2020) stated that, “Emotion is a particularly potent way to update memories because synaptic plasticity,

which is the molecular basis for encoding memories, is enhanced by the neurotransmitters and hormones (e.g., norepinephrine, cortisol) that are activated by emotional arousal” (p. 189). In addressing future research regarding salience and valence, I will discuss considerations for this area, but any emotional avoidance states should be downregulated in order to maintain learning capabilities for each subject (Diederer & Fletcher, 2021).

So, to answer the question, is emotion a possible target for successful memory reconsolidation in humans? The answer is yes. Emotion is a possible target; however, the results are not conclusive enough to say emotion is *the* target for creating a mismatch. This project involved too many variables, to be sure, but my suggestions for future research below will provide some considerations for controlling for some of those variables.

And while there are multiple variables to consider in understanding the application of neuroscientifically founded memory reconsolidation protocols to human subjects, some ambiguities may be removed by understanding more about emotion in animals. Memory reconsolidation has been empirically observed in animal studies on multiple occasions (Carew et al., 1981; Carew et al., 1983; Eisenberg et al., 2003; Hawkins et al., 1983; Nader et al., 2000b; Pedreira et al., 2002; Sara, 2000; Debiec et al., 2002; Debiec et al., 2006). From a biological standpoint, like humans, animals have approach and avoid states that motivate them to take action, as in approaching food (Harmon-Jones & Harmon-Jones, 2021). Unlike humans, to animals, context does not matter. There is no evidence that animals form beliefs or other contextual cognitive perspectives that drive their actions to approach or avoid. Humans have a highly developed cortex that creates meaning, reason, belief, and other cognitions that result in the creation of internal stimuli that motivates a human toward value directed emotional responses; approach or avoid states. Taking this knowledge into consideration, if memory

reconsolidation can take place in animal research, context (cognitions), cannot be the mismatch target, leaving emotion the likely mismatch target, again.

Research Question Three

Question three (*RQ3*), “How successful is emotion pairing alone at reducing discomfort from trauma cues?” was analyzed using coding questions three, four, and five, “Does the transcript subject note an initial and a subsequent SUDS rating and/or an initial somatic sensation that subsequently changes?” (With sub-question, “Can the noted changes be described as avoid states that transitioned to approach states?”), “Can emotion pairing in this transcript be considered the mismatch between what is expected by the subject and what happens, which is required for successful memory reconsolidation?” (With the sub-question, “Do the components of memory reconsolidation according to Elsey et al. (2018) exist in this transcript?” [discussed above]), and “Is there a follow-up interview?” (and “What is the subject’s status at follow-up?” and “What is the time span between initial session and follow-up?”).

As mentioned above, emotion pairing, as defined in this project, did occur in each transcript. Some approach state pairings were prompted when subjects were asked to recall experiences from the subject’s prior approach state memories. Although some of the recalled approach state memories had nothing to do contextually with the original memories, the contextual or emotional information shared about those events was applied to the original event as a different way of looking at, feeling about, or believing about the original memories, thus the manipulation still meets the theoretical framework laid out by Elsey et al. (2018) of original memory manipulation.

Yoo et al. (2017) and Ecker (2015) both stated that reconsolidating experiences, if too dissimilar from the original experience will not lead to destabilization of the originally stored

network. Some subjects in the RRT transcripts were prompted to recall and describe a beautiful place they had previously been to, and they then were prompted to describe the best parts of that experience. Although after recalling that beautiful place, which was contextually unrelated to the original distressing memory, the two memories were integrated in a contextual verbal interaction in the transcripts. This interaction was a clear network firing, while another network had also been reactivated (Hebb, 1949), suggestive of pairing. Based on the subject's description, there was clearly an elicited emotional approach state response by the subjects as a result of that reactivation. Therefore, I can speculate that the interaction was an emotional approach state pairing with an original avoid state, which was a likely mismatch target so that the emotional avoid state could transition to a reconsolidated emotional approach state.

The above description addresses the emotion pairing aspects, but other parts of that exercise likely emotionally contributed to a positive outcome for those subjects. The subjects recalled their beautiful place, or approach state, and they were not then asked to feel the same way about their original experiences as they did that beautiful place. Instead, the recall was sometimes used to help a subject recognize they can still recall such beauty even after a distressing event or trauma. They also just had an experience that potentially taught them how to accomplish that redirect from an emotion avoid state to an approach state, just by recalling the event right after reactivating their original avoid state memory. I speculate this mismatch was quite relieving, dopaminergic, in comparison to earlier reactivations of the distressing memories. Contextually, that treatment interaction may have changed how the subjects were able to see themselves in relation to their original distressing event; that they were safe and had survived. Such a realization was likely quite a rewarding mismatch. Regardless the message that resulted from the pairing, the subjects experienced a mismatch between what was expected and what

occurred, but likely an emotional disagreement, and if applied memory reconsolidation requirements were met, the interaction likely resulted in an implicitly encoded value driven approach state network that would respond reflexively and without any FFFF reaction.

While emotion pairing did occur in each session, there were undoubtedly many variables, like context, that could be considered a target for mismatch and the cause for a subject's improvement. For instance, hypnosis or guided meditations were used in 15 of the 21 RRT sessions. Because hypnosis and guided meditation are, by design, intended to downregulate the brain, an emotional approach state, it is not a stretch to speculate again that the correct target for pairing is emotion, not the preceding context.

Analysis also illustrated that each RRT session included a follow-up interaction. RRT follow-up interactions were often short and vague, but each subject did indicate that they were no longer experiencing discomfort specific to their original memory. The follow-up status each subject reported indicated that each subject experienced dissociation of immediate and delayed effects, the final requirement for successful memory reconsolidation according to Elsey et al. (2018). RRT follow-up interactions occurred from three months to seven and a half years post-treatment. While this project did not establish expectations regarding the necessary amount of time that should pass between pre- and post-treatment, I establish here that what matters most is that each subject can report there are no further avoidant responses necessary when reactivating the original distressing event and the need for any prior or new coping mechanisms with that memory are also unnecessary.

RTM sessions generally involve two follow-up sessions. Sessions occur one week and two weeks later and the protocol is repeated as designed and is focused, generally, on the same event as is the focus of session one (Gray et al., 2021). Each session, when effective, should

result in each subject's reported SUDS score trending downward and the final PSSI-5 assessment scores falling lower than pre-test scores and below the cut-off score that indicates a diagnosis of PTSD (< 20).

So, how successful is emotion pairing alone at reducing discomfort from trauma cues?

There is not enough information in this study to answer the question, except to say, as above, that emotion pairing did occur in each session transcript. Unfortunately, because the target for mismatch was not unmistakably emotion, the variables must be considered, however, this project also offers a strong argument, both from the literature review and this projects research findings, which continued research on emotion pairing has value to patients and society.

Changes to Limitations and Delimitations

There is little to change in the way of limitations and delimitations. There is still no direct physical evidence that the neural network changes that define memory reconsolidation occurred as a result of these emotion pairings. Instead, only an assumption remains, as does the assumption that emotion was manipulated, not just cognitions or context, or that some other phenomenon was also not present. Inferences based on the definitions for emotion used in this project can only lead to speculations about each subject's target for change, although, according to the definition of emotion as outlined here, emotion was the target. However, many experiences (including mental cognitions) can elicit emotional responses and not enough is understood about consciousness to assuredly separate the two to be clear that emotion is the mismatch target, rather than a preceding cognition or belief that, until unlocked, holds the key to an emotional approach state activation.

Implications for Professional Practice

If the goal of therapy is to treat individuals who are continually reliving their distressing events, these findings offer some validation that prolonged exposure therapy should not be the first-line treatment and that other new and alternative treatment approaches may be more effective and less distressing. Additionally, the APA and VA perpetuating the impression that there are only two or three main ways of treating trauma and anxiety is constraining, as there are vast treatment modalities that show promise. Furthermore, such as the VA (and other regulating entities) refusing to pay for treatments because they may not align with their evidence-based-only policies, requires veterans to continue to suffer or find funding outside the benefits they expected to receive in exchange for their enlistment sacrifice and must also sacrifice their own abilities to choose what works best for each of them as individuals.

Ultimately, this research also indicates that talk therapy does not necessarily need to involve endless hours of verbal interactions around the context of an original traumatic or distressing experience. Instead, activating other emotional states once the original memory network has been reactivated may be enough to cause the necessary prediction error for successful applied memory reconsolidation. This agrees with the Hebbian Principal that neurons that fire together do wire together and results in the development of associative learning networks through merely pairing the firing of electrochemically charged networks (Hebb, 1949; Pavlov, 1928). Additionally, considering that emotion, as defined here, is a component of an original established memory that implicitly engages motivation toward a stimulus or away from it and that cognition is not necessary, then original memory manipulation can likely involve only emotional manipulation (Else et al., 2018).

Emotional learning is not unidirectional. Just as Pavlov's dog learned to reflexively salivate to a bell through pairing and trauma survivors reflexively react using FFFF responses to associative trauma cues, so to can trauma survivors experience the conditioning of new rewarding responses to those associative cues. As observed in the session transcripts, approach states can transition from avoid states with "compelling power and speed" and humans do possess the ability for "adaptive generalization of the raw data of perception and emotion," bidirectionally (Ecker et al., 2012a, p. 202).

Using emotion pairing, psychotherapy sessions may be more rewarding for both patients and clinicians and may even help to reduce mental health stigma overall. This project offers hope and potentially reassurance to the mentally distressed and traumatized public that by using emotion pairing, the mental turmoil that results from traumatic and distressing events may be treated rapidly and without having to repeatedly relive those avoid state events. The same is true for clinicians who offer treatment for those individuals, that they also may experience less vicarious trauma.

Recommendations for Research

These results point to the need for further exploration of new and alternative treatments by unbiased entities and individuals. I recommend that clinicians consider the benefits of understanding the neuroscience that underlies brains under stress and what is required for brains to effectively change, improving the lives of their patients and clients. Doing so will increase the potential for change for individuals who continually relive their distressing experiences unnecessarily. When a psychologist understands what to watch for and avoid in their patients, so that new emotional learning can happen, treatment can occur more quickly and effectively. This

project informs the value of exploring and considering alternative treatments, regardless of the lack of a lengthy paper trail.

Due to the variability of descriptors for somatic awareness, feeling words, and descriptors for emotional responses between individuals, future researchers may benefit from reducing baseline and post-treatment measures to either avoid or approach states. Doing so may limit the inaccuracies that can result from the vast number of variables. One may easily determine an individual's improvement from 'sad' to 'happy,' but from 'scared' to 'feeling better' does not indicate how much better a subject feels in any measurable fashion. Using psychoeducation about this project's definitions for emotional approach and avoid state motivations with subjects and asking each only to indicate their pre- and post-treatment avoid or approach states may limit some of the possible variables.

Ecker (2015) stated that for memory reconsolidation to be successful there must be relativity between the original memory and the mismatch experience. Specifically, mismatch relativity requires, "that experience B is a mismatch of expected experience A if B resembles A enough to register as a reminder and repetition of A, while also containing saliently discrepant or novel features relative to those of A" (p. 19). The emotion pairing events in these transcripts demonstrated that at times the clinician seemed to be helping the subjects learn *how* to feel about their original event instead. While some content was contextual, such as eliciting contextual disagreement about person, place, time space, location, or distance, the disagreements still likely resulted in emotional approach state responses, or dopaminergic network forming responses. To limit any confusion, fine tuning the mismatch target should be a primary focus for future research.

This discussion brought to light a consideration for future research; that RTM offers a more neutral pairing of emotion states and RRT offers more of an approach state pairing. Comparing the difference between the two might be beneficial as RTM does contain some indirect exposure techniques and generally less emotional charge. This research may be valuable in understanding more about what techniques are useful and which are not when seeking successful applied memory reconsolidation. For instance, Ecker (2015) reported that emotional arousal is not required for erasure of the original memory. Again, as defined here, emotion is an electrochemical signal that motivates a subject to take an action to approach or avoid based on value to the subject (Lange et al., 2020; Wasserman & Wasserman, 2020; Miller, 2018; Moors, 2021; Reeve, 2018). Reactivation and manipulation of the original memory trace is required for memory reconsolidation to occur and network change is a result of electrochemical changes at the synaptic level (Bazzari & Parri, 2019; Harmon-Jones & Harmon-Jones, 2021; Langille & Brown, 2018; Solms, 2021; Ledoux, 2017; Bach & Dayan, 2017; Solms, 2021; Krawczyk et al., 2021; Ledoux, 2020b; Bach & Dayan, 2017; Okur Güney et al., 2019). Lane (2020), wrote, “Emotion is a particularly potent way to update memories because synaptic plasticity, which is the molecular basis for encoding memories, is enhanced by the neurotransmitters and hormones (e.g., norepinephrine, cortisol) that are activated by emotional arousal” (p. 189). That being said, research should answer, is it possible that greater emotional arousal creates more electrochemical activity at the level of the synapse so may be more effective for original memory manipulation than pairing with only a neutral stimulus? And for clarity, the word ‘arousal’ should also be clearly defined. Is network activation or reactivation of emotional arousal enough, or must there be an activation of more charged emotional states, as RRT appears to do in comparison with RTM? And if the intensity of approach state pairing is more effective, would having a clinician

that is skilled in eliciting strong emotional approach state responses in their patients improve patient outcomes?

Some additional topics should also be considered with applied memory reconsolidation research. For instance, Alexithymia and Alexisomia are both topics addressed in this study and should be included in future studies. Aphantasia should also be considered, as not being able to visualize some of the mental imagery used to elicit emotions could be a barrier to success for memory reconsolidation studies. As mentioned above, analysis regarding repetition in applied memory reconsolidation cases could also be beneficial. By understanding how much repetition is necessary for reconsolidation to occur, barriers can be removed, and psychotherapy can become just that much more effective and rapid.

A memory network is created to ensure organisms are energized and directed toward value; appetite or aversion, particularly for survival and safety (Elliot 2006, 2008; Elliot et al., 2001; Elliot et al., 2013; Lange et al., 2020, Lane, 2020). There are so many questions to answer regarding what is most rapid and effective for treatments, but I continue to assert that successful memory reconsolidation can be accomplished through emotion pairing, even without context, and I continue to speculate that contextual content is merely the springboard toward eliciting emotional responses that can engage a subject toward more valued approach state responses. Exploration of this phenomenon should continue, specifically around non-context related emotion pairing and in understanding how somatic awareness contributes to the salience and valence for which an individual experiences their emotional approach and avoid states.

Considering the above research content of this project, my future research may involve a study where subjects are asked to report and describe the somatic sensations they experience while using a word, chosen from a list of words known to cause some individuals discomfort, an

avoid state reactivation. Then each subject will be asked to recall a memory that also reactivates an already present approach state memory and the somatic sensations that arise with its recall. Then the subjects will be asked to imagine their avoid state memory as having their approach state memory's somatic sensation (manipulation). The subjects will be asked to imaginably pair those emotional approach and avoid states, somatically, until the approach state overtakes the avoid state. If the avoid state sensation cannot be recreated after the pairing experience, I would speculate that a mismatch occurred (immediate effect). If at follow-up the subject is again unable to recreate the original avoid state sensation (delayed effects), I would then speculate that memory reconsolidation can be inferred and that it applied memory reconsolidation occurred through emotion pairing.

Conclusions

In conclusion, there is vast evidence that operant and classical conditioning result in memory consolidation and that both contribute to memory reconsolidation in humans can be reliably speculated as well, that a new network results. Emotional learning is the outcome when the original or reconsolidated network results in the “energization of behavior by, or the direction of behavior” toward positive and away from negative stimuli (Monni et al., 2020) and this procedural memory becomes the rule for future responses. Reconsolidating a distressing or traumatic memory requires that an individual breaks the electrochemically encoded procedural rules that were designed to ensure safety and survival, through avoidance (FFFF). When that network no longer serves the purpose of keeping an individual safe, especially from perceived threats, an individual must learn to disagree with his or her prior emotional learnings (implicit or explicit). Because emotional approach state interactions enhance learning, helping patients maintain a downregulated state can only improve the chances of reconsolidating, or rewiring the

brain to a more effective approach state. Whether successful reconsolidation is achieved through emotion pairing, as speculated, or reconsolidation is achieved by some other manner, the world will be a better place when humans are no longer stuck implicitly and reflexively responding to events that no longer exist. The same is true when the mental health system is cleared of the often upregulating, pathologizing, stigmatizing, and time hungry approaches that can interfere with continuity of care. Too many treatment approaches do not account for an individual's experiences that might normalize, first, why that individual's networks originally served a purpose, before helping them find the emotional disagreement for that network to rewire to another more effective network.

Ultimately, distressing and traumatic memories are stored in the limbic system (the emotion center for the brain), which is the home to the amygdala and hippocampus, where approach state and avoid state motivators are sourced. Because reactivation of those memories is required, one cannot get a distressing memory out of the limbic system without using it. This means emotion is required for rewiring, but this project, while still unclear about direct non-contextual emotion pairing outcomes, has identified that there are rapid ways that emotional avoid state networks can be changed without repeatedly reliving an overwhelming emotional memory.

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APPENDIX A

3/1/23, 5:23 PM

Mail - Mary Bowles - Outlook

Re: FW: Info

Charles Brooks <Charles.Brooks@my.calsouthern.edu>

Wed 3/1/2023 3:38 PM

To: Mary Bowles <Mary.Bowles@mycalsouthern.onmicrosoft.com>

Ms. Bowles: Congratulations on achieving IRB approval. Below is the important information.

IRB # 010323 - 89434 date of issuance 3/1/2023

Your approval will expire 1 year from the date of issuance, after which you will need to apply for an extension to continue collecting data.

In keeping with regulatory requirements, notify the IRB should there be any changes to the proposed research. Approval would be necessary from the IRB for all modifications. As a reminder, please submit the completion form for processing when done.



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