

DISTINCT BUT LINKED:
HOW FRIENDSHIPS CONTRIBUTE TO PERSONAL GROWTH
THROUGH THE LENS OF INTERPERSONAL NEUROBIOLOGY

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ABSTRACT

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The purpose of this study was to integrate diverse fields of thought to demonstrate how friendships uniquely promote personal growth through the lens of interpersonal neurobiology (IPNB). This study utilized quantitative methodology with a cross-sectional survey from the third wave of Midlife in the United States (MIDUS 3) to investigate whether neural and social integration mediated the effects between friendship and personal growth. Friendships were shown to contribute meaningfully to personal growth above and beyond the role of intrapersonal factors, as supported through a hierarchical linear regression. Also, the influence of friendships on personal growth was partially mediated through neural and social integration, as revealed through a parallel mediation model using the PROCESS syntax. Results from these analyses supported all research hypotheses and indicate that friendships contribute to personal growth through both neural and social integration.

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CHAPTER 1

INTRODUCTION

The excellent person is related to his friend in the same way he is related to himself, since the friend is another self.

--Aristotle

Aristotle had a lot to say about friendship. Between two of his most famous works, *Nicomachean Ethics* and *Eudemian Ethics*, almost one-fourth of his writings were on the topic of friendship (Stern-Gillet, 1995). As one of the most influential thinkers in history, his contributions to Western thought are so significant that he is called the father of logic, scientific method, psychology, biology, individualism, and political science – just to name a few. Considering his vast areas of expertise as a philosopher and polymath, Aristotle’s disproportionate focus on friendship might seem confusing at first—perhaps just as confusing as the meaning behind, “the friend is another self.” Despite his precedence, friendship remains one of the most understudied and least understood personal relationships in scholarly literature. In the book *Aristotle’s Philosophy on Friendship*, Suzanne Stern-Gillet (1995) highlighted the 2,000-year gap between Aristotle’s writings and modern scholarship on friendship: “Friendship thus remained in a penumbra, traditionally considered to be a philosophical topic in virtue of the ancients’ interests in the matter, yet rarely since systematically explored” (Stern-Gillet, 1995, p. 3). In this dissertation, I will attempt to integrate both by combining philosophy and scientific research to illuminate the significance of modern-day friendship and how a friend could be considered “another self.”

Throughout history, scholarly attention to the relationships between friends has been negligible compared to family relationships; however, researchers predict that cultural and

societal changes will bring about a newfound need and appreciation for friendship, particularly friendship in adulthood (Blieszner et al., 2019; Merz & Huxhold, 2010; Watt et al., 2014). Due to longer life expectancies, decreasing fertility rates, smaller family sizes, and an increase in geographic mobility, the social relationships of older adults are increasingly centered around friendship, rather than family relationships (Fiori et al., 2020). Potentially, the relative paucity of friendship research compared to research on family relationships is due to researchers' difficulty in defining friendship (Langkamp, 2020). For instance, family relationships often involve specific biological, cultural, and legal components while friendship is much more elusive. Further, friendships can exist throughout one's lifetime, while relationships with family members—like one's parents, spouse, or children—vary depending on life stage. In addition to their relative significance throughout the lifespan, the disparity between the scholarly literature on friendship comes in sharp contrast to the importance of friendship in Aristotelian philosophy. As evidenced by the long gap in friendship scholarship, friendship, as a topic of research, seems much more amenable to be studied philosophically rather than scientifically.

Fortunately, the field of marriage and family therapy (MFT) provides precedent in integrating different points of view to understand human relationships. MFT, a discipline developed from psychotherapy and family systems, is based upon the notion that people develop, learn, and grow in relationships. Decades of research support this approach, as the therapeutic relationship is often credited to be the most influential factor of therapeutic change regardless of modality (Blow et al., 2007; Blow & Karam, 2017; Blow & Sprenkle, 2001; D'Aniello & Fife, 2020; Norcross & Wampold, 2011). Despite what its name suggests, MFT clinicians are not limited to working with only couples or families. In fact, about half of the clients seen by marriage and family therapists are individuals. What distinguishes MFT from other mental health

fields is that MFT acknowledges the systemic nature of human functioning and the power of relationships as agents of change. While the focus has been predominantly on familial relationships, the rising culture of individualism, the decline of traditional communities, and the continuous evolution of families signal a shift in the growing significance of close friendship in adulthood. Many MFT theories offer helpful frameworks for understanding interpersonal relationships, however, they generally describe romantic and familial relationships.

Interpersonal neurobiology (IPNB), a field pioneered by Dan Siegel, Alan Schore, and Louis Cozolino, utilizes a consilient approach to scientific research to provide extensive insights into the neural processes involved in one's closest relationships as well as their wider social groups (Siegel, 2001; Siegel et al., 2021). Based on E. O. Wilson's notion of consilience, IPNB cuts through the cacophony of the different theoretical, scientific, and scholarly knowledge and condenses them down to their unifying truths (Wilson, 1998). Connecting findings from neuroscience, biology, psychology, and physics, the field of IPNB offers an accessible and empirical framework from which MFT researchers and practitioners can understand friendship and personal growth in their work. Personal growth, or what Aristotle referred to as eudaimonia, refers to the consistent striving towards learning, growing, and improving as a person (D. S. Lee et al., 2018).

As mental health professionals, understanding the relative influence that friendship can have on a client's personal growth is essential – especially since friendship is the only relationship that can last throughout the life span. Friendships, especially adult friendships, are often ignored in MFT research despite the importance of these relationships throughout the lifespan. Many studies from other fields have indicated that friendship, compared to family relationships, promote better mental and physical health outcomes (Allan, 2008; Cleary et al.,

2018; Dunbar, 2018; Lecce et al., 2019; Pahl & Pevalin, 2005). This study combines diverse fields of thought including IPNB, MFT, and philosophy to help MFT clinicians and researchers understand the importance of friendship in adulthood.

Statement of the Problem

For MFT professionals in the United States, their systemic views of health and well-being often come in stark contrast with the individualistic approach of Western culture; however, as research in the field of IPNB continues to reveal, personal growth is a relational process—one that is not confined to just marital or familial relationships. To progress and evolve in an ever-changing culture, MFT researchers and clinicians must recognize the steady yet vital role of friendship in the lives of their adult clients, as well as the valuable and pertinent insights available from IPNB.

Theoretical Perspective

IPNB is an interdisciplinary theory that consolidates information from diverse fields of knowledge, including neuroscience and psychotherapy, and provides an accessible framework from which clinicians can apply concepts from neuroscience into their practice with individuals, groups, couples, and families (Siegel, 2001, 2019). In a recent book, *Interpersonal Neurobiology and Clinical Practice*, Dan Siegel described the main principles of IPNB: linking peer-reviewed empirical research from diverse disciplines to understand mental health, acknowledging the importance of relationships in mental health, understanding the connection between what happens in one's relationships and what happens inside of one's body and brain, recognizing the neuroscience behind the processes of the mind, and utilizing a consilient approach to explore life in new ways (Siegel et al., 2021). This study will use a consilient approach to understand the role of friendships in adulthood.

At its core, IPNB proposes that the human experience can be explained through the bidirectional influences between mind, brain, and relationships – what Siegel (2001) called the “triangle of well-being.” According to IPNB, a mutually engaging interpersonal connection can activate, strengthen, and connect diverse neural circuits, providing balance and integration within the brain. In other words, emotionally significant relationships play a powerful role in shaping the brain, and therefore, the mind. In this way, healthy adulthood friendships contribute to personal growth.

Purpose of the Study

The purpose of this study is to integrate different fields of knowledge to demonstrate how friendships promote personal growth. Personal growth is conventionally linked to intrapersonal rather than interpersonal factors in Western cultures (Bauer et al., 2019; Çankaya et al., 2017; Toyama et al., 2020; van Woerkom & Meyers, 2019; Weigold et al., 2013); however, an abundance of studies from diverse fields of research consistently endorse the significance of interpersonal relationships on healthy human functioning. This study provides a thorough and comprehensive view of friendship through both philosophical and scientific literature and explores how friendship in adulthood contributes to personal growth.

Research Hypotheses

1. Friendships are significantly associated with personal growth, while controlling for self-esteem, mental health, education, age, and sex.
2. Neural integration mediates the relationship between friendship and personal growth while controlling for self-esteem, mental health, education, age, and sex.
3. Social integration mediates the relationship between friendship and personal growth, while controlling for self-esteem, mental health, education, age, and sex.

Significance of Study

The significance of this research is its contribution towards integrating various fields of study including neuroscience and family therapy, and the incorporation of friendships in MFT research. Traditionally, MFT literature is centered around couple relationships, parent-child relationships, nuclear or blended families, or intergenerational family processes, with few studies addressing the interpersonal dynamics within friendships. Further, within the friendship literature, most existing studies explore friendship processes in childhood and adolescence rather than adulthood. Finally, this study contributes crucial cross-disciplinarian overlap to the field of MFT by incorporating the concepts of interpersonal neurobiology, which aligns with the current needs and goals of the MFT profession (Celano, 2013; Lebow, 2014a; Wampler et al., 2019). As MFT professionals continue to navigate an increasingly diverse and complex clientele, it is crucial that they broaden their repertoire to account for cultural and technological advances.

Definitions

1. *Brain* – the embodied mechanism of the energy and information flow within the body; refers to both the skull-based brain and the extended nervous system throughout the human body (Siegel, 2001).
2. *Mind* – the inner subjective experience of awareness and consciousness; a process that regulates the flow of energy and information within the brain and within relationships (Siegel, 2001).
3. *Relationships* – the people or groups of people with which an individual shares energy and information (Siegel, 2001).
4. *Friendship* – a volitional relationship between two individuals that is characterized by authenticity, mutuality, and positivity (Langkamp, 2020).

5. *Integration* - the linking of differentiated parts of a system, creating a more optimally functioning whole (Siegel, 2001).
6. *Neural Integration* - the process of linking differentiated neural networks within the brain, thus promoting emotion regulation, cognitive flexibility, and resilience (Siegel, 2001).
7. *Social Integration* - the sense of belonging, compassion, and social optimism that occurs as a result of an individual's repeated positive connections and interactions with other people (Siegel, 2001).
8. *Personal Growth* - the consistent striving towards learning, growing, and improving as a person (D. S. Lee et al., 2018).

Summary

Western culture has historically promoted the ideas of individualism, logic, and autonomy over connection, compassion, and cooperation; however, findings from various scientific disciplines, including MFT and IPNB, consistently reveal the necessity of social relationships in healthy human development and functioning. The holistic views of human functioning stem back to Ludwig von Bertalanffy's work on general systems theory. Of course, von Bertalanffy did not discover the existence of systems, but rather that this perspective was noticeably missing from current scientific knowledge. In an article describing the history and status of his "systems approach," von Bertalanffy explains:

Aristotle's statement, "The whole is more than the sum of its parts," is a definition of the basic system problem which is still valid. Aristotelian teleology was eliminated in the later development of Western science, but the problems contained in it, such as the order

and goal-directedness of living systems, were negated and by-passed rather than solved.

Hence, the basic system is still not obsolete (1972, p. 407).

Despite 2,000 years of technological advancement, Western science cannot fully explain the distinct phenomena of human friendships; however, the comprehensive approach of IPNB can help close some of the gaps. By zooming out to include other fields of knowledge, understanding the role of friendship in personal growth becomes a process of synthesizing disparate and fragmented knowledge and combining it to create a greater whole. To fully embrace a systemic approach to knowledge, this study extends the scope of exploration beyond theoretical and empirical research by incorporating relevant concepts from other fields of knowledge to find consilient patterns. The overarching themes of balance, harmony, and unity to provide a guiding framework to understand the role of friendships in personal growth.

CHAPTER II

LITERATURE REVIEW

If you would understand anything, observe its beginning and development.

---Aristotle

From its inception, the field of MFT has bridged the divide between seemingly opposing perspectives to provide a more synergistic understanding of human functioning. This holistic approach posits that when each part of a system is specialized for a distinct function, the system can progress more quickly together than if each part had to function in every capacity. While MFT research primarily addresses couple and familial relationships, understanding friendships requires integration from other fields of thought. Adult friendship is relatively ignored in the scholarly literature, likely due to the difficulty researchers face to define and measure it. Through the consilient framework of IPNB, this study weaves together information from science, philosophy, art, and literature to provide a more holistic understanding of adult friendship and its role in personal growth.

This literature review is organized by three overarching themes: balance, harmony, and unity. The first section addresses the balance between the intrapersonal and interpersonal factors of growth. I explain the increasing importance of friendship in adulthood to balance global trends towards individualism. The second section emphasizes the role of harmony within a system and explains how IPNB can be used to understand the influences between the mind, the brain, and relationships. Through the lens of IPNB, friends facilitate neural integration by being both distinct and linked. The last section on unity reflects the systemic foundation of both IPNB and MFT, and explains how friendships promote social integration.

Balance

This section addresses the extent to which one's relationships with friends, in addition to their individual characteristics, contributes to personal growth. First, it is worthwhile to consider the historical background of the term *friendship* and how it has morphed into what people now experience as modern-day friendship. Predating Aristotle, Greek mathematician and the first self-proclaimed philosopher Pythagoras is credited with developing the idea of friendship (Guthrie, 1988). Pythagoras promoted friendship "of all things towards all," which applied to more than just peer relationships, but also extended to friendship between husband and wife, between animals and humans, between what's rational and irrational, and between body and soul (Guthrie, 1988, p. 73). Just as the definition of friendship rests in the balance between nebulous philosophical concepts and a more practical, measurable science, Pythagoras's teachings brilliantly combined wisdom from both nature and philosophy, simplifying the infinite possibilities of the universe down to its simplest form. About friendship, he articulated, "Friendship is equality; equality is friendship" (Guthrie, 1988, p. 97). The meaning behind Pythagoras's teachings, like much of philosophy, is intentionally ambiguous and obscured, inviting both contemplation and connection with the natural world. In the following sections, I will review the current literature on individual and relational factors in personal growth, describe friendships in adulthood, and explain how current cultural, social, and global trends indicate the increasing importance of research on adult friendships.

Individual Versus Relational Factors and Personal Growth

Despite its prevalence in Greek philosophy, the importance of friendships is often ignored in scholarly literature. Currently, most theories of personal development continue to perpetuate the Western myth of individual achievement, despite philosophical ideals and

contemporary empirical research suggesting otherwise (Compton, 2018; Maslow, 1971; Schwarzer & Taubert, 2002; Toyama et al., 2020; Ugur et al., 2015; van Woerkom & Meyers, 2019). Personal growth, sometimes referred to as eudaimonia, thriving, or flourishing within the literature, is defined as the consistent striving towards learning, growing, and improving as a person (D. S. Lee et al., 2018). Previous research indicates that personal growth tends to decline with age (Ryff & Singer, 2008); however, studies consistently endorse the positive influence of relationships to reverse this trend (Jakubiak & Feeney, 2016; D. S. Lee et al., 2018; D. S. Lee & Ybarra, 2017; Toyama et al., 2020). Understanding relationship needs for older adults will become increasingly relevant, as the aging population will reach a new milestone in 2034, in which adults over 65 will outnumber children 18 years old and younger (Vespa et al., 2020).

Previous researchers have investigated factors that contribute to personal growth in adulthood, finding evidence for the influence of both individual and interpersonal factors. Past studies have emphasized the role of self-esteem in personal growth; however, confusion remains as to whether self-esteem is a cause or a consequence of social support (Ali Yıldız & Karadaş, 2017; Kinnunen et al., 2008; Marshall et al., 2014). For example, D. S. Lee et al. (2018) proposed that social support leads to personal growth through its influence on self-confidence. Related individual factors linked to personal growth include self-efficacy (Çankaya et al., 2017; Karademas, 2006), self-awareness (Ugur et al., 2015), willpower (Quirin et al., 2021) and focusing on one's strengths (van Woerkom & Meyers, 2019). The impact of these personal characteristics is undeniable, but do not fully account for the dynamic and perpetual process of personal growth.

Factors of Personal Growth

Although the term personal growth can encompass a wide range of concepts, including psychological recovery, redemption (Bauer et al., 2019), or a specific mindset (Dweck, 2008), this study measures personal growth through Ryff's model of psychological well-being (Ryff, 2013; Ryff & Keyes, 1995; Ryff & Singer, 2008). To put it succinctly, the pursuit of personal growth is rooted in the development of three factors: the capacity to take on challenges, the willingness to learn new things, and the disposition towards an open mindset.

Take on Challenges. To achieve personal growth, one must feel confident in their ability to overcome obstacles and take on challenges (Schwarzer & Taubert, 2002; Toyama et al., 2020). Challenges are meant to test one's capability to the full extent; therefore, this requires the ability to persevere without being overcome by feelings of anxiety or relenting to the stress and disengaging. To do this, one must have adequate emotion regulation to balance these two extremes. Emotion regulation allows one to stay the course, focus on the task at hand, and adapt to any bumps in the road (Flores-Kanter et al., 2021; McRae et al., 2012; Nguyen et al., 2020). Of course, not all challenges can be easily overcome, so one must also have the reassurance of social support to buffer them in times of need and build them up when they need a boost. The shared intimacy experienced between friends promotes emotional regulation and a secure sense of belonging, enabling one to take on the inevitable challenges towards personal growth.

Learn New Things. Research studies continue to validate the notion that learning is inherently social and emotional (Immordino-Yang et al., 2019; Li et al., 2021; J. Smith & Hu, 2013). Brains learn best within a secure relationship and with low to moderate stress (Cozolino, 2014). Anxiety and fear can activate the amygdala to trigger a fight-flight-freeze response, inhibiting necessary cortical processes such as cognitive thought, creativity, and neural

integration. Conversely, brains are naturally conservative, so they will continue to do whatever has worked in the past without proper motivation (Cozolino, 2017). Individuals need to be in learning's "sweet spot" to trigger neural plasticity—sufficiently attentive but not too stressed (Cozolino, 2017, p. 386). The mutual engagement required for friendships facilitates many of these processes, including sitting with another's pain in the expression of compassion. Much like compassion requires the ability to tolerate discomfort to care for others, learning also involves sitting with the discomfort long enough to make the necessary neural connections within the brain. The cognitive control and sense of compassion that develops from mutual engagement within a friendship provides the foundation from which learning can occur.

Open Mindset. Finally, to pursue growth, one must have an open mindset and be receptive to change. Interactions with friends tend to put people in a good mood, remind them of their ideal selves, expose them to new ideas, and help strengthen their resolve (Demir & Özdemir, 2010; Langkamp, 2020; Nicolaisen & Thorsen, 2017). With adequate social support, people can approach life's obstacles with equanimity and fortitude. As a result, they become more willing to consider others' perspectives and become open to new experiences.

Personal Growth in Adulthood

Growth requires learning new things, a task that generally declines in adulthood. Without the necessary structure and incentive inherent in educational settings, adults can be reluctant to learn new things—whether it is due to a lack of perceived opportunities or lack of motivation (Nguyen et al., 2020). Learning new information also becomes increasingly difficult in adulthood. Despite previous assumptions that neuroplasticity was confined to childhood, neuroscience studies have revealed that the brain has the capacity to change throughout the lifespan; however, neuroplasticity becomes more strenuous as one ages (Fuchs & Flügge, 2014).

Learning requires time, effort, focused attention, and the initiative to pursue learning opportunities.

For those in middle to late adulthood, the aging process is often associated with cognitive and physical decline, potentially limiting opportunities for taking on new activities or learning opportunities. However, the neural changes that accompany old age contradict many of these assumptions. For example, in midlife, the decrease in cortical gray matter and increase in white matter volume reflects a more efficient process for focus, less emotional variation, and better problem solving (Cozolino, 2018). Further, neural pruning appears to follow the old adage “use it or lose it,” reflecting the importance of maintaining cognitive activity and engaging interpersonal connections. Additionally, this pruning seems to be impacted by the density of one’s accumulated neural connections, and those with more education are shown to maintain their ability to perform more complex cognitive processes than those with less education (Cozolino, 2018). Finally, certain neural functions have the capacity to improve with age, specifically those that support wisdom and compassion. Neuroimaging studies show decreased activity in the amygdala and an increased activity in frontal lobes for adults ages 60 to 80 (Cozolino, 2018; Kremen et al., 2012). This shift in cortical-subcortical balance softens the fear response and promotes deeper reflection, allowing older individuals to broaden their perspectives and experience deeper empathy for those around them.

Friendship in Adulthood

Studies of friendship consistently emphasize the benefits of friendships at any age and how they contribute to life satisfaction, health, and overall well-being (Chopik, 2017; Gillespie et al., 2015; Nicolaisen & Thorsen, 2017; Sharifian et al., 2020). Even the mere presence of a friend can lower one’s blood pressure, strengthen one’s immune systems, and give them courage

in the face of fear (Hojjat & Moyer, 2017). Support from friendships is also a tremendous need for new mothers, with research indicating that it is the most effective intervention to prevent post-partum depression (Bost et al., 2002; Harrison et al., 2021; Leger & Letourneau, 2015; Mulcahy et al., 2015; Sampson et al., 2015). The many benefits of friendship in adulthood have even been shown to exceed the benefits of significant others (Antonucci et al., 2001; Birditt & Antonucci, 2007).

Within the family science literature, research on friendships is generally restricted to peer relationships during childhood and adolescence, perhaps due to the misconception that those are the ages in which friendships are most influential. Friendships provide integral and meaningful social connections throughout the lifespan; however, the influence of friends tends to vary based on life stage. Friendships tend to be more influential than family during adolescence and emerging adulthood, take a backseat during middle adulthood for parents raising young children, and peak again in older adulthood (Allan, 2008; Pahl & Pevalin, 2005; Pahl & Spencer, 2003). While individual friendships can span one's entire lifespan, perspectives of what is important in a friendship differ across generations, cultures, geographic location, and different life stages (Gillespie et al., 2015).

Previous studies have already explored the vast benefits of healthy friendships in older adulthood. In a study by Fiori et al. (2020), the authors discussed the sociohistorical context for late-life friendships, noting that "the role of choice seems to be historically increasing in its influence" while "genetic relatedness" continues to decrease in importance (p. 291). This supports the findings from Suanet and Antonucci (2017) in their study exploring the difference between friend-focused and family-focused support in late adulthood. They found that friend-focused social networks were more common in later cohorts (i.e., those born after 1927), and that

those with friend-focused networks receive more emotional and instrumental support (Suanet & Antonucci, 2017). In a similar study, researchers found that instrumental support from friends had a positive impact on well-being, whereas instrumental support from family had a negative impact (Merz & Huxhold, 2010). These findings may be due to the effects of obligation on family relationships, as research shows that obligation can have deleterious effects for both the giver and the receiver of support, especially when support cannot be reciprocated (D. S. Lee & Ybarra, 2017; Oh et al., 2020; Parker et al., 2018).

Social Support and Health

Researchers in social neuroscience have been exploring how detrimental the lack of social connection is to health and well-being. In a meta-analysis of 148 studies, Holt-Lunstad and colleagues (2015) found that social relationships significantly protect against mortality across age, sex, and initial health status. In a follow-up study, the Holt-Lunstad (2017) concluded that social isolation, living alone, the feeling of loneliness increased one's chance of mortality by around 30%. The connection between social relationships and physical experience is also evident within the human brain, as the same neural circuits are activated in physical pain and social pain (Fallon et al., 2020; Holz et al., 2020; Timmers et al., 2018). This overlap explains why loneliness and isolation can feel just as distressing as physical pain. Loneliness, which is often the byproduct of social isolation, was identified as a major health concern by the World Health Organization (Cacioppo & Cacioppo, 2018; Hawkey & Cacioppo, 2010). The COVID-19 pandemic exacerbated this "loneliness epidemic," as mandatory social distancing and isolation policies were necessary to slow the spread of the virus. Since the beginning of the pandemic, mental health issues, including depression, anxiety, and insomnia, have drastically increased (Xiong et al., 2020).

Numerous studies have revealed the integral role of friendships in alleviating loneliness and mitigating mental and physical health issues during the COVID-19 pandemic (Bierman et al., 2021; Cavallini et al., 2021; Gan & Best, 2021; Goodwin et al., 2020; Harrison et al., 2021; Juvonen et al., 2022; Kovacs et al., 2021; Lippke et al., 2021; Teichert, 2021; Ye et al., 2021). These studies confirm previous research findings on the unique influence of friendships on feelings of loneliness (Buunk & Prins, 1998; Nicolaisen & Thorsen, 2017). Specifically, Nicolaisen and Thorsen (2017) explored how friendships protect people against loneliness across the lifespan. Across all age groups, feeling satisfied with friendships was more significant to loneliness than the frequency of contact. Dissatisfaction with contact with friends was also strongly associated with loneliness in all age groups (Nicolaisen & Thorsen, 2017). Understanding the role of friendships in a Western society will become increasingly important as researchers note a global trend towards individualism.

The Rise of Individualism

Individualistic cultures traditionally value individuality, self-sufficiency, and personal freedom while more collectivist cultures prefer relational closeness and interpersonal harmony; however, researchers speculate that this dichotomous view is inaccurate as more countries across the globe are trending towards individualism (Alzola et al., 2020; Oyserman et al., 2002; J. Smith & Hu, 2013; Vignoles et al., 2016). Individualism implies that growth is a personal, rather than relational process, likely contributing to the dominance of self-esteem research in Western science (Baumeister & Leary, 1995; Oyserman et al., 2002). In previous research studies, individualistic cultures were shown to be associated with greater income equality, lower levels of happiness and well-being, and higher levels of stress (J. Smith & Hu, 2013; Vignoles et al., 2016), highlighting the importance of balancing both individual factors and relationships in

societal well-being. While individual factors like self-esteem, age, mental health, and education have been shown to influence personal growth throughout the lifespan, one must also consider the powerful role of relationships – especially for those in increasingly individualistic societies.

Even though it is the most researched cultural factor in friendship research, studies investigating the differences between friendship in individualistic cultures and collectivist cultures are scarce. In a recent study investigating the importance of friendship across different cultural factors, researchers found that prioritizing friendship promoted higher levels of health and well-being for those living in individualistic societies (Lu et al., 2021). These effects were especially apparent for women, older adults, and those with less education (Lu et al., 2021). Potentially, this is due to the dramatic power differential that tends to correspond with individualistic societies. Oyserman (2006) suggested that the extent to which societies handle power inequities must also be considered alongside both individualism and collectivism and that some of the detrimental impacts of individualism on a society can be mitigated through equality relationships, like colleagues, peers, siblings, or friends (Oyserman, 2006). As Pythagoras championed the role of friendship “in all things towards all,” this finding potentially sheds light on Pythagoras’s maxim: “Friendship is equality; equality is friendship.” Friendships facilitate balance between honoring one’s own individuality and autonomy with the need for belonging and support within relationships by promoting a sense of equality between oneself and others.

Harmony

In the previous section, I explained how the consilient theme of balance promotes equality between independence and interdependence. In this section, I explain how the introduction of a third variable promotes harmony within a system. Harmony, another concept credited to Greek philosopher Pythagoras, occurs when parts of a system come together in a way

that is efficient and pleasing. Harmony does not necessarily mean equality, but rather that each part gives and receives proportionately and that all parts are working towards the same goal. In this section, I explain how IPNB's triangle of well-being supports harmony between seemingly disconnected scientific research, and how the unique characteristics of friendship facilitate neural integration, thus promoting harmony within the brain.

Theoretical Framework

One of the most exciting insights that has resulted from the abundance of neuroimaging studies is the extent to which these findings validate the practice of MFT. From birth, human beings are “wired to connect,” as relationships are essential to human survival (Fishbane, 2007). Human relationships play a vital role in brain development, and researchers are leaving behind the dichotomy of genetics versus experience in support of the notion that “nature is nurture” (D. Meyer et al., 2013), “the mind is the brain” (Ivey & Zalaquett, 2011), and “experience is biology” (Fishbane, 2007). A key example of this is found in attachment theory, in which humans develop a pattern of relating to others based upon their earliest relationship with their caregiver (Bowlby, 1969/1982). The neurobiological research from attachment theory offers empirical evidence for MFT as it validates the relative importance of relationships on an individual's functioning.

IPNB is an interdisciplinary framework that consolidates information from diverse fields of knowledge and combines them to create a consilient approach to human functioning (Siegel, 2001). IPNB, pioneered through the works of Dan Siegel, Louis Cozolino, and Alan Schore, provides a comprehensive view of human functioning that can inform the work of clinical therapists as well as public policy, education, and parenting. Keeping up with the latest scientific research from a wide range of disciplines and then translating it into practical tools to use in

therapy would prove to be a Sisyphean task for any therapist. IPNB provides an inclusive and accessible framework from which clinicians can utilize the findings from advanced and complex fields, like neuroscience, without the necessary time and effort it would require to understand these disciplines from the ground up. IPNB's framework illustrates the systemic nature of human functioning through the bidirectional connections between the brain, the mind, and relationships – what Siegel refers to as “the triangle of well-being” (Siegel, 2015). In the following sections, I will elaborate on the relevant concepts of IPNB and explain why integration is considered the key to health and well-being.

Triangle of Well-Being

The triangle of well-being addresses the three fundamental aspects of life: the mind, relationships, and the brain. Perhaps the least understood concept of IPNB's triangle of well-being is the mind. Siegel (2006) defined the mind as “a process that regulates the flow of energy and information” (p. 248). The mind is the source of human consciousness and how one experiences, attends to, and processes the world around them (Siegel, 2019). With every sensory experience or shift in focus, the mind transforms neural activation within the brain, actively shaping the neural circuits in its path. While genetics play a part in life-sustaining connections and one-third of the human genome is responsible for shaping brain structures (Szente, 2000), it is experiences, especially within interpersonal relationships, that impact the development and maturation of the nervous system beyond those two factors (Siegel et al., 2021). Both neurobiological (within the brain) and interpersonal processes (between brains) create and direct the flow of the mind continuously throughout the lifespan. Due to the rich resonance circuits within the human brain, interpersonal interactions have a tremendous impact on the

neurobiological processes of individuals, illustrating how both nature and nurture are inextricably linked.

The Embodied Brain. IPNB defines the brain as the embodied mechanism of energy and information flow throughout the entire human body (Siegel, 2001). The human brain is made up of billions of neurons that are connected through trillions of synapses. Synapses carry messages between neurons through neurotransmitters, like dopamine or serotonin. Neurons will then undergo biochemical and structural changes based on the message received. This process then triggers DNA for epigenetic changes, thus determining the expression of genes. When two adjacent neurons fire together, there are metabolic changes to both, leading to greater efficiency when activated again. This process is often described through the phrase “what fires together, wires together,” or Hebb’s law (Hebb, 1949). Through enough repetition, these experiences strengthen specific neural connections, thus making them more likely to be activated together in the future. While much of the focus lies within the skull-based brain, it also includes the extended nervous system that runs throughout the entire human body (Siegel, 2007).

Consciousness and Attention. Although most brain processes are below one’s level of consciousness, one can use their focused attention to direct neural firing towards a higher level of integration, and therefore, well-being. Attention occurs when one integrates consciousness with their felt experiences through the five senses, mental activity, emotions, or interpersonal connections. Focused attention activates specific neurons in the brain, allowing people to change, link, or strengthen those neurons and their connections.

While one can, to some extent, control what they pay attention to, human brains also prioritize certain types of input or information over others. Brains constantly scan the environment for potential threats, thereby activating the salience network to divert thoughts and

behaviors towards safety. This process, called neuroception, occurs below one's level of awareness until the salience network deems the information as important and brings it into awareness (Porges, 2007). Anything that might indicate danger, including emotional or social stimuli, is fast-tracked to consciousness. An example of how brains direct unconscious stimuli towards the conscious mind is the cocktail party effect. The cocktail party effect, or the ability to hear one's name even when engaged in other conversation, illuminates how much humans prioritize information about themselves and their place within their social environment (Cozolino, 2014). Once this information is brought to attention, they can make conscious decisions on what to do next.

Further, brains are equipped with distinct neural reward systems, which encourage rewarding activities and thoughts and help people avoid any potential pain – including social pain. Social rewards and social pain activate the exact neural mechanisms as nonsocial stimuli, illustrating the significance of relationships and interpersonal interactions on processes of the mind (Camara et al., 2009; Fallon et al., 2020). After the salience network appraises the potentially rewarding or painful stimuli as worthy of attention but not dangerous enough to trigger the sympathetic nervous system, the salience network then engages the middle regions of the prefrontal cortex, giving the mind access to a wide range of mental functions. The medial prefrontal cortex (MPFC) is uniquely integrative, as it can link all parts of the brain with focused attention (Siegel, 2009). With enough repetition, the mind can strengthen the neural connections of the MPFC, allowing people to be more flexible and intentional in their thought processes and supporting their path towards personal growth.

The Role of Relationships. Neuroscience has proven what philosophers, artists, authors, and marriage and family therapists have always known – relationships are central to human

development and well-being (Fishbane, 2007; Pietromonaco & Collins, 2017; Siegel, 2001). Social interactions facilitate the activation and organization of neural networks from birth and throughout one's life (Immordino-Yang et al., 2019). An infant's earliest caregiver relationship shapes the physiology of their developing nervous system, resulting in neural connections that guide their future self-concept, coping mechanisms, and expectations in relationships (Schoore, 2000, 2001). Throughout the lifespan, social interactions activate specific neural structures, strengthening their synapses and creating structural and functional changes within the brain. (Siegel, 2015; Vrticka & Vuilleumier, 2012). As explained in IPNB, these social interactions occur through the social synapse.

The social synapse, a term coined by Louis Cozolino, refers to the space where communication and connection occurs. Verbal and nonverbal communication is transferred through the social synapse to sensory receptors within the brain. After processing this information, the salience network can then activate relevant neural circuits, elicit chemical changes, and trigger compensatory behaviors in response to the information. This process occurs mostly below consciousness through neuroception (Porges, 2007). The characteristics that provide safety and openness within a relationship are also the core conditions of a therapeutic relationship posed by Carl Rogers: congruence, positive regard, and empathy (Rogers, 1961).

Integration and Personal Growth

Put simply, integration occurs by linking differentiated parts of a system, creating a more optimally functioning whole. As Siegel (2019) explains, "Integration can be functional and structural, and it can take place within the brain, within the whole body, and within our relationships" (p. 203). In other words, integration can describe a densely connected neural network, as well as a close-knit community of people. When a system is not well integrated, it

often gravitates towards chaos or rigidity (Siegel, 2015) – either becoming too random and variable (chaos) or too orderly and strict (rigidity). According to IPNB, integration is considered the key to health and well-being.

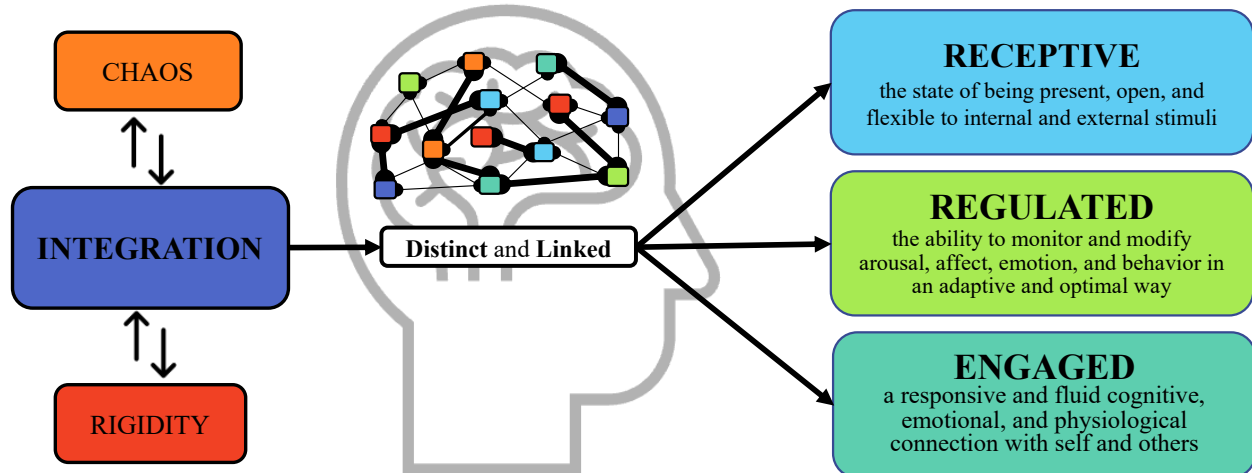
No matter the components, a well-integrated system is receptive, regulated, and engaged. Receptivity reflects being present, open, and flexible to internal and external stimuli. A well-integrated system moves away from reactivity and can respond in a fluid and accommodating way. Regulation is the ability to monitor and modify activity in an adaptive and optimal way. For example, a regulated nervous system balances the stimulation and mobilization of the sympathetic branch by activating the parasympathetic branch, which supports downregulation and energy conservation. Engagement refers to the participation and execution of activities that support the system's functions. Integration allows the system to operate without the risk of becoming overloaded or disengaged.

Neural Integration

As with any system, a well-integrated brain promotes optimal functioning through receptivity, regulation, and engagement (see Figure 1). Neural integration describes the process of linking differentiated neural networks within the brain, promoting emotion regulation, cognitive control, and resilience in the face of stress. Integration within any system advances the system towards optimal functioning; thus, neural integration promotes personal growth. Research has shown that neural integration is associated with a multitude of positive attributes, including fluid intelligence, sustained attention, and life satisfaction, indicating that a more integrated brain is a healthier, happier brain (S. M. Smith et al., 2015).

Figure 1

Process and Descriptions of Neural Integration



Indicators of neural integration as defined in this study include emotion regulation, cognitive control, and resilience, all of which contribute to an individual's ability to cope with the stressors of everyday life. Emotion regulation allows an individual to respond intentionally when faced with a stressful situation instead of becoming flooded by emotional reactions or withdrawing after feeling overwhelmed. Cognitive control supports the ability to cope by allowing people to be more strategic and logical with their responses in the face of stress. Finally, when people are receptive to the opportunity for learning and growth that can result from stressful experiences, they develop resilience.

For neural integration to occur, the neural networks that support various neural functions must be well differentiated before linking together. For instance, the left and right hemispheres of the brain are associated with complementary but distinct functions. The left hemisphere primarily operates through logical, top-down, mathematical, and explicit processes, while the

right hemisphere contributes a more automatic, intuitive, and emotional approach. When either hemisphere is not differentiated, one develops a bias towards the other, leading to either a chaotic (right bias) or rigid (left bias) state of functioning. However, when one balances both hemispheres, they can achieve bilateral integration through the corpus callosum. This explains why using language (left hemisphere) to describe relational and emotional wounds (right hemisphere) can be healing in and of itself.

While the brain is equipped with integrative structures, like the corpus callosum and hippocampus, relationships are the most effective means of integration. As IPNB explains, the social circuits within the brain are uniquely integrative, and healthy interpersonal connection supports neural integration (Siegel, 2009). This is most evident in one's earliest relationships with their attachment figures, as those early interactions shape the foundation of neural structures; however, as explained in attachment theory, one's closest relationships continue to influence them "from the cradle to the grave" (Ainsworth, 1985). In other words, social integration fuels neural integration throughout the lifespan. In the following sections, I will describe how friendships uniquely contribute to neural integration because they are both distinct and linked.

Friends Are Distinct

One of Aristotle's most famous quotations about friendships, "A friend to all is a friend to none," likely refers to the finding that friendships are limited by both time and cognitive capacity (Stern-Gillet, 1995). Friendships require space – both within one's schedule and in their brain. The selection, development, and maintenance of friendships during adulthood provides numerous opportunities for people to learn about themselves and experience the world around them within the context of an authentic, mutual, and positive relationship. While various research

disciplines emphasize the apparent importance of social relationships on healthy individual functioning, the means through which this occurs remains unclear. The core principles of IPNB provide a clear and concise understanding of these social processes and validate the systemic foundation of MFT. In this section, I will explain how friendships are distinct from family relationships and what distinct characteristics describe friendship in this study.

Friends, Family, and Social Network Research

Social network research within sociology has provided innumerable insights into the structures and characteristics of social relationships. According to this research, the size of social networks is limited by humans' finite capacity for cognitive engagement and time (Roberts et al., 2008). Almost half of one's social energy, whether measured in time or emotional closeness, is spent on the five most important relationships within a social network, with 60% dedicated to the closest 15 (Sutcliffe, Wang, & Dunbar, 2012). The consistency of these numbers reflects the cognitive capacity for human beings to maintain social relationships, whether they are with partners, relatives, or friends (Dunbar, 2018).

Social networks typically include equal parts family members and friends (Roberts et al., 2008), but family members often have a privileged position within an individual's social network (Curry et al., 2013). Therefore, individuals with large families tend to have fewer friends within their network (Roberts & Dunbar, 2011a; Roberts et al., 2008). This is referred to as the *kinship premium*, a concept that describes the tendency to act more altruistically towards relatives (Curry et al., 2013). The altruism shown to relatives may also be due to the interconnectedness of relationships inherent in families. Curry and Dunbar's 2011 study indicates that *network density* (or the connectedness between members within a social network) correlates with increased altruism.

Due to the quantitative nature of social network research, studies often do not reflect the qualitative aspects and nuances inherent in personal relationships. Specifically, social network analysis fails to fully portray the frequent crossover between the roles of family and friends (Policarpo, 2015). Because there are no set rules or boundaries designating what constitutes “friendship,” researchers face methodological challenges in studying the roles and expectations of friends (Gillespie et al., 2015; Massen et al., 2010). While family relationships are typically expected to be permanent, stable, and supportive, friendships are typically characterized as volitional, nonhierarchical, and enjoyable (Allan, 2008; Gillespie et al., 2015).

Relationships that are identified as both family and friend are generally described as closer and more supportive, and individuals report spending more time and sharing more personal information in these relationships (Bush et al., 2017). In a study designed to account for this missed overlap, researchers found that one-fifth of respondents’ family members were also considered their friends, and one-fourth of friendships were also identified as family members by the respondents (Bush et al., 2017).

The use of descriptive labels to identify the distinction between family and friend underscores the differing roles inherent within these labels. For a family member to also be described as a friend signifies a solid interpersonal connection and enjoyment of the relationship (Allan, 2008). Typically, if someone selects a family member as a friend, this is true for more than one of their family relationships; people who identify family as friends do so repeatedly (Verbrugge, 1979). Identifying a family member as a friend is also more likely in “horizontal” family relationships, meaning siblings or similarly aged cousins (Wrzus et al., 2012). Wrzus and colleagues (2012) suggested that the relationship between horizontal family members and friends is compensatory, so when one has a sufficient number of horizontal family relationships, they do

not seek as many nonkin friends. According to several studies with similar results, people who identify family members as friends tend to be older adults, those who are less educated, and those with a lower socioeconomic status (Amati et al., 2018; Chopik, 2017; Cleary et al., 2018; Gillespie et al., 2015; Miche et al., 2013; Pahl & Pevalin, 2005). This study does not distinguish family relationships from friendships, and therefore the characteristics of friendships in this study can be applied to both: authenticity, mutuality, and positivity.

Expectations in Friendship

In this study, friendships are characterized as authentic, mutual, and positive, which might describe relationships with either friends or family members. It is not biology, legal rights, or labels that separates family from friends, but rather the expectations of the individuals within that relationship. As Shakespeare famously said, “Expectation is the root of all heartache.” Previous studies have revealed that individuals benefit more from volitional support – both as the provider and as the recipient (Deci et al., 2006; D. S. Lee et al., 2018; D. S. Lee & Ybarra, 2017; Merz & Huxhold, 2010; Siebert et al., 1999; Suanet & Antonucci, 2017). Relationships in which two individuals feel they can be their authentic selves, share mutual responsibilities to maintain the friendship, and genuinely enjoy each other’s company describe friendship in this study.

Authenticity. One of the most fundamental motivations for human beings is the need to belong (Baumeister & Leary, 1995). In their widely cited article, Baumeister and Leary (1995) explained that to meet this need, one needs frequent positive interactions with a few people they care about and who care about them. Further, as Lambert et al. (2013) pointed out in their study, having positive interactions within their close relationships is not enough to foster a sense of belonging; one must feel accepted for who they are. It is authentic intimacy between two people that makes the difference.

Self-disclosure is necessary for intimacy, and vulnerability is much easier when one perceives the listener as capable of empathizing with their position. Similarities within friendships pave the way for vulnerability, as it is more likely that friends share many of the same thoughts, feelings, and reactions. On the other hand, hiding vulnerabilities creates immense suffering in the form of shame. In Brené Brown's original research on shame and vulnerability, Brown (2006) explained that shame creates feelings of judgment, powerlessness, and isolation; and without empathy and connection, individuals feel "unworthy of acceptance and belonging" (p. 45). Shame is a painful reminder of how powerful social belonging and acceptance are to human beings. However, a mutually empathic relationship in which individuals can "speak shame" fosters safety, supports emotion regulation, and allows the individual to return to a sense of social belonging (Brown, 2006; Cozolino, 2017).

Mutuality. Maintaining friendships requires a balance of both giving and receiving support. While the benefits of receiving support may be more apparent, giving support is also advantageous, but only in certain circumstances. In a review of the literature, Inagaki (2018) explored the neural mechanisms involved in the link between giving support and health benefits. Positive health outcomes from giving support were related to two conditions: support effectiveness and free choice (Inagaki, 2018). Correspondingly, self-determination theory posits that prosocial behavior benefits both the giver and the receiver to the extent that the behavior is volitional or autonomous (Deci & Ryan, 2000; Ryan et al., 2008). Several studies have supported this theory, indicating the significance of motivation in the act of giving support (Weinstein, DeHaan, & Ryan, 2010; Weinstein & Ryan, 2010). In light of these findings, one could imply that the volitional support given to a friend is more beneficial than the support shown to relatives and can more accurately be described as compassion.

For a healthy friendship to survive, both individuals must have enough capacity for self-regulation so that neither partner feels burdened by their friends' emotional dependence (Reeck et al., 2016). However, self-regulation is not always possible, and co-regulation with a supportive friend facilitates trust, supports bonding, and enhances one's own ability to self-regulate in the future (Cheung et al., 2015; Morawetz et al., 2021; Porges, 2007). Because friends typically share many similarities and reflect one's "authentic" identity, friendships provide a safe context to share diverse emotional experiences that one might feel uncomfortable sharing with family members or romantic partners (Cronin, 2014). Further, these similarities facilitate empathic accuracy, promoting more appropriate regulatory strategies (Reeck et al., 2016). However, the specific strategies may not be as influential as the felt connection between friends, as one study revealed that the same supportive statements were much more effective when participants thought a close friend provided them rather than a stranger (Morawetz et al., 2021).

Positivity. The final characteristic of friendship in this study is positivity. Previous researchers have investigated the relative influence of various traits in the development or maintenance of friends. The most appealing traits in new friends are sharing the same taste in music and sharing the same political beliefs (Shelton et al., 2010). Established friendships are more likely to share the same sense of humor, have the same hobbies and interests, share moral beliefs, and be from the same geographic area. Specifically, a study by Curry and Dunbar (2013a) revealed that sharing the same sense of humor was the most prominent predictor of friendship. These findings suggest that time spent with friendships are typically rewarding and positive, which creates a positive feedback loop in which friends expect to enjoy their time with each other.

How Friends Link

In this section, I will describe how friends link together. In contrast with family members, friends require more frequent interactions to maintain the relationship. Before adulthood, this is often made much easier through social institutions that bring friends together regularly – such as school and other various extracurricular activities (Mcpherson et al., 2001). However, in adulthood, friendship requires more effort to develop and sustain. Adults stay in touch with friends by communicating either face-to-face, on the phone, or through digital media (Teichert, 2021), as well as participating in hobbies or doing something active together (Heo et al., 2017; Huxhold et al., 2014; Protein Agency for Snap Group Limited, 2019). In a study investigating friendship maintenance strategies, Oswald and colleagues (2004) identified four components that contributed to sustaining friendship commitment and satisfaction: interaction, positivity, supportiveness, and openness. The authors also highlighted that friendships need much less maintenance than romantic relationships, which also require shared tasks and shared social networks, avoidance, mediated communication, and seeking external help (Oswald et al., 2004). In other words, friendships require much more maintenance than family relationships, but less than romantic relationships. The effort used in maintaining friendships is worthwhile, as research indicates that valuing friendships compared to family relationships is associated with health and well-being in adulthood (Chopik, 2017).

Birds of a Feather

Perhaps the most consistent finding within friendship research is that people tend to be friends with people who share many of the same traits as themselves. Homophily within an individual's social network occurs through both sociodemographic dimensions—like age, gender, or ethnicity, as well as similar values, hobbies, or political beliefs (Mcpherson et al.,

2001). These factors tend to have an additive effect, as friendships within the innermost circles of one's social network tend to have more commonalities than those in the outer layers (Curry & Dunbar, 2013b).

Friendships often develop out of convenience. For instance, two people who share a dorm, work at the same office, or live next-door to each other require less effort to develop a friendship than those who are physically distant. Individuals in similar settings, whether it be geographic or organizational, have an assumed baseline of similarity, making them appear safer and easier to trust than those outside of the setting. Proximity also facilitates the maintenance of friendships, reducing the cost of the friendship while maintaining the benefits.

Social networks are mostly homophilous for gender, as studies investigating differences across gender support the significance of and preference for same-gender friendships (Hall, 2011, 2015). This is partly due to the differences in the preferred structure and functions of these friendships; women prefer dyadic friendships (David-Barrett et al., 2015) characterized by intimacy and self-disclosure (Gillespie et al., 2015; Hall, 2011), and men prefer social groups (David-Barrett et al., 2015), and enjoy the competition and instrumental support of friends (Carr & Fitzpatrick, 2011; Hall, 2011, 2015; Migliaccio, 2009). While these differences tend to be small (David-Barrett et al., 2015; Felmlee et al., 2012), scholars anticipate this gap will continue to shrink alongside the acceptance of more fluid gender identity (Galupo et al., 2014) as well as an increase in cross-gender friendships (Felmlee et al., 2012).

While there is wide agreement for homophily within social networks, there is a growing body of research on neural homophily: people tend to befriend others with similar brain activity. Several fMRI studies have revealed that friends tend to have similar neural responses when presented with the same stimuli, to the extent that neural patterns can accurately predict

friendship closeness within a social network (Hyon, Kleinbaum, & Parkinson, 2020; Hyon, Youm, et al., 2020; Lahnakoski et al., 2014; Parkinson et al., 2018). Similarities are particularly evident in the subcortical and parietal regions of the brain, areas associated with attentional control and meaning making. To expand upon these findings, Hyon, Youm, and colleagues (2020) conducted an experiment in which they examined the social network of an entire village using both personality and neuroimaging data. Instead of analyzing neural activity using task-based fMRI data, participants in this study underwent resting-state fMRI, revealing the functional connectivity within the brain. Their results confirmed that similarities in functional connectomes were also associated with social network proximity, even while controlling for demographic variables and personality traits (Hyon, Youm, et al., 2020).

Similarities between friends, both overt and covert, create safety and predictability within the relationship. The ability to anticipate or predict others' behaviors is at the core of cooperation as it promotes trust, encourages generosity, and facilitates more efficient communication (Axelrod & Hamilton, 1981; Mcpherson et al., 2001).

Choosing Friends, Choosing Friendship

While it is necessary for friends to spend time with each other to maintain the relationship, time is often an obstacle in adulthood. Because of the reliance on extensive maintenance strategies to support these relationships, empirical studies endorse the investment in fewer, more emotionally intimate relationships (Oswald et al., 2004; Oswald & Clark, 2006; Roberts & Dunbar, 2011a, 2011b; Tamarit et al., 2018). Time spent together is one of the most reliable indicators of relationship strength, and frequent interactions are key for the development of mutual trust and intimacy (Roberts & Dunbar, 2011a; Sutcliffe, Dunbar, et al., 2012).

In a study investigating how many hours it takes to form friendship, Hall (2019) explored friendship development for students during their first weeks of college. Results from this study revealed that good friendships can develop after spending around 120 to 160 hours together, and best friendships generally result from spending over 200 hours together during the first six weeks. Of course, in adulthood, time becomes more challenging, so individuals need to be selective with whom they choose to befriend. Hall (2019) found that particular forms of everyday talk can help friends integrate one another into their daily lives, which can facilitate closeness above and beyond the number of hours spent together. Routine social interactions that involve simply catching up and joking around supports friendship development without the required time or effort of planned interactions and long, intimate conversations.

Spending time in close proximity is key for friendship development, but still does not guarantee that two people will become friends. According to the clicking model of relationship development, people choose potential friends based on a rapid assessment of compatibility and spend time with those who pass this selection process (Berg & Clark, 1986 as cited in Hall, 2019). For a friendship to continue, one must repeatedly choose to spend time with a person, and that person must continue to choose them as well

Fortunately, research suggests that the trust and intimacy developed between friends over an extended period of time can provide a foundation of commitment between members (Sutcliffe, Dunbar, et al., 2012). Once these relationships hit a certain “threshold,” their friendship becomes more resilient to time apart, which is inevitable in certain stages of adulthood. This is pertinent for adult friendships, as one study indicated that those in middle adulthood (ages 30 to 49) were the least satisfied with their contact with friends, likely due to

increased parental, familial, and career-related obligations during these years (Nicolaisen & Thorsen, 2017).

Link and Sync

Frequent conversations alone are not sufficient in sustaining emotional closeness within friendships; interactions must be meaningful to both members. As stated in the previous section, intimate conversations between friends can be mutually beneficial, but intimacy can only be achieved when the speaker feels understood by the listener. Responding appropriately to a friend's personal story requires staying attuned to the speaker and using mentalization to understand their perspective. Mentalizing, which integrates neural regions within the default mode network (DMN) and central executive network (CEN), increases empathy and prosocial behaviors towards others (Majdandžić et al., 2016). The DMN is generally responsible for social cognition, self-reflection, and self-generated thought, while the CEN is identified for its primary role in problem-solving, abstract thinking, self-control, and goal-oriented cognition (Uddin et al., 2019). Because friends often share similar neural network patterns, mentalizing is made easier due to the overlap between the friends' DMN and CEN connectivity. This self-other overlap in neural activation that is experienced when empathizing with close friends is also a precursor to compassion.

Intimacy is an interpersonal and dynamic process in which both partners disclose personal information, thoughts, or feelings and respond to each other's disclosures with validation, understanding, and care (Reis & Shaver, 1996 as cited in Laurenceau et al., 1998) . Using this definition, Laurenceau and colleagues (1998) explored the development of intimacy on an interaction-by-interaction basis. They found that greater intimacy was achieved to the extent that individuals disclosed emotional rather than factual content and whether individuals

felt understood and accepted by their partner. Intimacy is often associated with romantic relationships, but a recent study concluded that both men and women thought their best friendships were more intimate (Pearce et al., 2021). This may be due to increased homophily between friends – specifically for gender (Bowman, 2009; Fuhrman et al., 2009).

The influences of friends on emotional processes are also reflected within the brain. When people discuss emotional content with close friends, their brains naturally synchronize with each other's, allowing them to “tune in” to each other's experiences (Nummenmaa et al., 2012). Simultaneously sharing emotions with friends activates reward circuits within the brain, whether the emotions are positive or negative (Wagner et al., 2014). Several studies have used neuroimaging methods to identify the neural correlates of friendship compared to other relationships, including relationships with partners, relatives, or strangers (Bizzego et al., 2020; Dunbar et al., 2021; Güroğlu et al., 2008; Laurita et al., 2019; M. L. Meyer et al., 2013; Parkinson et al., 2018). For example, relationships with primary attachment figures—including parents, adult children, and romantic partners, are typically associated with reduced activation in regions associated with fear or stress relief (Laurita et al., 2019). Friendships, in contrast, activate more diverse neural circuits, including those required for mood regulation (Güroğlu et al., 2008) and cognitive reappraisal (Morawetz et al., 2021; Wagner et al., 2014). To translate, one's closest attachment figures facilitate neural integration by reducing one's emotional responses and facilitating a sense of security, while friends support neural integration through activating diverse down-regulating neural processes and facilitating positive feelings. These studies reveal that the complexities of social relationships are reflected within the brain.

Integration and Friendship

While different friendships will have varying needs, maintaining friendships requires time, planning, and monitoring each person's needs, all of which require cognitive control. Cognitive control predominately relies on the neural structures within the CEN and refers to the ability to process complex information, selectively direct attention, and implement strategies that support progress towards personal goals. Due to the considerable cognitive load required to maintain social connections, the brain regions associated with social processes increase in volume based on the individual's social network (Kwak et al., 2018). Neural volume effects are particularly strong for individuals with satisfying friendships (Taebi et al., 2020).

Humans are limited in the number of social connections they can maintain due to cognitive capacity and time constraints (Sutcliffe, Wang, & Dunbar, 2012); however, compared to friendships, kin relationships require less time investment as they provide certain neural shortcuts. Unlike friends, family relationships can be stored as schemas within the brain, allowing for more automatic responses instead of mentally reviewing the history of the relationship, considering potential responses, and identifying the response that will support one's goals for that relationship (Wlodarski & Dunbar, 2016). In a study investigating the neural differences between processing information about kin versus friends with similar levels of closeness, researchers found greater activation in several areas of the brain associated with social cognition (Wlodarski & Dunbar, 2016). Specifically, processing information about friends versus kin triggered greater activation in two regions of the DMN: the ventral medial prefrontal cortex (VMPFC) and the posterior cingulate cortex (PCC). The VMPFC is associated with self-referential thought and processing information about similar or familiar others, and the PCC is implicated in the retrieving autobiographical memories (Fuentes-Claramonte et al., 2019). These

findings suggest that processing information about friends requires more cognitive effort in evaluating others' emotions and intentions and involves referencing autobiographical memories and using one's perspectives as a point of reference. In contrast, processing information about kin appears to be more automatic and engages more basic and efficient cognitive functions, supporting the notion that maintaining friendships is much more cognitively taxing than maintaining family relationships. As stated by Eckhart Tolle, "The more shared past there is in a relationship, the more present you need to be; otherwise, you will be forced to relive the past again and again" (2004, p. 101). By activating these diverse neural regions, repeated interactions between friends support neural integration while also promoting present moment awareness.

Self-Disclosure and Narrative Integration

Friendships are maintained through meaningful conversations—sharing one's pivotal moments from the past, processing current struggles, and revealing hopes and expectations for the future. In each case, creating a coherent narrative engages multiple areas of the brain, including those involved in focused attention, autobiographical recollection, self-reflection, and emotions. Processing emotional experiences with a friend requires input from both left and right hemispheres as well as cortical and subcortical regions of the brain, supporting both horizontal and vertical integration (Badenoch, 2008). The act of forming a coherent narrative through the assimilation of various personal memories taps into the integrating capabilities of the hippocampus (Cohn-Sheehy et al., 2021; Tylén et al., 2015). Also, unlike family members with whom one grew up, a person can intentionally choose the elements from their history to reveal and share their stories from their perspective. Recalling past experiences, reflecting on the themes of their life stories, and deciding what elements they want to reconstruct or strengthen in their current relationships all support neural integration through narrative integration. This ability

to create a coherent narrative regarding one's past experiences is a key indicator of well-being in the adult attachment research and reflects one's capacity for personal growth (Graci & Fivush, 2017).

Humor and Positivity

Compared to other close relationships, interactions with friends are primarily positive. Because human beings' cognitive capacity and time are limited, choosing to spend time with a friend is costly; therefore, the more positive interactions one has with a friend, the more likely they will continue to maintain that relationship. Further, spending time with friends is necessary to maintain the relationship, resulting in the repetition of positive interactions, positive emotions, and positive affect. Repetition takes advantage of the effects of Hebb's law, which states that the more one engages specific neurons together, the more likely those neurons will become engrained networks in the brain (Hebb, 1948). In this way, spending time with friends strengthens positivity circuits within the brain, allowing people to be more receptive to the world around them.

While friends tend to share many similarities, the most reliable predictor of friendship is sharing the same sense of humor (Curry & Dunbar, 2013b). Humor uniquely filters the compatibility of potential friends because it efficiently tests for and detects the breadth of shared knowledge between two people; identifies those with common attitudes, values, and goals; and signals their similar backgrounds and shared culture (Flamson & Barrett, 2008). Further, the complexity of humor can be measured by the extent to which one can mentalize, thus indicating similar cognitive abilities between two people (Dunbar et al., 2016). Laughter also promotes social bonding as it synchronizes individuals' emotional states and triggers the release of

endorphins, which support the formation, reinforcement, and maintenance of relationships (Manninen et al., 2017; Vlahovic et al., 2012).

The positive benefits of humor go beyond relationships: laughter promotes well-being and positive affect, strengthens the immune system, and elevates one's threshold for pain. Humor also supports neuroplasticity and enhances cortical functioning, allowing people to take in, process, and remember new information (Cozolino, 2014). As an effective coping mechanism, a good sense of humor allows people to reframe stressful situations as less threatening, thereby regulating their state of arousal, expanding their awareness, and improving their ability to respond.

Whether sharing a joke or discussing personal struggles, time spent with friends is predominantly rewarding (Manninen et al., 2017; Wagner et al., 2014). Friends help people feel more regulated, motivate them to engage in the world around them, and encourage people to be more receptive to the unknown. When people feel confident in their ability to handle challenges, they are willing to take more risks. With the support of friends, people become more resilient in the face of stress and more optimistic about the future.

Unity

The consilient theme of unity addresses the systemic and holistic framework characteristic of IPNB and MFT. According to IPNB, neural integration reflects social integration due to the bidirectional influences between the brain, the mind, and relationships. Friendships facilitate unity in that they help people understand who they are in the world and help people connect to the world around them.

Social Integration

The brain is a social organ (Donaldson & Young, 2008; MacDonald & MacDonald, 2010; Siegel, 2001). Just as densely connected brain cells survive synaptic pruning (Sakai, 2020), the social integration of human beings is necessary for survival (Sutcliffe, Dunbar, et al., 2012). While this has been a long-standing assumption of marriage and family therapists, decades of research within the field of neuroscience have supported this notion, and so far, no research has disproved it.

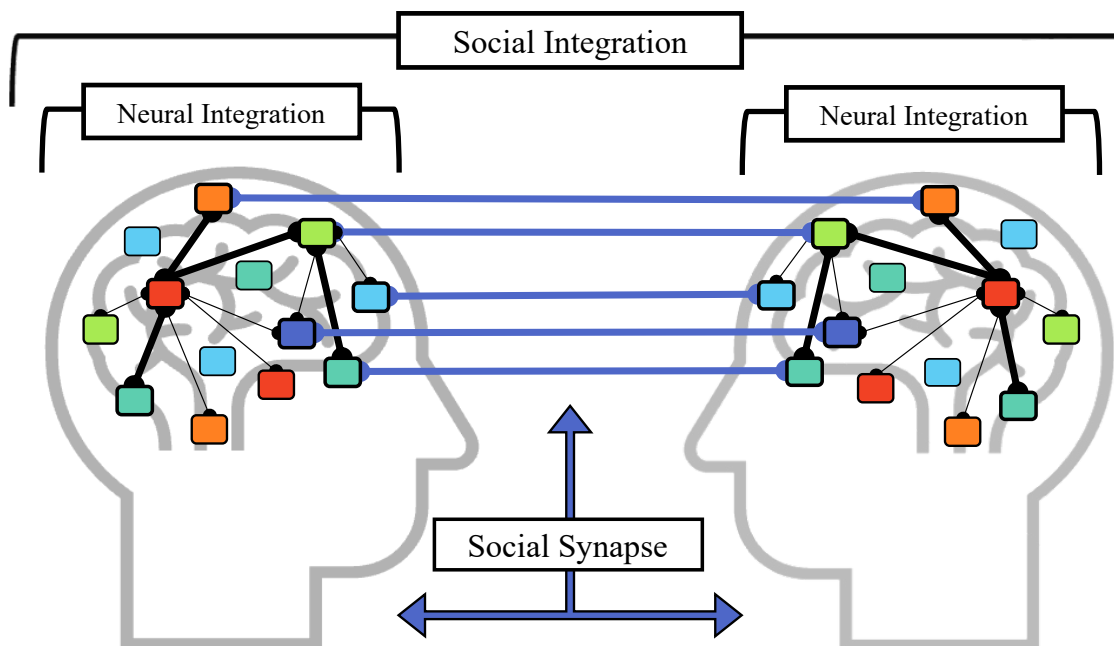
As systemic therapists, MFTs acknowledge that individuals operate within the context of a social system. As with any other system, social integration occurs when distinct parts are linked together, allowing the system to function in a way that is more receptive, regulated, and engaged. Differentiation is required for healthy integration, meaning that the integration of a relational system is supported when the individuals within the system are well-differentiated.

Bowen family systems theory (BFST), one of the most influential theories in MFT, introduced this notion of individual differentiation and McGoldrick and Carter (2001) covered it in depth. BFST posits that human beings are innately emotional and reactive but also have the capacity to be more rational and intentional. According to BFST, individuals can achieve higher levels of differentiation through the awareness of both their emotional and intellectual capacities and utilizing a more balanced approach in their behaviors and reactions. In other words, differentiation provides a balance between the chaos of emotional reactivity with the rigidity of over-rationalization. In terms of IPNB, individuals with high levels of differentiation can develop secure attachments, while low differentiation can lead to anxious attachment (chaos), avoidant attachment (rigidity), or ambivalent attachment (both chaos and rigidity). In this case, social

integration can occur both within a dyadic relationship and within an entire social network, supporting regulation, engagement, and receptivity in each (See Figure 2).

Figure 2

Relationship Between Neural Integration, Social Integration, and the Social Synapse



Social integration leads to a greater sense of belonging, compassion, and a more optimistic approach to the world around us. Differentiation within relationships provides a sense of safety from becoming too enmeshed or too withdrawn, supporting the individuals' innate need to belong. Healthy engagement within a relationship is characterized by connection and cooperation, facilitating helping behaviors within a system. Finally, social integration allows people to be more optimistic about and receptive to the world around them.

Cumulative Identity

Unlike relatives, people choose their friends. Additionally—although humans are limited by time and cognitive constraints—people can have multiple friends who can support different

facets of themselves. When one share their stories with friends who understand and accept them as they are, emotional stories have the power to synchronize emotions (Nummenmaa et al., 2012), neural responses (Cañigüeral et al., 2021; Kinreich et al., 2017; Lahnakoski et al., 2014; Lieberman, 2018), heart rates (Pérez et al., 2021), and body language (Latif et al., 2014), simultaneously regulating them and strengthening their friendship bond. Having multiple people to count on for this kind of support strengthens one's sense of well-being (Cheung et al., 2015), and knowing that one's friends continue to choose them makes them feel good (Davey et al., 2010). When friends share different parts of themselves with different friends, their stories are embedded within the neural wiring of their friends and are reflected back to them when they are with those friends. Instead of harboring memories from the past or reinforcing childhood roles from one's family of origin, friends validate different facets of one's current self. The cumulative effect is a more comprehensive and balanced identity and a more secure sense of belonging (Chavez & Wagner, 2020).

Compassion for Others

Although friends are typically attracted by their similarities, they still bring distinct identities into the relationship. Friendships can develop across gender, life stage, religion, or race, and the interpersonal process involved in developing intimacy within friendships remains the same. Alongside the development of trust and safety within friendship, the notion of friends as representative of an “out-group” subsides. This prompts the gradual reorganization of the related implicit and explicit expectations of that “out-group” within the brain. Altogether, friendships provide positive reinforcement towards the diversity in the environment, allowing people to be more receptive to and compassionate towards the world around them.

The kinship premium refers to the innate tendency for individuals to act altruistically towards relatives regardless of reciprocity, cost, or emotional closeness (Curry et al., 2013). In contrast, supporting friends, which involves no evolutionary benefit, requires adequate motivation and the expectation of future rewards (Massen et al., 2010). In other words, compassion towards kin is automatic and altruistic, whereas compassion for friends is more intentional and therefore, more rewarding. In fact, in a study by Sanchez and colleagues (2020), researchers found that friendship maintenance mediates the relationship between compassion and happiness.

As defined by Stauss and colleagues (2016), compassion comprises five components: recognition of suffering, understanding its universality, empathizing, tolerating the distress from witnessing suffering, and motivation to act to alleviate suffering. The extent to which one shows compassion to others is determined by their willingness to share in their suffering long enough to motivate them towards taking action (Strauss et al., 2016). Compassion can be both emotionally and physically costly, so one must be discriminant in showing compassion to others to avoid burnout or emotional exhaustion (DeSteno, 2015; Weng et al., 2013). Like empathy, research shows that individuals are much more likely to act compassionately towards similar others because, at least subconsciously, people believe similar others are more likely to reciprocate, so helping those individuals also helps themselves. Of course, people tend to befriend those with many of the same traits as themselves; thus, people are much more likely to act compassionately towards friends compared to others.

According to Siegel (2019), compassion cultivates neural integration by linking the ability to attune to others' needs with the urge to respond. With enough repetition, this connection is strengthened and thus becomes more automatic, facilitating the capacity and

inclination to show kindness, care, and compassion to others. Unlike compassion towards relatives, which relies on different neural mechanisms, showing compassion towards friends reinforces neural circuitry in response to empathic distress and enhances one's capacity to show compassion towards others (Weng et al., 2013).

Optimistic Expectations

Optimism is the generalized tendency to primarily expect positive outcomes for the future and underestimate the possibility of adverse outcomes (Erthal et al., 2021). Studies have shown that optimism contributes to a longer life (L. O. Lee et al., 2019), speedier recovery from illnesses (Briley et al., 2017), and better coping skills to handle life's stressors (Nes & Segerstrom, 2006). Neuroimaging research points to the joint activity of the salience network and central executive network in the preferential focus of information congruent with one's optimistic expectations (Singh et al., 2020). When salient information is deemed incongruent to one's positive expectations, neural structures within the central executive network engage in additional cognitive processing to alter the information towards relevant goals or outcomes (Singh et al., 2020). Additionally, a systematic review of relevant literature revealed the critical role of the anterior cingulate cortex (ACC) in optimism (Erthal et al., 2021). As part of the salient network, the ACC also directs attention towards relevant cues in the environment and encodes the predicted rewards of optimistic outcomes (Erthal et al., 2021). Additionally, in correspondence with the DMN, the ACC is largely involved in processing self-relevant information and imagining future events. The power of optimistic expectations on neural functioning is highlighted in the research on the placebo effect (Price et al., 2008).

The placebo effect, primarily associated with healthcare outcomes, refers to the potential effects of internalizing another person's positive expectations (Cozolino, 2013). Expectations can

be communicated nonverbally through the “social synapse” and relies on top-down integration between the cortex and limbic region (Cozolino, 2013, p. 155). For example, research has shown that teachers can positively affect their students’ outcomes by having unspoken optimistic and positive expectations of their students’ learning abilities (Cozolino, 2013). In the same way, when one internalizes a friend’s positive expectations of one’s own circumstances, those predictions trigger the brain’s preference for predictability, motivating the initiation of congruent behaviors and the detection of corroborating information within their environment (Cozolino, 2014).

In addition to personal optimistic biases, friendships also promote the development of social optimism. While people generally expect relatives to act altruistically towards them due to the kinship premium, these expectations do not extend to others outside of family (Curry et al., 2013). The salience network works below one’s level of consciousness to detect either safety or danger in the environment, motivating them towards either approach or avoidant behavior. The same mechanisms also operate in social interactions, protecting people from potentially dangerous others or stressful social situations. This automatic appraisal of social stimuli aligns with Porges’ concept of the neuroception of safety or danger. According to Porges (2007), nonverbal safety cues such as soft eye contact, open body posture, and warm facial expressions contribute to the neuroception of safety, affirming that potential social interactions will be positive and rewarding. A number of studies have provided evidence for the role of reward circuits in reinforcing social approach behaviors (Fareri, Niznikiewicz, et al., 2012; Fareri & Delgado, 2014); however, unconscious biases towards “out-group” others can contribute to the neuroception of danger despite the lack of an actual threat (Dricu et al., 2020). In this case,

interactions with close and trustworthy friends can help diminish the false threat and contribute to more positive expectations of groups outside of one's relatives.

Unity in Research

While clinicians continue to navigate the ever-changing landscape of the healthcare system alongside a drastic increase in demand for mental health treatment (Afrin et al., 2021; Chambers, 2020; Patterson et al., 2018), MFT researchers are being called to find new ways to advance the field while still maintaining a systemic foundation (Wampler, 2019; Wampler et al., 2019; Wittenborn et al., 2019). By integrating a meta-framework—like interpersonal neurobiology—the field of marriage and therapy can progress alongside the rapid proliferation of research in diverse scientific fields without abandoning its unique identity.

Marriage and Family Therapy Research

MFT emerged as its own field in the 1960s, integrating several social science disciplines, including psychology, social work, and cybernetics (Blow & Sprenkle, 2001; Wampler, 2020). Despite its interdisciplinary roots, the field of MFT is quickly becoming confined to represent a particular therapeutic modality (Wampler et al., 2019), guided by a few theoretical approaches with their own loyal followers (Lebow, 2014a). This “tribal loyalty” discourages the incorporation of new or different ideas, thus preventing innovation (Lebow, 2014a; Wilson, 1998). As training programs continue to encourage a singular theoretical orientation to facilitate efficient treatment planning and decision making for new therapists (Hardy et al., 2019), integrating concepts from alternative, sometimes conflicting, theories can become more difficult for therapists outside of a formal training setting. Moreover, applying concepts and theories from different disciplines—like neuroscience—can be especially challenging.

Neuroscience Research

Just as MFT can benefit from incorporating scientific research from the biological sciences, biological sciences also benefit from the context and practical implications provided through the social sciences. In the field of neuroscience, the rapid advancement of technology inspired by the Decade of the Brain led to the accumulation of extensive data at the cellular level, leading to a problematic role reversal between research and theory. The imbalance between the substantial data collected through neuroimaging studies and a limited understanding of psychological processes has led researchers to use reverse inference when interpreting their findings (Poldrack, 2011). In other words, researchers attempt to predict the mental state of an individual based on neural activation; however, this simplistic view of the brain does not account for the intricacies of the human brain nor the complexity of human experience. To mitigate this issue, researchers first need a solid theoretical foundation of human behaviors from which to base their studies, which can be accomplished through collaboration with other disciplines, like MFT (Krakauer et al., 2017). Just as an individual client cannot be fully understood outside of their relational system, scientific research suffers when it is not positioned within the broader literature.

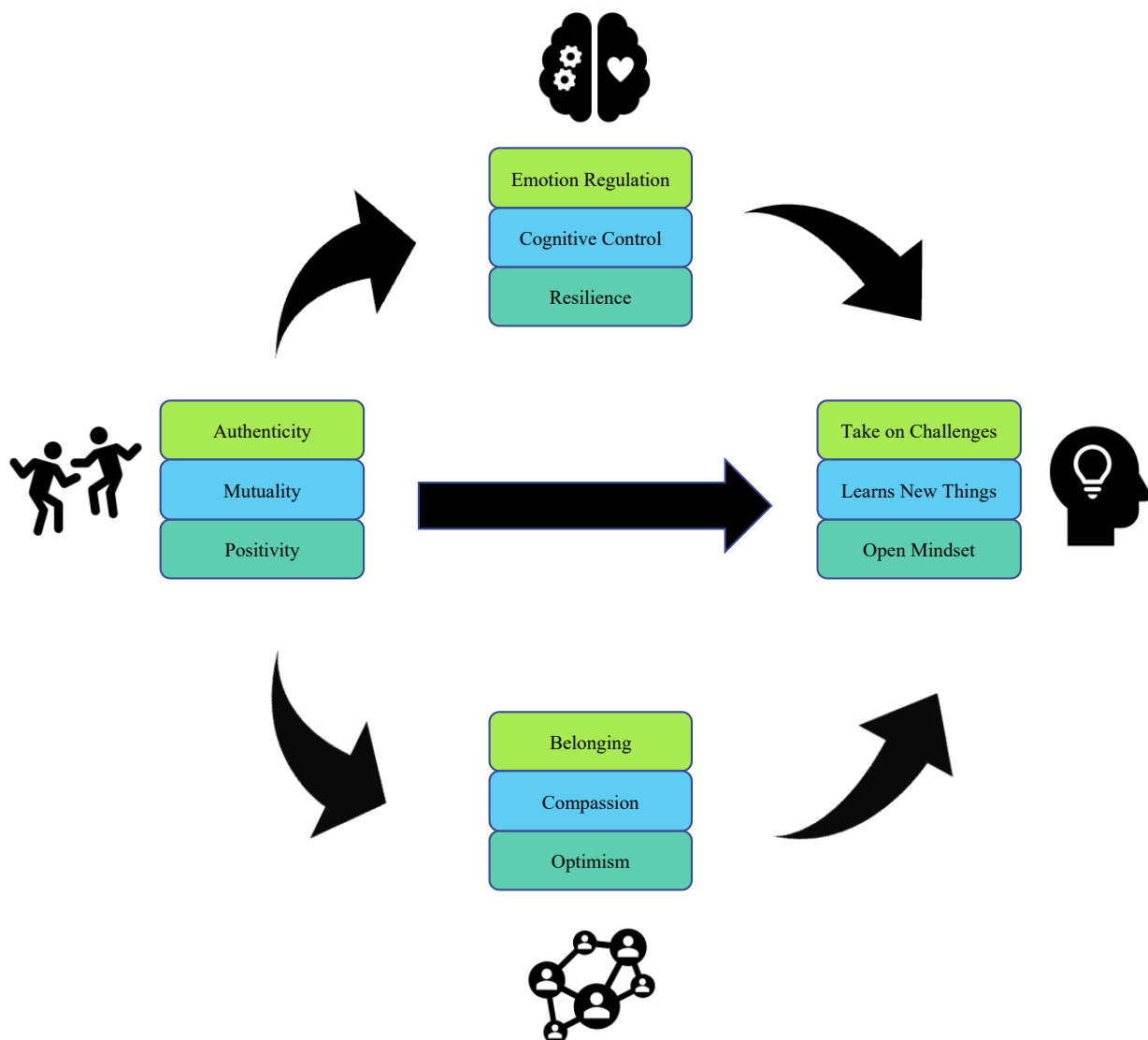
Summary

Historically, people have relied more on family members rather than friends to serve as their main social support in middle and late adulthood, but friendships are becoming increasingly important at this stage of life due to a wide range of cultural and social changes. Longer lifespans, delayed marriage, decreasing fertility, and geographic mobility have contributed to a decline in the nuclear family (Fiori et al., 2020), and the rise of individualism across the globe highlights the increasing importance of friendship for older adults. Through the lens of IPNB,

this study explores the role of friendship and investigates whether neural and social integration mediates the relationship between friendship and personal growth (see Figure 3).

Figure 3

Friendships Promote Personal Growth Through Neural and Social Integration



CHAPTER III

METHODS

It is the mark of an educated mind to be able to entertain a thought without accepting it.

---Aristotle

This study integrated diverse fields of thought to demonstrate how instrumental friendships are in the journey towards personal growth. Friendships were hypothesized to contribute to personal growth by promoting neural and social integration. This study utilized quantitative methodology using a cross-sectional survey from the MIDUS dataset. MIDUS covers a diverse and inclusive sample of American citizens in middle to late adulthood and includes detailed and specific information related to each of the variables within the study. The third wave, completed in 2014, provides the most current information for this investigation. The sample, instruments, and data analysis procedures for the current study will be explained in detail in this section.

Sample

Participants for this study were drawn from the third wave of the MIDUS. The original MIDUS survey took place in 1995/96 at Harvard University, and sought to assess the role of behavioral, psychological, and social factors on the health and well-being of Americans. Recruitment for the original MIDUS study in 1995 was done through a nationally multistage sampling design. Researchers utilized a random digit dial method and included only participants that fulfilled their criteria. Participants were all U.S. citizens, English speaking, non-institutionalized, and between the ages of 24 and 74 years at baseline. After the success of the initial study, additional funding allowed researchers to collect longitudinal data from their participants, leading to MIDUS 2 in 2004/05 and MIDUS 3 in 2013. This study included a

subsample from the third wave of MIDUS 3, which originally included 3,294 participants ranging from 39 years old to 93 years old. After filtering out cases with missing variables, the sample for this study was reduced to 2,714 participants.

Recruitment

Recruitment for the original MIDUS study in 1995 was done through a nationally multistage sampling design. Researchers utilized a random digit dial method and included only participants that fulfilled their criteria. Requirements for inclusion in the study were that the individuals spoke English, they could not be institutionalized, and they were at least 24 years old. The initial interview was completed via telephone, and a follow-up advance letter was mailed, which included a \$2 pre-incentive for participation. An additional \$25 check along with a thank you letter was sent to participants after a 25-minute telephone interview, which was followed by the Self-Administered Questionnaire, which also included \$10 as pre-incentive for completion.

Protection of Human Subjects

For this study, I was approved for exempt status for research using secondary data from the Texas Woman's University Institutional Review Board (IRB) committee. The original MIDUS study was conducted at Harvard University in 1995 after receiving approval from IRB. MIDUS 3 was conducted at the UWSC in 2013/2014 and was funded by the National Institute on Aging. Participants of this wave were previous participants in the first two waves of this study, and thus already had familiarity with the processes and procedures. Informed consent and an explanation of the study was sent to the participants after the initial phone interview in plain language along with a toll-free number, participants could call with any questions or concerns regarding the study. To ensure the protection of participants' identity, a Certificate of Confidentiality was obtained from the federal government. A copy of this certificate was

provided for any participant with concerns about participation due to confidentiality issues. All interviewers that participated in data collection were thoroughly trained, and all interviews were monitored to ensure quality.

Measures

All data for this study came from the Self-Administered Questionnaire of the MIDUS 3 survey. The main variables for this study were all composite variables in the questionnaire, meaning that the variable is the result of a combination of multiple indicator variables. By using composite variables, a more accurate and multidimensional representation can be achieved within the analysis.

Main Variables

Personal Growth

The Personal Growth scale was used to measure the respondents' consistent striving towards learning, growing, and improving as a person. As the main outcome measure, the longer 7-item version of the scale (Ryff, 2013; Ryff & Keyes, 1995) was used for both analyses in this study. Respondents were asked to indicate how much they agreed with the statements including "I am not interested in activities that will expand my horizons," "I think it is important to have new experiences that challenge how you think about yourself and the world," and "For me, life has been a continuous process of learning, changing, and growth." Items were scored on a Likert-type scale ranging from 1 to 7, with some items reverse coded to reflect higher scores for higher standing in the scales. For an item with a missing value, the MIDUS team imputed the mean value of completed items. In cases with at least four valid items, the scale was then calculated through the sum of all items. Cronbach's alpha for the scale was .752 ($M = 38.32$, $SD = 6.85$) indicating adequate reliability.

Friendships

The Positive Relationships with Others scale was used to measure one's support from relationships characterized as mutual, intimate, and positive. Positive Relationships with Others consists of 7 items (Ryff, 2013; Ryff & Keyes, 1995). Items included "Maintaining close relationships has been difficult and frustrating for me," "I often feel lonely because I have few close friends with whom to share my concerns," and "I know that I can trust my friends, and they know they can trust me." Items were scored on a Likert-type scale ranging from 1 to 7, with some items reverse coded to reflecting more positive friendships. The scale was calculated through the sum of all items. Cronbach's alpha for the scale was .775 ($M = 40.62$, $SD = 6.75$), indicating adequate reliability.

Neural Integration

To measure emotional regulation, cognitive control, and resilience in the face of stress, the Problem Focused Coping scale from the COPE Inventory will be used (Carver et al., 1989). The Problem Focus Coping scale combined three subscales that assessed one's emotional regulation, cognitive control, and resilience. Combined, this scale consisted of 12 items that reflect how participants respond to a stressful situation. Items included "I try to see it in a different light, to make it seem more positive," "I do what has to be done, one step at a time," and "I make a plan of action." Items were scored on a Likert-type scale ranging from 1 to 4 with some items reverse-coded so that higher scores reflected higher coping. The scale was then computed by calculating the sum of all values. For items with a missing value, the mean value of the completed items was imputed. Cronbach's alpha for the scale was .899, indicating adequate reliability.

Social Integration

The sense of belonging, compassion, and optimism that occurs because of an individual's repeated positive connections and interactions with other people was measured using items from several subscales of the Social Well-Being scale, including Social Integration, Acceptance of Others, Social Contribution, and Social Actualization (Keyes, 1998). To evaluate the appropriateness of the 12 items within these subscales as it relates to the definition of social integration within this study, an exploratory factor analysis was conducted to verify factor loadings and remove unnecessary items. The EFA resulted in three components extracted, corresponding to the sense of belonging, compassion, and optimism. Each component corresponded to a characteristic of social integration within this study, thus all 12 items were included from the original scale. Items included "I feel close to other people in my community," "I have something valuable to give the world," and "I believe that people are kind." Items were originally scored on a Likert-type scale ranging from 1 to 7, with some items reverse coded to reflect higher scores for higher standing in the scales. In order to better interpret and evaluate the mediation output, the variables were converted from a 7-point scale to a 4-point scale by using the equation $X = (x - a) / (b - a)$; Transforming different Likert scales, n.d.). This adjustment put both mediation variables on the same scale, permitting a comparable measurement in the unstandardized output (Hayes & Rockwood, 2017). The total scale was calculated through the sum of all items. Cronbach's alpha for the scale was .813, indicating adequate reliability.

Control Variables

Self-Esteem

Self-esteem, which is commonly associated with personal growth, was measured using items from Rosenberg's Self-Esteem Scale (Rosenberg, 1979). Respondents were asked how

much they agreed to statements such as “I take a positive attitude toward myself” or “On the whole, I am satisfied with myself.” This variable was calculated by taking the sum of seven items rated on a 7-point scale, with some items reverse coded so that higher scores reflected a higher sense of self-esteem. Cases with fewer than five valid items on the scale were not computed. Cronbach’s alpha for the scale was .757.

Mental Health

Respondents were asked to rate their current mental and emotional health on a scale from 1 (*Excellent*) to 5 (*Poor*), such that higher scores indicated more mental health concerns. For this study, this variable was reverse scored for consistency with the other variables in this study, such that higher scores reflected better mental health. This was included as a control variable as mental health is associated with greater personal growth (Robitschek & Keyes, 2009) and neural integration (Siegel, 2001).

Education

Respondents were asked to report the highest level of education completed. Education is commonly associated with friendship (Allan, 2008; Galupo & Gonzalez, 2013; Pahl & Pevalin, 2005), neural integration (Becht et al., 2021; Taebi et al., 2020), social integration (Bahns, 2019; Gibbons & Olk, 2003; Nicolaisen & Thorsen, 2017), and personal growth (Lachman & Weaver, 1998), so this variable was included to account for variance on the study’s main variables.

Age

This study will examine the dynamics of relationships in middle and later adulthood because this is the age group in which relationships are typically prioritized and stable (Miche et al., 2013), which likely impact one’s friendships and social integration. Respondents’ ages will be included in the analysis as a control variable to account for the variance in personal growth

associated with aging, as personal growth tends to decline with age (Toyama et al., 2020).

Neuroimaging research also indicates a decrease of gray matter volume with age reflecting a difference in neural integration (Fuchs & Flügge, 2014).

Sex

Respondents were asked to choose either male or female, but no information was provided regarding respondents' gender identity for this sample. Gender has been associated with differences in personal relationships and personal growth in adult populations (Toyama et al., 2020); however, the construct of gender has become more fluid for younger generations (James et al., 2016).

Analysis Plan

After receiving IRB approval, the dataset was downloaded through the ICPSR website. Cases that had any missing data were excluded from this study. Preliminary analyses and primary analyses were done through IBM SPSS version 28.

Preliminary analyses were done initially to test for all relevant assumptions. Each variable was assessed for normality, with skewness less than 3 and kurtosis less than 10 (Field, 2013). To test for linearity and outliers, a scatterplot was evaluated. All predictor variables were also assessed for multicollinearity, through bivariate correlation and assessing the variable inflation factor (VIF) and Tolerance to ensure VIF is less than 3 and Tolerance is greater than .33 (Field, 2013). After evaluating missingness or significant outliers, the remaining cases were included in a comprehensive demographic analysis. All analyses were evaluated based on statistical significance, effect sizes, and confidence intervals.

Hypothesis 1

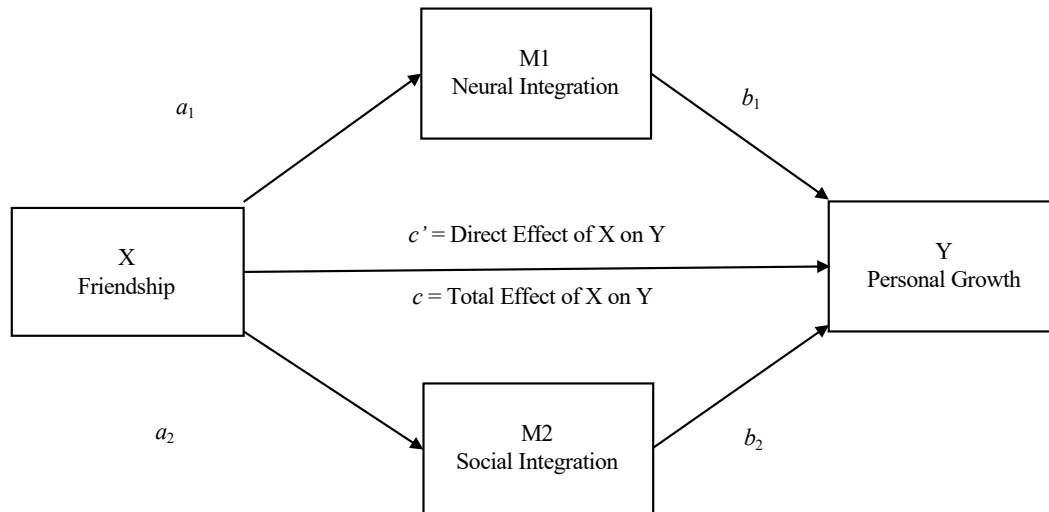
Hypothesis 1 stated that friendships are significantly associated with personal growth, while controlling for self-esteem, mental health, education, age, and sex. A hierarchical linear regression was conducted to evaluate the influence of friendship on personal growth while controlling for self-esteem, mental health, education, age, and sex. All control variables will be entered in Step 1 and Friendships will be entered in Step 2 to assess its unique contributions to the outcome variable, Personal Growth.

Hypotheses 2 & 3

The second and third hypotheses built upon the first analysis by exploring potential mechanisms through which friendships effect personal growth. Hypothesis 2 stated that neural integration mediates the relationship between friendship and personal growth while controlling for self-esteem, mental health, education, age, and sex. Similarly, hypothesis 3 stated that social integration mediates the relationship between friendship and personal growth while controlling for self-esteem, mental health, education, age, and sex. The analyses for both hypotheses were simultaneously tested through a parallel mediation model, as shown in Figure 4. Self-esteem, mental health, education, age, and sex were all entered as covariates. Covariates were included in all regression analyses to rule out explanations that the effects were due to those variables (Hayes & Rockwood, 2017).

Figure 4

Path Diagram of Parallel Mediation Model



Note. X is the independent variable; Y is the dependent variable; M1 and M2 are mediating variables; c is the total effect of X on Y without taking mediators into account; c' is the direct effect of X on Y while controlling for M1 and M2. Indirect effects are calculated through the product of two processes: the effect of X on M (a_k) and the effect of M on Y (b_k) in a model with k mediators. In this parallel mediation model, the specific indirect effects of M1 and M2 are calculated as follows: $M1 = a_1b_1$ and $M2 = a_2b_2$. The total indirect effects are calculated through the sum of both specific indirect effects ($a_1b_1 + a_2b_2$; Hayes, 2013).

Mediation Analysis

A parallel mediation analysis was performed using the PROCESS version 3.5 macro for SPSS (Hayes, 2013). PROCESS is a validated and free add on for SPSS that uses ordinary least squares (OLS) regression-based analyses for mediation and moderation. Mediation analyses are used to evaluate how the effect of an independent variable operates on a dependent variable and helps to identify critical components for intervention in family science research (Hayes & Rockwood, 2017; MacKinnon, 2011; MacKinnon et al., 2000). As suggested by Hayes and Rockwood (2017), inference in mediation analyses is focus on indirect effects. The indirect effects are estimated through the product of the effect on the independent and mediator variable,

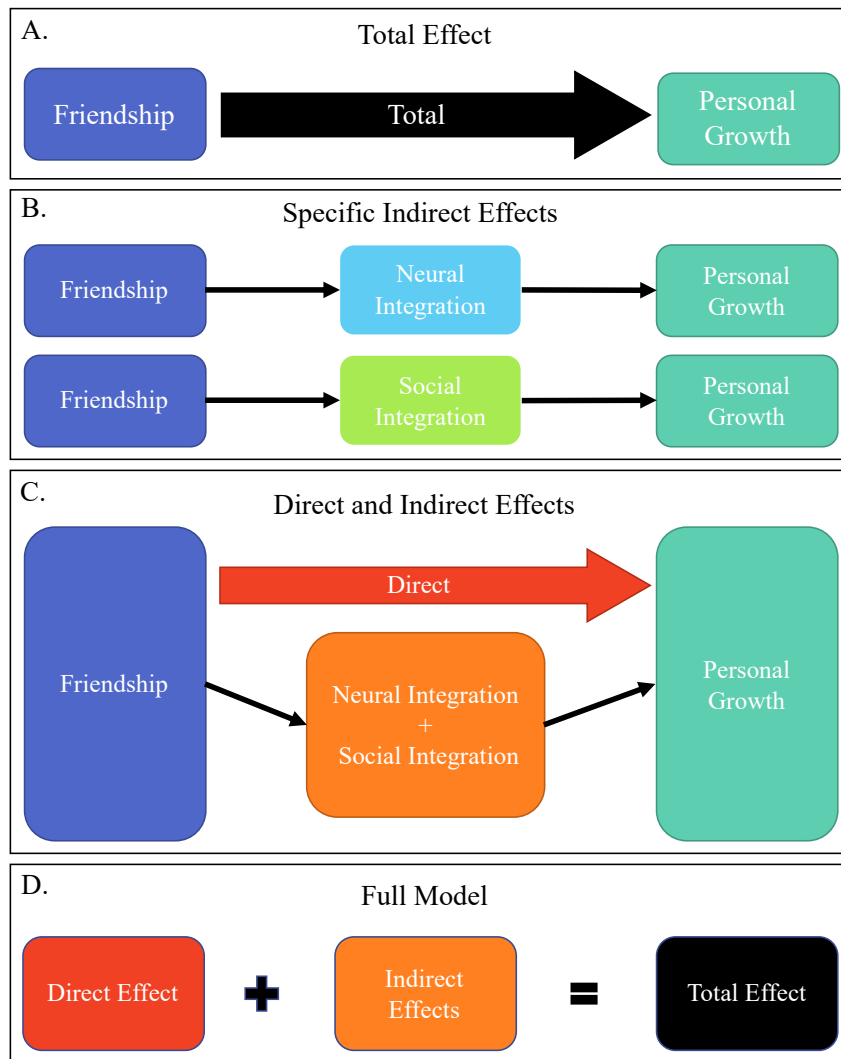
and the mediator and dependent variable. Parallel mediation operates through the same simple mediation model in PROCESS (Model 4) and allows researchers to test more than one mediator simultaneously while controlling the effects produced by the other variables in the study. See Figure 4 for the path diagram of the parallel mediation analysis in this study.

Specific indirect effects were calculated for both mediators through two simultaneous processes, as shown in Figure 4. The specific indirect effect of neural integration (M1) was calculated through the product of the effect of friendship on neural integration (a_1) and the effect of neural integration on personal growth (b_1) when controlling for all other variables, or a_1b_1 . Likewise, the specific indirect effect of social integration (M2) was calculated through the product of the effect of friendship on social integration (a_2) and the effect of social integration on personal growth (b_2) when controlling for all other variables, or a_2b_2 .

The conceptual diagram of the full model is shown in Figure 5. Because this model has two mediators, the full indirect effect is calculated through the sum of both specific indirect effects ($a_1b_1 + a_2b_2$). As reflected in the Figure 5, the sum of the direct and indirect effects is equal to the total effect. In other words, the indirect effect reflects the difference between the total effect (c) of friendship on personal growth and the direct effect (c') of friendship on personal growth when controlling for the unique effects of both neural integration (a_1b_1) and social integration (a_2b_2). Any indirect effect that is different than zero reflects mediation (Hayes, 2013).

Figure 5

Conceptual Figure of Total Effects, Specific Indirect Effects, Direct and Indirect Effects, and the Full Model in a Parallel Mediation Model



Note. This conceptual diagram shows the relationship between the variables within this study and the various effects. Panel A: The total effect of friendship on personal growth without controlling for any mediators. Panel B: The parallel mediation model reflects two simple mediation processes for both mediators. For each mediation analysis, the other mediator is used as a control variable. In other words, the mediating effects of neural integration are calculated while controlling for social integration and the mediating effects of social integration are calculated while controlling for neural integration. Panel C: The direct effect of friendship on personal growth controls for both neural and social integration. Panel D: The sum of the direct and the indirect effects equal the total effect.

In addition to model coefficients, PROCESS provides bootstrap confidence intervals for inference in parallel mediation models. To reject the null hypothesis, the confidence intervals of the indirect effects cannot cross zero. In this model, 5,000 bootstrap samples were used to calculate 95% confidence intervals.

Summary

The use of secondary data to analyze the predictive relationship between supportive friendships and personal growth provided an appropriate and effective method for this quantitative research study. The descriptive statistics of the sample's demographic data revealed the extent to which this sample represents the population based on age, gender, ethnicity, education, and income level. The findings from this study provide family science researchers and clinicians more information regarding the significance of friendships, as well as exposure to the relevant concepts of interpersonal neurobiology.

CHAPTER IV

RESULTS

The purpose of this study was to integrate diverse fields of thought to demonstrate how friendships uniquely promote personal growth through the lens of IPNB. This study utilized quantitative methodology with a cross-sectional survey from the third wave of MIDUS 3 to investigate whether neural and social integration mediated the effects between friendship and personal growth. In the following sections, the sociodemographic characteristics of the sample, descriptive statistics, preliminary analyses and main analyses will be provided. All preliminary analyses were conducted to assess whether the variables within the study met the assumptions for each model. The chapter will then conclude with the results of the main analyses.

Sociodemographic Characteristics

As shown in Table 1, the sample used for this study included 2,714 total participants. All cases with missing values in the original MIDUS sample were excluded. The average age of participants in the current study was 63.6 years, ranging from 39 to 93 years old, with slightly more females (55%) than males. The vast majority of participants were White (90%) and married (67%). The sample for this study was highly educated, with most of the participants reporting at least some college education (76%).

Table 1

Sociodemographic Characteristics of Participants (N = 2,714)

Characteristic	<i>n</i>	%
<i>Gender</i>		
Female	1,488	55
Male	1,226	45
<i>Race</i>		
White	2,429	90
Black	86	3
Native American	21	1

Characteristic	<i>n</i>	%
Asian	9	<1
Pacific Islander	1	<1
Other	151	6
<i>Education</i>		
Less than high school	124	5
High school/GED	628	23
Some college	524	19
Associate degree	273	10
Bachelor's degree	602	22
Some graduate school	67	2
Master's degree	346	13
Ph.D., M.D., Ed.D.	143	5
<i>Marital Status</i>		
Married	1828	67
Separated	35	1
Divorced	367	14
Widowed	287	11
Never Married	193	7

Preliminary Analyses

Preliminary analyses were conducted to assess the assumptions for multiple regression and mediation using IBM SPSS version 28. First, descriptive statistics were conducted on all variables in this study. Next, tests were conducted to ensure the study's design met all requirements for regression analyses, including normality, linearity, multicollinearity, and independence of residuals.

To test for normality, variables were assessed for both skewness and kurtosis. Values for skewness and kurtosis for each variable fell within an acceptable range, with skewness below ± 3 and kurtosis less than ± 10 (see Table 2; Field, 2013). There was independence of residuals, as assessed by a Durbin-Watson statistic of 2.01. The value of the Durbin-Watson statistic should be between 1 and 3 to ensure there is no correlation between residuals (Field, 2013). In addition, no multicollinearity was detected, as shown by the VIF and Tolerance, as VIF was less than 3

and Tolerance greater than .33 (Field, 2013). In summary, all variables in the study met the assumptions for multiple linear regression.

Table 2

Descriptive Statistics for Study Variables (N = 2,714)

	<i>M</i>	<i>SD</i>	<i>Range</i>	<i>Skewness</i>	<i>Kurtosis</i>	<i>α (items)</i>
Personal Growth	38.3	6.8	14-49	-0.48	-0.37	.75 (7)
Friendship	40.6	6.7	14-49	-0.77	0.05	.78 (7)
Neural Integration	37.7	6.1	14-48	-0.36	-0.12	.90 (12)
Social Integration	34.0	5.5	13-48	-0.09	-0.04	.83 (12)
Self-Esteem	37.7	7.1	12-49	-0.83	0.29	.76 (7)
Mental Health	3.60	1.0	1-5	-0.25	-0.41	

Bivariate Correlations

Bivariate correlations were also conducted to assess for multicollinearity. All main variables within the study were significantly related (see Table 3). Additionally, all bivariate correlations were below .80, indicating no issues with multicollinearity (Field, 2013). Most control variables also showed significant correlations to the study's main variables, although age was not significantly related to neural integration ($r = .02, p = .28$), social integration ($r = .02, p = .06$), or mental health ($r = .01, p = .68$), and sex was not significantly related to neural integration ($r = .04, p = .06$) or age ($r = -.02, p = .42$).

Table 3*Correlations Table for Study Variables (N = 2,714)*

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Personal Growth	-								
2. Friendships	.58***	-							
3. Neural Integration	.52***	.37***	-						
4. Social Integration	.52***	.50***	.34***	-					
5. Self-Esteem	.56***	.55***	.40***	.43***	-				
6. Mental Health	.34***	.32***	.24***	.30***	.43***	-			
7. Education	.26***	.07***	.14***	.28***	.16***	.21***	-		
8. Age	-.06**	.13***	.02	.02	.10***	.01	-.12***	-	
9. Sex	.06**	.16***	.04	.06**	-.06***	-.08***	-.12***	-.02	-

Note. * $p < .05$. ** $p < .01$. *** $p < .001$.

Main Analyses

Research Hypothesis 1

The first research hypothesis in this study sought to explore whether friendships are significantly associated with personal growth, while controlling for self-esteem, mental health, education, age, and sex. To test this hypothesis, a hierarchical linear regression was used to evaluate the influence of friendship on personal growth while controlling for self-esteem, mental health, education, age, and sex. The regression analysis was conducted in two steps. In the first step of the regression, the control variables were entered together. Friendship was then added in the second step of the regression analysis to evaluate its additional influence.

Both models were significant, as indicated by the F-test (Model 1: $F(5, 2886) = 358.01, p < .001$; Model 2: $F(6, 2885) = 428.01, p < .001$). The first model, which included intrapersonal characteristics, accounted for 38% of the variance in personal growth. With the addition of friendships in the second step, the total model accounted for 47% of the variance, a statistically

significant increase of 9% ($p < .001$). Therefore, the model fit the data well and accounted for nearly half of the variance in personal growth.

As shown in Table 4, all variables in both models were shown to be significant. In support of the literature, personal growth slightly decreased with age in that one year is associated with a slight decrease in personal growth ($\beta = -0.13, p < .001$). Also, as hypothesized, better mental health ($\beta = .10, p < .001$), more education ($\beta = .16, p < .001$), and higher self-esteem ($\beta = .51, p < .001$) were all positively and significantly associated with personal growth.

In addition, friendship had the greatest contribution towards personal growth, as indicated by the standardized beta coefficient ($\beta = .37, p < .001$). Friendships contribute significantly to personal growth beyond the influence of self-esteem, mental health, education, age, and sex.

Table 4

Multiple Regression Results for Personal Growth ($N = 2,714$)

Variable	Model 1			Model 2		
	<i>b</i>	<i>SE</i>	β	<i>b</i>	<i>SE</i>	β
Self-Esteem	.50	.02	.51***	.31	.02	.33***
Mental Health	.73	.12	.10***	.40	.11	.06***
Education	.56	.05	.16***	.55	.05	.16***
Age	-.06	.01	-.10***	-.08	.01	-.13***
Sex	1.71	.20	.12***	.69	.19	.05***
Friendship				.38	.02	.37***

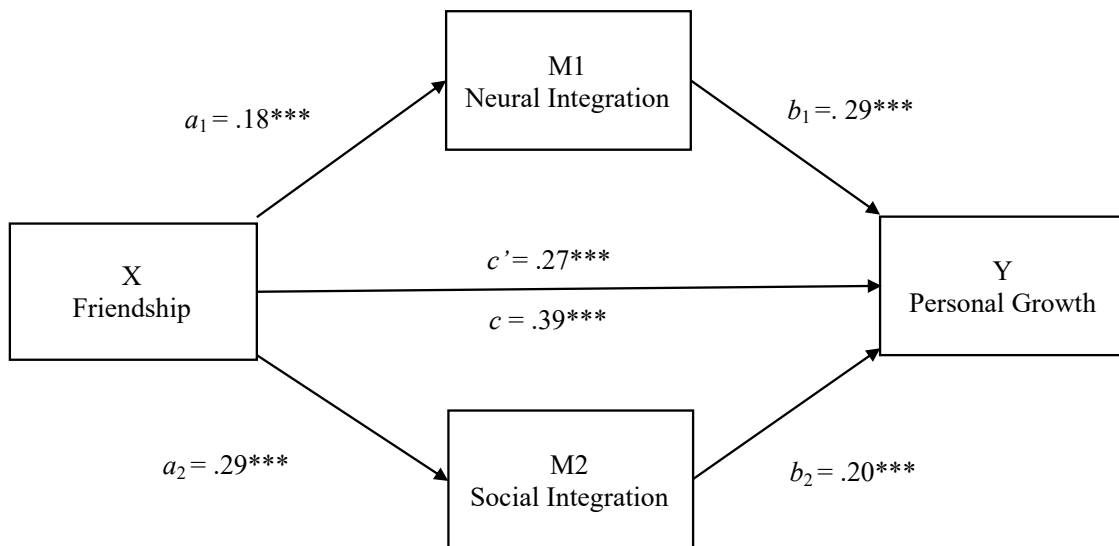
Research Hypotheses 2 & 3

The second and third research hypotheses for this study sought to explore whether neural integration and social integration mediates the relationship between friendship and personal growth while controlling for self-esteem, mental health, education, age, and sex. For both

Research Hypotheses 2 and 3, the analyses were conducted using Hayes' (2013) PROCESS macro (v2.13, Model 4). In this model, friendship was entered as the predictor variable, personal growth was entered as the outcome variable, both neural and social integration were parallel mediators, and self-esteem, mental health, education, age, and sex were entered as covariates. Indirect effects were tested through bootstrap sampling. All presented effects are unstandardized and presented in Figure 6 and Table 5.

Figure 6

Path Diagram of Parallel Mediation Model With Unstandardized Coefficients



Note. All effects are unstandardized beta coefficients. X is the independent variable; Y is the dependent variable; M1 and M2 are mediating variables; c is the total effect of X on Y without taking mediators into account; c' is the direct effect of X on Y while controlling for M1 and M2; a_1 is the effect of friendship on neural integration; b_1 is the effect of neural integration on personal growth; a_2 is the effect of friendship on social integration; b_2 is the effect of social integration on personal growth.

Table 5

Regression Coefficients, Standard Errors, and Confidence Intervals for the Influence of Friendship on Personal Growth through Neural Integration and Social Integration as Parallel Mediators (N=2,714)

Predictor	Mediator(s)	Outcome	Variable	<i>b</i> (SE)	CI [<i>LL</i> , <i>UL</i>]
<i>Pathway Coefficients</i>					
Friendship		Neural Integration	<i>a</i> ₁	.18*** (.02)	[0.15, 0.22]
Friendship		Social Integration	<i>a</i> ₂	.29*** (.02)	[0.26, 0.33]
Neural Integration		Personal Growth	<i>b</i> ₁	.29*** (.02)	[0.26, 0.32]
Social Integration		Personal Growth	<i>b</i> ₂	.20*** (.02)	[0.16, 0.24]
<i>Specific Indirect Effects</i>					
Friendship	Neural Integration	Personal Growth	<i>a</i> ₁ <i>b</i> ₁	.05*** (.01)	[0.04, 0.07]
Friendship	Social Integration	Personal Growth	<i>a</i> ₂ <i>b</i> ₂	.06*** (.01)	[0.05, 0.07]
<i>Total Indirect Effects</i>					
Friendship	Neural Integration + Social Integration	Personal Growth	<i>a</i> ₁ <i>b</i> ₁ + <i>a</i> ₂ <i>b</i> ₂	.11*** (.01)	[0.09, 0.13]
<i>Direct Effects</i>					
Friendship		Personal Growth	<i>c</i> '	.27*** (.02)	[0.24, 0.31]
<i>Total Effects</i>					
Friendship	Neural Integration + Social Integration	Personal Growth	<i>c</i>	.39*** (.02)	[0.35, 0.42]

Note. Indirect paths tested with 5,000 bootstraps. CI = 95% confidence interval; LL = lower limit; UL = upper limit.

Neural Integration as a Mediator

The direct effect of friendships on personal growth was statistically significant (path *c*' ; *b* = .27, *p* < .001; see Table 5). Friendship was also positively related to neural integration (path *a*₁; *b* = 0.18, *p* < .001) and neural integration was positively related to personal growth while controlling for friendship (path *b*₁; *b* = 0.29, *p* < .001). A 95% confidence interval based on 5,000 bootstrap samples indicated that the direct effect through neural integration holding all

other variables constant was above zero (path a_1b_1 ; $b = 0.05, p < .001$). In other words, neural integration was shown to partially mediate the relationship between friendship and personal growth, supporting the second hypothesis.

Social Integration as a Mediator

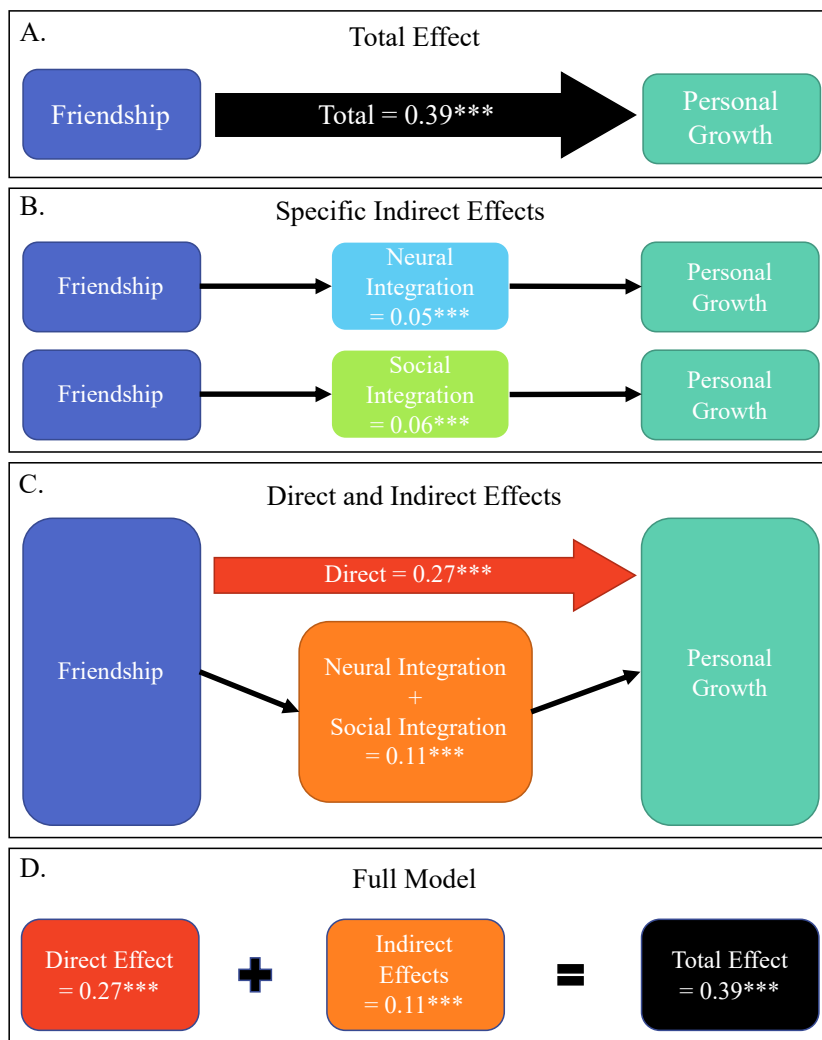
As described above, a parallel mediation model through the PROCESS macro was used to test the mediation effects of both neural and social integration on the relationship between friendship and personal growth. Friendship was positively related to social integration (path a_2 ; $b = .05, p < .001$) and social integration was positively related to personal growth while controlling for friendship (path b_2 ; $b = .06, p < .001$). The bootstrap confidence interval for the indirect effect of social integration using 5,000 bootstrap samples resulted in the confidence intervals above zero (path a_2b_2 ; $b = .06, p < .001$), which indicates that there is a significant indirect effect for social integration between friendship and personal growth. In other words, both neural integration and social integration were shown to partially mediate the relationship between friendship and personal growth, supporting the third hypothesis.

Combined Mediating Effects

Results from the parallel mediation analysis indicate that friendship is indirectly related to personal growth through its relationships with neural integration and social integration. As shown in Figure 7, all direct and indirect effects within this model were significant, including the full indirect effect (path $a_1b_1 + a_2b_2$; $b = 0.11, p < .001$). The full model accounted for nearly 47% of the variance in personal growth, as indicated by the F-test ($F(6, 2660) = 391.31, p < .001$).

Figure 7

Conceptual Figure of Total Effects, Specific Indirect Effects, Direct and Indirect Effects, and the Full Model in a Parallel Mediation Model With Effect Sizes



Note. All presented effects are unstandardized.

Covariates

Covariates were used in the parallel mediation regression model to account for additional individual variables that are associated with friendship and personal growth. As shown in Table 6, all covariates had significant effects on both mediator variables and the outcome variable, except for the insignificant effects of age on neural integration ($b = -.01$; $p = .145$) and

insignificant effects of sex on social integration ($b = .48$; $p = .445$). For all other effects, bootstrapping at 95% confidence intervals did not cross zero.

Table 6

Covariate Influences on Variables (N = 2,714)

Covariate	Consequent					
	M1: Neural Integration		M2: Social Integration		Y: Personal Growth	
	<i>b</i>	SE	<i>b</i>	SE	<i>b</i>	SE
Self-Esteem	.22***	.02	.02	.01***	.21	.02***
Mental Health	.29**	.13	-.08	.02***	-.21	.10*
Education	.23**	.06	.09	.01***	.28	.04***
Age	-.01	.01	-.01	.01**	-.07	.01***
Sex	.45*	.22	.02	.029	.48	.18**

Note. Indirect paths tested with 5,000 bootstraps. CI = 95% confidence interval

* $p < .05$. ** $p < .01$. *** $p < .001$.

Summary

The results of the analysis support all three hypotheses in this study. Friendships were shown to contribute meaningfully to personal growth above and beyond the role of intrapersonal factors, as supported through a hierarchical linear regression. Also, the influence of friendships on personal growth was partially mediated through neural and social integration, as revealed through a parallel mediation model using the PROCESS syntax. These results indicate that friendships contribute to both neural integration and social integration.

CHAPTER V

IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSION

The current study sought to explore how adult friendships contribute to personal growth through the lens of IPNB. Personal growth, as defined within the current study, refers to the consistent striving towards learning, growing, and improving as a person (D. S. Lee et al., 2018). While Western culture suggests that personal growth comes from an individual's internal resources, like motivation, ambition, or persistence, MFT and IPNB are based upon the notion that humans grow in connection with other people. According to IPNB, positive interactions with close others activate integrative neural networks within the brain, and with enough repetition, can transform the structure and function of the brain (Siegel, 2001). This systemic approach to mental health validates the basic assumptions of MFT while also providing scientific evidence that relationships are powerful agents of change. As the general population ages and families grow smaller in size, research on friendship in adulthood will become increasingly important for the field of MFT (Blieszner et al., 2019). This study integrates diverse fields of research to evaluate whether neural and social integration mediate the relationships between friendships and personal growth.

Discussion

Research Hypothesis 1: Friendship and Personal Growth

As Western culture continues to promote the notion that personal growth comes from individual traits like self-esteem and autonomy, this study indicates that personal growth also comes from one's relationships—specifically, their friendships. Results from the hierarchical linear regression supported the first hypothesis that friendships are significantly associated with personal growth, while controlling for self-esteem, mental health, education, age, and sex. This

finding is consistent with numerous other research studies from various fields that champion the role of friendship in well-being (Blieszner et al., 2019; Cleary et al., 2018; Dunbar, 2018; Nicolaisen & Thorsen, 2017; Sarris et al., 2020). In this study, friendship significantly influenced personal growth above and beyond the impact from one's individual traits, offering additional support to the systemic foundations of both MFT and IPNB.

Individual Factors and Personal Growth

Most individual factors, including self-esteem, mental health, and education, were significantly and positively related to personal growth. Age was the only individual factor that was negatively associated with personal growth, a finding that is consistent with previous studies (Huxhold et al., 2014; Ryff & Singer, 2008). Self-esteem, a factor that is frequently cited as a main contributor to personal growth (Ali Yıldız & Karadaş, 2017; Kinnunen et al., 2008; Marshall et al., 2014; Yang et al., 2014), showed the most significant positive influence other than friendship. Previous longitudinal studies have explored the relationship between social support and self-esteem, specifically whether self-esteem is the cause or consequence of social support (Kinnunen et al., 2008; Marshall et al., 2014). In contrast, this study illuminates the distinct and significant contributions of both self-esteem and friendship on personal growth, confirming the positive influence of self-esteem on personal growth while also validating that individual factors including self-esteem do not fully account for the powerful influence of friendships. These findings suggest that taking on challenges, learning new things, and growing as an individual involves both individual and relational factors.

Friendship Selection and Personal Growth

For this study, friendship is defined as a volitional relationship characterized by emotional intimacy, mutuality, and positivity. Unlike other relationship domains, like relatives or

colleagues, friendships are chosen rather than given (Allan, 2008). People often choose friends with similar interests or characteristics that they like within themselves (Mcpherson et al., 2001), resulting in relationships based on affirming and positive feedback (Davey et al., 2010). Spending time with friends is typically a positive experience, as friends often share the same sense of humor (Curry & Dunbar, 2013a; Flamson & Barrett, 2008), participate in mutually enjoyable activities together (Heo et al., 2017; Lippke et al., 2021; Sharifian et al., 2020), and find validation for their authentic identity (Chavez & Wagner, 2020). A possible interpretation of the results from this study could be that individuals choose friends who reinforce their own personal strengths, further develop the traits that they admire within themselves, and facilitate more positive emotions through repeated interactions, thereby leading to personal growth.

Research Hypothesis 2: Neural Integration

As research studies continue to validate the influence of friendships on a range of positive outcomes the means through which this occurs is less understood. To better understand the influence of friendship on personal growth, a second analysis was performed using a parallel mediation analysis in which neural integration and social integration were entered as parallel mediators. Neural integration refers to the process of linking differentiated neural networks within the brain, promoting emotion regulation, cognitive flexibility, and resilience in the face of stress. For this study, neural integration was hypothesized to mediate the relationship between friendship and personal growth due to the bidirectional influences between the brain, the mind, and relationships. The analysis was done through PROCESS using OLS regression-based analysis while controlling for self-esteem, mental health, education, age, and sex. As expected, the results from the analysis confirmed the second hypothesis, indicating that neural integration

acts as a partial mediator between friendship and personal growth. These findings suggest that friendships influence personal growth in part due to an increase in neural integration.

Friendship Development and Personal Growth

Friendships develop through meaningful conversations and mutual self-disclosure. The act of forming a cohesive narrative about one's life experiences is inherently rewarding and engages various diverse neural networks, including those involved in attention, emotions, language, and memory (Cohn-Sheehy et al., 2021; Tamir & Mitchell, 2012). Further, listening to a friend's emotional stories synchronizes conscious and subconscious neural processes between the speaker and the listener, providing opportunities for neural integration below one's level of consciousness and strengthening the emotional connection between friends (Kinreich et al., 2017; Nummenmaa et al., 2012; Pérez et al., 2021). In fact, many of the benefits of talk therapy occur through telling emotional stories in a safe, open, and receptive therapeutic relationship (Baldini et al., 2014; Geller & Porges, 2014; Siegel, 2006, 2019). While friends cannot replace therapists, findings from this study suggest that the intimacy that develops from sharing personal stories with a trusted friend may help facilitate neural integration and thus, personal growth.

Friendship Maintenance and Personal Growth

A distinguishing factor that separates friendships from family relationships is the additional maintenance that is required to sustain a friendship. Because friendship is considered volitional, friendship requires both time and effort from both partners to maintain the relationship. Friendships can promote continued neural and social integration by exposing individuals to different thoughts and ideas without the resistance that might come from those outside of their social group (Dricu et al., 2020; Leszczensky et al., 2019; O'Gorman & Roberts, 2017). The reciprocity required to maintain friendship also forces people out of perpetual self-

referential thought (Alcalá-López et al., 2018; Esch & Stefano, 2011; Weng et al., 2013), and encourages empathy and generosity. Because of the tendency for friends to share many of the same attitudes and perspectives, it is much easier for friends to experience empathy for each other. Without the sense of obligation or loyalty inherent in family relationships, both giving and receiving support from one's friends feels more rewarding (Davey et al., 2010; Fareri, Chang, & Delgado, 2012; Wagner et al., 2014). The increased activity in the neural reward circuitry of the brain reinforces the positive effects of mutual support and can facilitate the development of compassion for those outside of one's family (DeSteno, 2015; Sanchez et al., 2020).

Research Hypothesis 3: Social Integration

The results from the parallel mediation analysis also supported the final hypothesis that social integration mediates the relationship between friendship and personal growth. In this study, social integration refers to the sense of belonging, contribution, and social optimism that occurs as a result of an individual's repeated positive connections and interactions with other people. As in previous studies, the results of this analysis confirm that social integration is an important component in well-being and is fostered through the development and maintenance of friendship (D. S. Lee et al., 2018; Rook & Ituarte, 1999; Siebert et al., 1999). Further, neural integration and social integration had comparable effect sizes as mediators, and the full model accounted for about half of the variance in personal growth. This finding illustrates the interconnection between neural integration and social integration, further supporting the notion that the brain is a social organ (Cozolino, 2017).

Social Integration Through Friendship

As research continues to reveal, one of the most fundamental needs for human beings is a sense of belonging (Baumeister & Leary, 1995). This develops when one can be authentic within

their relationships and feel seen, validated, and accepted for their true, authentic self (Lambert et al., 2013). Friendships harness an individual's capacity towards growth by allowing individuals to reap many of the powerful benefits of close relationships without the hindrance of challenges more typical to family relationships – like a sense of obligation, caretaking duties, or financial stressors. Even in healthy families, one may be hesitant to reveal parts of themselves for fear of judgement or conflict. Family relationships are constant, even when they are negative. Because of the brain's negativity bias, it is vital to create and maintain positivity within one's social relationships, as the quality of relationships is the most powerful predictor of one's health, well-being, and happiness (Cozolino, 2014). Friendships provide a safe relationship in which people can explore parts of themselves that they may not feel safe discussing with family, and their continued presence through adulthood reflect and reinforce the many facets of one's unique identity.

Personal Growth in Adulthood

Findings from this study emphasize the integral role of friendship in adulthood. In both the hierarchical linear regression and the parallel mediation model, age was the only factor that had a negative association with personal growth. This finding potentially reflects the decrease in neuroplasticity with age (Fuchs & Flügge, 2014). Although neuroplasticity allows the brain to grow and change throughout the lifespan, it becomes increasingly difficult as one ages (Cozolino, 2018; Fuchs & Flügge, 2014). Further, social networks tend to shrink with age, and adults are less likely to add same-aged family members as they grow older. Friendships can provide older adults the opportunity to engage in relationships that provide validation through shared interests and perspectives, mutuality without the burden of obligation, and interactions that promote both cognitive and physical benefits (Gillespie et al., 2015; Huxhold et al., 2014;

Watt et al., 2014). As neuroimaging studies continue to reveal the dangers of loneliness and isolation on psychological and physical decline, social integration becomes especially pertinent to older adults who are already at risk. Results from this study reveal the capacity for friendships to support neural and social integration, thus contributing to personal growth.

Implications

Theoretical Implications

While different theoretical frameworks offer varying conceptualizations of the influence of social relationships, this study utilized the consilient approach of IPNB. Specifically, IPNB emphasizes the systemic nature of human functioning through the bidirectional influence between the brain, the mind, and relationship (Siegel, 2001). Through understanding the essential role of interpersonal relationships on an individual's mind and brain, researchers and clinicians can better recognize why friendships are so influential on personal growth.

As the field of MFT continues to adapt to a changing population, their systemic viewpoint can remain intact while also broadening their relational interventions. MFT clinicians can benefit from the consilient approach of IPNB, as it aligns with the systemic notions of the field's predecessors while also simplifying the various theories of human development, social relationships, and mental health into one overarching framework. Just as a trained MFT clinician can cut through extraneous context to identify the core processes within a relational system, IPNB consolidates findings from across scientific disciplines and identifies the core principles relevant to human functioning. IPNB allows MFT researchers and clinicians to simplify and broaden their work by acknowledging the bidirectional forces between the brain, the mind, and relationships, and the importance of both differentiation and integration in healthy systems.

Research and Education Implications

While the empirical research incorporating neuroscience into counseling and family therapy is still in its infancy, its quickly growing traction in the field (Bailey, 2022). New and experienced counselors crave information on how to incorporate information about the brain into their clinical practice (Beeson, Kim, et al., 2019); however, there is little agreement on how to include this into an already full training program. Some argue that neurobiology should be integrated into each course, similar to how educators have incorporated multicultural competencies (Busacca et al., 2011). Without a foundation from their own training programs, counselor and therapist educators feel ill-prepared to teach content on this topic and reading research from this field can be challenging (Beeson, Kim, et al., 2019; Lebow, 2014b). Fortunately, several authors have consolidated findings from neuroscience and concepts from IPNB and applied it to the work of MFT professionals (Beeson, Field, et al., 2019; Corbin & Norton, 2020; Fishbane, 2007; Jones et al., 2015; Patterson & Vakili, 2014; Tootle, 2003). Interdisciplinary integration within the field of MFT facilitates a more comprehensive and balanced view of individual and relational therapeutic support. Without this integration, scientific fields are at risk of becoming disconnected from the real-world issues they seek to resolve.

Clinical Implications

The inclusion of friendships in MFT literature provides clinicians and clients the opportunity to recognize and reinforce the many benefits of these relationships. While MFT provides established expertise for committed partnerships, parent-child dynamics, and intergenerational processes, without the reinforcement of other supportive and meaningful connections—like friendship—MFT may fall short. The acknowledgement of friendship within

scholarly literature validates the needs of individuals who do not have family or are estranged from their relatives, as well as those who are widowed or choose not to pursue romantic relationships. Additionally, by reinforcing the role of friendships, the demands placed on families and spouses to support all social, emotional, and instrumental needs can be mitigated, and the powerful benefits inherent in friendships can be accentuated. By intentionally including and encouraging a client's friendships when conceptualizing their relational system, MFTs can harness the many benefits inherent within authentic, mutual, and positive relationships

Although the research on friendships is still limited within the field of MFT, clinicians can pull from various other disciplines, including social psychology and social neuroscience, to inform their research and clinical work. Seen through a multisystemic lens, supporting healthy friendships can impact the relationships outside of and between closed family systems. In turn, therapeutic interventions that support the development and maintenance of friendships in adulthood can also benefit the broader community.

Strengths and Limitations

This study addresses several gaps within the family science literature. First, this study broadens literature in MFT by including friendship as the focal relationship domain.

Traditionally, MFT literature is centered around couple relationships, parent-child relationships, nuclear or blended families, and intergenerational family processes. According to numerous sources, the importance of friendship research continues to increase due to various cultural, societal, and demographic factors (Demir & Özdemir, 2010; Nicolaisen & Thorsen, 2017).

Further, this study also expands friendship research, because most existing literature describes friendship processes in childhood and adolescence.

Additionally, by incorporating IPNB, this study integrates various branches of neuroscience, biology, sociology, psychology, and psychotherapy. Within those varied disciplines, this study also contributes to the consolidation of fragmented and inconsistent findings within those disparate fields of research. Just as an MFT clinician uses their outsider's perspective to identify troublesome patterns and processes within a relational system, taking a comprehensive and systemic approach to interdisciplinary research reveals the overlap and inconsistencies between and within scientific fields. Fortunately, the extant literature and principles of IPNB supports the underlying assumptions of MFT while also indicating where the field can continue to develop.

This study also has limitations. Data from the MIDUS study was collected in 2013 and 2014, before the global pandemic wreaked havoc on individuals' health, well-being, and interpersonal relationships. While the influence of friendship on personal growth may be consistent regardless of when the data was collected, a more recent sample would provide better insight into this inquiry.

Further, although the MIDUS dataset was drawn to reflect a representative sample of the United States, the sample considerably lacked minority representation. The sample included in this study was primarily white, educated, and middle class, and therefore cannot be generalized to those not represented. This continues to present an issue in much of social science research, and there continues to be a push to include more diverse samples within MFT literature.

This study also utilizes data from self-report questionnaires for each of the main variables. While this is widely accepted in social science research, there are limitations due to the validity of these measures. The scales used to measure neural and social integration for this study reflect structural and functional integration of the brain; however, fMRI studies provide a more

complex and specific understanding of these processes. The collaboration between researchers in neuroscience and social sciences would provide benefits to both disciplines.

Future Directions

Future studies should continue to explore how friendships can be incorporated into the work of marriage and family therapists, both in and out of the therapeutic setting. To account for many of the limitations of this sample, this study could be replicated using a more recent and more diverse sample. This would help to identify any differences between friendship's impact within the last decade, as well as differences within or between certain demographic groups.

Additionally, future studies can investigate the connections between friendship and the vast data available from fMRI studies. In the years since the development of the fMRI, more than 200,000 fMRI studies have been published (listed in <http://www.ncbi.nlm.nih.gov/pubmed> under “fMRI; brain”). Due to the extensive data accumulated through just one fMRI scan, most studies use small samples, negatively impacting the generalizability of the findings. Additionally, just like the social sciences, most fMRI studies tend to be limited to WEIRD societies – Western, Educated, Industrialized, Rich, and Democratic (Falk et al., 2013). Thus, the rapid explosion in neuroimaging studies over the past few decades resulted in an oversupply of underpowered studies with small, homogenous samples. To mitigate many of these issues, Neurosynth—a large-scale automated meta-analysis platform—was developed for researchers to synthesize and interpret findings from thousands of studies (Yarkoni et al., 2011). Neurosynth allows researchers across scientific disciplines to benefit from the plethora of neuroimaging data while also resolving the issues of high false positive rates and small, underpowered studies. As the population continues to grow older and familial connections decrease, recognizing the characteristics of friendship that support brain health will continue to be relevant.

Conclusion

The significance of friendships may be readily apparent in poetry, music, art, or philosophy, but without recognition in scientific theories, research, and clinical work, the influence of friendship within the lives of MFT clients and the larger community is limited. This study provides evidence that having supportive friendships is associated with greater neural integration and more integrated social relationships, thereby facilitating an individual's journey towards personal growth. According to IPNB, this occurs due to the bidirectional influences between the brain, the mind, and relationships (Siegel, 2001). Integration, which is considered the key to well-being in IPNB, occurs when distinct parts of a system are linked together to support a regulated, engaged, receptive, and more optimally functioning whole. Findings from this study indicate that having supportive friendships predicted regulation, engagement, and receptivity within the brain (neural integration), in relationships (social integration), and thought the mind (personal growth). Friendships, compared to other interpersonal relationships, uniquely promote integration because they encourage individuals to be both distinct—as friendships are voluntary and autonomous, and linked—through shared intimacy, repeated positive interactions, and mutual compassion.

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