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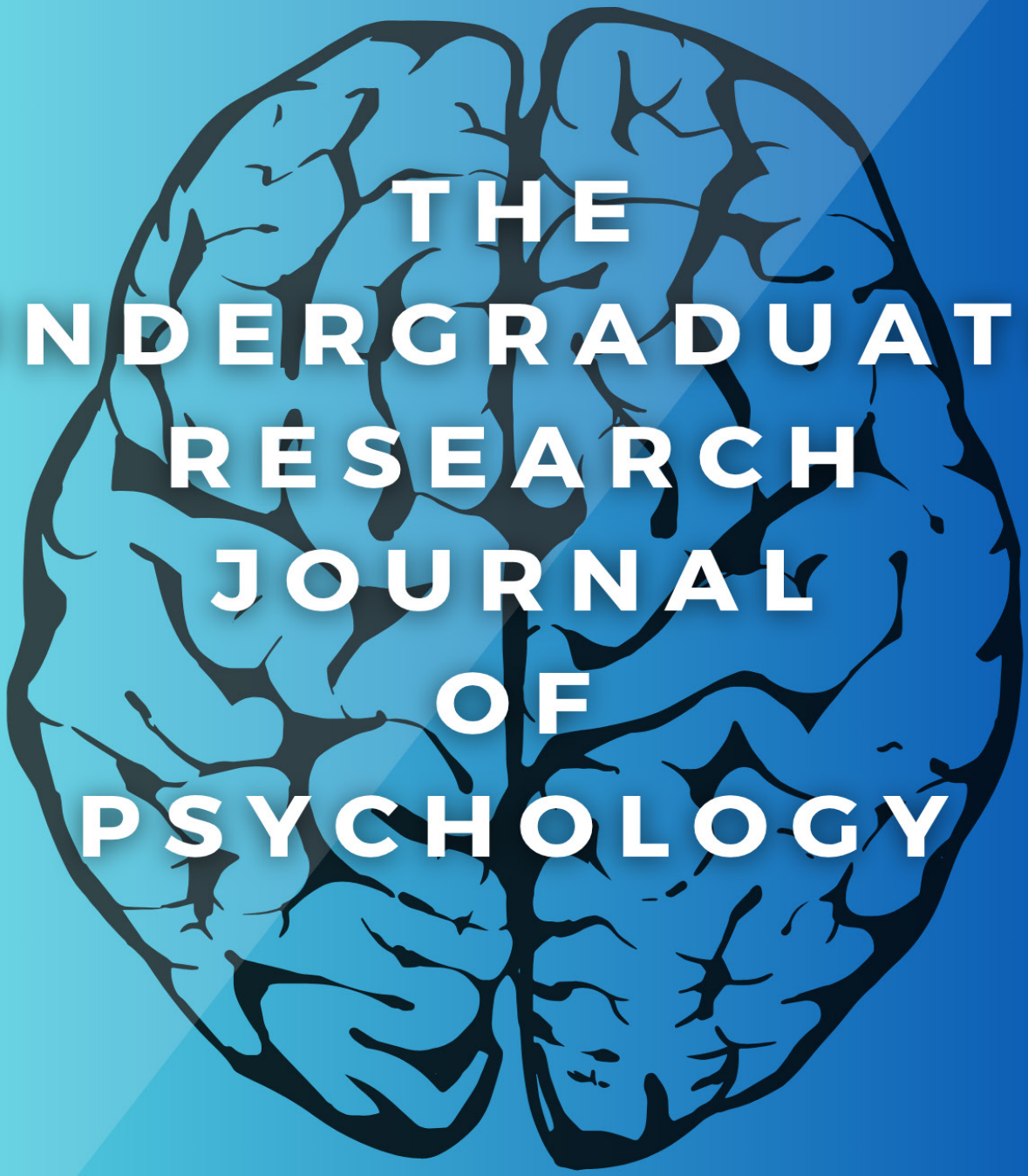

THE UNDERGRADUATE RESEARCH JOURNAL OF PSYCHOLOGY

12th Edition, 2025

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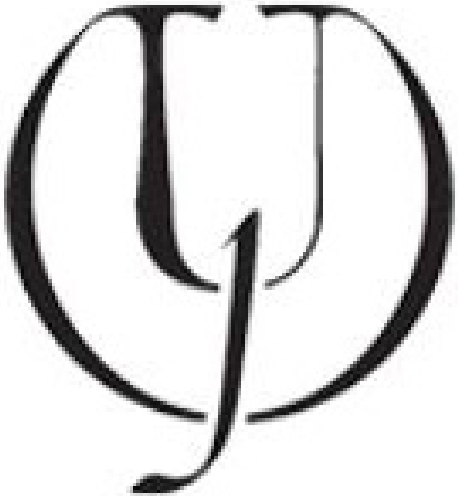

Special thanks to our founders and past members, Dr. Aaron P. Blaisdell, Dylan Sarnowski and the rest of the University of California, Los Angeles, Department of Psychology, and all of the faculty, staff, and graduate students who have supported us throughout the years.

NOTE FROM THE EDITORS-IN-CHIEF

Dear Readers,

We are delighted to share the 12th annual edition of the Undergraduate Research Journal of Psychology at the *University of California, Los Angeles.*

Since August 2024, our team has dedicated itself to collecting submissions, producing and sharing psychology-related content with our community, and carefully selecting the highest quality articles for this edition. Our Editing Team diligently reviewed nearly one hundred qualified research submissions from across the globe, ranging from Asia to the United States. Our Marketing Team actively promoted our organization and raised awareness of the issues highlighted in our volumes. Furthermore, our Submissions and Workshops Team expanded the journal's reach to a broader audience, engaging both authors and readers worldwide. Notably, thanks to the guidance of our past Editors-in-Chief and the continued efforts of our executive board, we successfully migrated our journal to the eScholarship portal, enabling our authors and their work to reach an even wider audience.

In the curent publication you will find original research from eight distinguished authors who have contributed novel insights across diverse areas of psychology. Covering topics such as experiences of neurodiversity, the connection between early trauma exposure and childhood-onset obsessive-compulsive disorder and the neural basis of dance and aesthetics, these research and literature review articles showcase the ongoing advancement of the field. Our team is truly delighted to see their hard work come to fruition in publication.

We sincerely hope that this journal can contribute meaningfully to the advancement of psychological research and scholarship. We are truly honored to recognize the accomplishments of these authors and eagerly anticipate their future contributions to the field. It is with great pleasure that we present our 12th edition, and we hope you find as much value in reading it as we have in preparing it.

Sincerely,

Angelina Meng and Haryn Shin

Editors-in-Chief

PREFACE

Charlotte Kelly, M.A.
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Welcome to the 12th Edition of the Undergraduate Research Journal of Psychology (URJP) at the University of California, Los Angeles! I am so excited to introduce you to these fantastic pieces of research, conducted by some of the brightest undergraduates and post-graduates in the world today. Everyone who contributed to this journal deserves a round of applause, including the executive board of URJP. This journal strives to engage in a true peer review process, providing proof of the excellence and rigor of all those involved.

Now more than ever, initiatives like this journal are needed in academia, to showcase the important research we do at UCLA, across the country, and abroad. In the United States, funding for science at universities is facing a crisis. Important research on everything from health care to engineering is coming to a halt, as the federal government is stripping away the grants and other financial support we need to advance these projects. It is imperative that we support our early researchers and show the world the value of their work and the significance of their education.

Throughout this volume, you will find novel and insightful research on topics spanning the diverse field of psychology. Eva Anderson begins our journey with an interdisciplinary synthesis on how we produce and perceive dance movements. As someone who also engages in the scientific study of the arts, I enjoyed her neurological approach to aesthetics research. She delves into the literature on the neural underpinnings of dance, highlighting the areas of the brain that allow us to make aesthetic judgements. Her paper and her ideas for future studies will act as a catalyst for neuroaesthetic research, helping to grow this subfield of inquiry. Another article that utilizes an interdisciplinary approach is Kristina Senk's paper on personality development, which can be found near the middle of this journal. Personality is something so unique to each of us, and yet the mechanism behind how we develop our personalities is both complex and illusive. Senk tackles the question of personality development in her paper, assesses our current scientific knowledge on the topic, and synthesizes both genetic and environmental perspectives. She urges personality researchers to fully dedicate themselves to integrating these two fields as they pursue the study of personality development, for neither will be able to explain it alone.

PREFACE

In the second paper in the journal, Margot J. Delery shifts the discussion toward the study of and treatments for autism spectrum disorder (ASD). She expertly reviews varied clinical techniques and proposes Acceptance and Commitment Therapy (ACT) as an intervention to be used in combination with the current statndard Resilience-based interventions (RBIs). Together these therapies could enhance the internal emotional regulation skills of children with ASD in addition to their external social-behavioral skills. Near the end of this journal, Chalyn Faye Valdez also engages in the study of interventions for ASD. In her research on parent-child interactions during language learning, she discovered that parents who have an older child with ASD potentially use less labeling and less descriptions when describing novel objects to their infant. This shift in behavior for mothers with a child who is at-risk of ASD not only highlights how parents adjust to the needs of their children, but also how this could lead at-risk children to fall behind in their language development. Valdez proposes introducing at-risk children to interventions to improve attention and engagement early, as it could allow mothers to use more complex labeling and descriptions when teaching language without inadvertently overwhelming their child.

Our next authors address an emotion everyone is familiar with: lonliness. In their review, Estela Jung and Jeein Ching describe how loneliness is often studied from within a Collectivism Individualism framework, which divides cultures into those that value independence (individualism) and those that value interdependence (collectivism). They argue that lonliness should be studied from beyond that lens, proposing that it is due to a deviation from the normative standards of one 's own culture, regarless of the type of culture they are from. This relates very well to the final article on this journal, in which Alice Wood and her colleagues surveyed neurodivergent individuals on their perceived sense of belonging, social support, and overall well-being. Despite scoring similarly across all other measures, they found that neurodivergence was realted to higher lonliness, compared to a neurotypical sample. This would align with the theory of Jung & Chung, as the feeling of "deviance" in a culture might lead to this higher sense of loneliness among those with neurodivergence.

Continuing in a clinical direction, Zaid Kamal and his colleagues investigated the relationship between alcohol use disorder (AUD) and impulsivity. In this study, they describe how impulsivity, both as a personality trait and in the choices we make, is linked to AUD; however, they did not find evidence that impulsivity affected drinking outcomes or cravings during a 6-day quit attempt. They suggest research into longer quit attempt periods, to better clarify this relationship between impulsivity and AUD. Grace Knor then spends time on a different disorder: Obsessive Compulsive Disorder (OCD). In her review, she details how certain treatments, such as cognitive-behavioral therapy (CBT) and exposure and response prevention (ERP), are currently the primary treatments for OCD. There is, however, a pathway from childhood trauma to early maladaptive schemas to OCD, implying that schema therapy (ST) may also be a successful treatment option for patients with this disorder. She artfully provides evidence for her theory, and encourages clinical psychologist to pursue research on the effectiveness of ST for OCD.

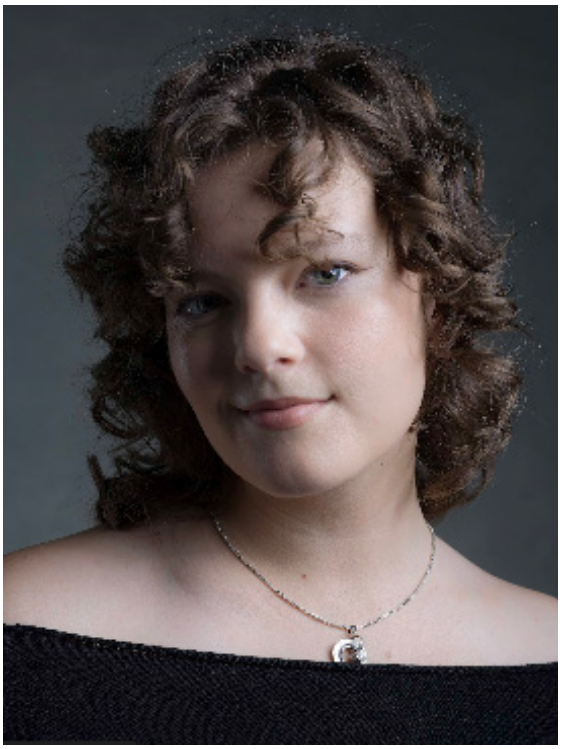
With my short review of the impressive papers contained in this journal, I hope you came across a topic that makes you yearn to discover more. I encourage you to engage thoughtfully with these articles, and when you learn something interesting, share it with your community! Science is doing its best work when it expands the knowledge of not just scientists, but of everyone.

Once again, please join me in congratulating these up-and-coming scientists and editors for a job well done!

Happy reading,

Charlotte Kelly

Eva Anderson, BA, University of California, Davis



Eva Anderson is a dancer-choreographer and scientist based in California. She is a Regent's Scholar and recent graduate of the University of California, Davis, where she double majored in cognitive science and theatre & dance. Most of the time, Eva can be found in a dance studio. Her most recent project, A Cabaret Show, was an original work Eva conceptualized, co-directed, and choreographed. She is a company member with Mounarath Powell Dance in San Diego, where she has also been commissioned to create original choreographic work. Eva works as a research assistant at UC Davis on the Jewish Family Project. In her free time, Eva enjoys house shows, spending time with her loved ones, and playing

From Brain to Ballet: Mapping the Neural Landscape of Dance and Aesthetics

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Acknowledgments

Thank you to Katie Rodger for her feedback on this article.

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The arts and sciences have often been treated as separate domains. However, a growing body of interdisciplinary research–particularly in the emerging field of neuroaesthetics–is beginning to bridge the divide by using scientific tools to explore artistic phenomena. Dance offers a unique avenue for researchers interested in the intricate connections between cognition, embodiment, and movement expertise. New methodologies in neuroscience have enabled researchers to examine the neural mechanisms underlying both the production and perception of dance. This vein of research falls into the realm of neuroaesthetics, which aims to explore the neural underpinnings of aesthetic experience, perception, and judgment. The human action observation network (AON), which supports our ability to understand and imitate other's movements, plays a central role in this process and is strongly modulated by movement expertise. This review synthesizes research on how the brain and body produce and perceive dance, contributing to a deeper understanding of the neural basis of artistic expression, embodiment, and aesthetic experience..

Keywords: Dance, neuroscience, neuroaesthetics, action observation, embodiment

Introduction

Our bodies and minds are constantly in conversation, each influencing and responding to the other in a dynamic exchange of signals and sensations. In the realm of dance, this ongoing dialogue between bodies and minds takes center stage, as dancers use their bodies to create meaning through movement. This interplay exemplifies embodiment—the integration of mental, emotional, and physical processes through the lived experience of the body. Unlike other complex physical activities, such as sports, dance requires not only technical precision but also expressive depth and stylistic nuance. Dance transcends cultural boundaries, uniting people from diverse backgrounds in an amalgamation of various dance styles. While these styles differ in form and tradition, they share a common foundation: experienced dancers are movement experts. They are masters of physical control, exhibiting exacting precision, beauty, and athleticism through embodiment.

At the heart of dance-neuroscience research lies a fundamental inquiry into the neural processes that govern motor control, sensory integration, and emotional resonance during dance performance and observation. The following is a review of the existing literature on the brain of the dancer and the brain of the dance-observer. This review examines the literature on how exactly the brain coordinates with the body to produce embodied, aesthetic movement, in addition to the neural mechanisms of how people subjectively process and perceive dance. This emerging field of aesthetic processing is called neuroaesthetics and examines neural underpinnings of aesthetic experience, perception, and judgment (Chatterjee & Vartanian, 2014). New methodology and imaging techniques have allowed researchers to gain a more comprehensive understanding of this body-brain connection from a neurobiological standpoint. This review draws on peer-reviewed journal articles, focusing on studies relating to the neuroscience of dance, motor control, and aesthetic perception, identified

through database searches (PubMed, JSTOR, Google Scholar) using keywords related to dance, embodiment, neuroaesthetics, and aesthetic perception. Inclusion criteria prioritized studies employing empirical methods (e.g., fMRI, EEG, behavioral analysis) while also considering theoretical and conceptual works that address neural, cognitive, and embodied aspects of dance.

How Do We Learn to Dance

Motor Activity Pathway

The basic pathway of motor activity is as follows: voluntary movement is planned in the premotor cortex and those instructions are projected to the primary motor cortex. From there, signals are sent to the muscles through the spinal cord (Brown & Parsons, 2008). Muscles contract and movement is produced. Sensory organs within the muscles then relay feedback to the brain, informing us of our exact spatial orientation—a process known as *proprioception*, or the perception of one's limbs in space (Konczak et al., 2009), which forms the foundation for understanding body positioning and movement.

This is the structure of voluntary movement that allows us to move our bodies though the world every single day. To become expert movers, dancers take this motor pathway to the next level through years of intensive practice, which not only enhances efficiency of movement, but precision in motor planning, proprioception, and sensorimotor integration.

The Human Action Observation Network

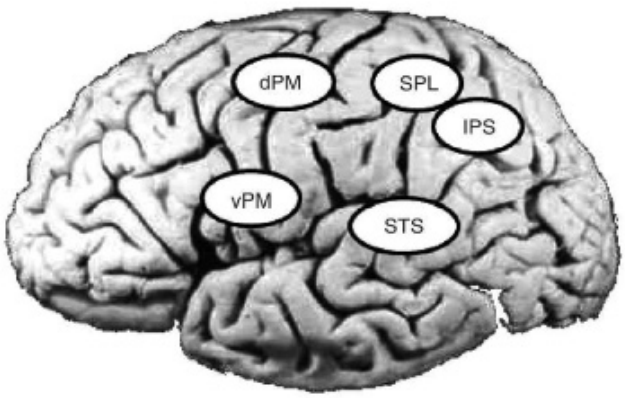
Dancers learn by doing, but they also learn by watching. They observe an action and simulate it. The human ability to integrate new movements through perceptual processing can be readily examined in dancers, whose ability to learn new movements and replicate them successfully is paramount.
ourselves, yourselves, and themselves (Trask, 1993).

Observational learning was first studied in macaque monkeys–where the discovery of mirror neurons, cells that fire both when an action is executed and observed, sparked major interest in how we understand others' movements (Rizzolatti & Craighero, 2004). While direct evidence of individual mirror neurons in humans is limited due to methodological constraints (Marshall, 2014), neuroimaging studies strongly support the existence of a comparable human system (Grezes & Decety, 2001; Rizzolatti, 2005). This network, often referred to as the mirror neuron system (MNS), activates during both action execution and observation and is thought to underlie abilities such as imitation, empathy, and action understanding (Gallese, 2001; Keysers & Perrett, 2004).

The action observation network (AON) expands on the MNS by encompassing a broader network of regions active during the observation of both familiar and unfamiliar actions, including those not part of one's own motor repertoire (Cross et al., 2009). While the MNS is closely tied to imitation and internal motor mirroring—activating brain areas as if the observer were performing the action themselves—the AON involves a wider set of processes. This includes motor resonance, which refers to the brain's automatic response to observed movement, as well as higher-level visual and cognitive interpretations of others' actions. Internal motor mirroring can be described as a simulation process, where your brain imitates the action internally. Motor resonance is an automatic reaction to movement, but your brain does not necessarily copy the movement. Figure 1 illustrates key components of the AON, particularly those involved in movement perception (Calvo-Merino, 2018). As shown in the figure, key components of the AON include the ventral premotor cortex (vPM) and dorsal premotor cortex (dPM), which play crucial roles in planning and stimulating motor actions. The superior parietal lobe (SPL) is involved in integrating visual and proprioceptive information, allowing for the spatial mapping of observed movement. The intraparietal sulcus (IPS) helps transform visual input into motor commands. The superior temporal sulcus (STS) is sensitive to biological motion and is involved in decoding meaning behind actions (Grafton et al., 1996; Buccino et al., 2001; Keysers & Perrett, 2004; Blake & Shiffrar, 2007; Acharya & Shukla, 2012). Together, these areas highlight the significant overlap between the AON and the neural pathways involved in the motor activity pathway.

Figure 1: *Brain regions active in movement perception*

Figure 1 represents the AON: the areas active in movement perception.



These areas respond both during action execution and action observation (Calvo-Merino, 2018).

Note. vPM: ventral premotor cortex; dPM: dorsal premotor cortex; SPL: superior parietal obe; IPS: intraparietal sulcus; The function of the AON is well-understood, but

questions remain about how this system adapts to different types of expertise. As an activity that demands complex motor control and extensive observational learning, dancers are a compelling population for examining the neural underpinnings of the AON.

What can dance tell us about the AON?

Dance training appears to modify and enhance the AON. The AON responds more strongly when dancers observe movement from their own style (Calvo-Merino, 2005). A study by Cross et al., 2009, investigated observational learning by training inexperienced dancers to perform dance sequences, while modulating the presence or absence of physical rehearsal. A strong correlation was evident between the neural areas activated during observational training (watched condition) and those engaged during physical learning (danced condition). Substantial AON activity was demonstrated both when participants underwent physical rehearsal or passive observation. Participants in the passive observation condition were not instructed to learn the movements to later perform, yet their ability to perform greatly benefited from the observation task. This study offers evidence in support of the formation of similar neural representations within the AON for movement sequences that have been physically rehearsed and those that have been passively observed (Cross et al., 2009).

Dance is a valuable model for studying the AON, but it is important to understand what distinguishes dancers from other groups. This helps clarify whether observed neural changes are specific to dance or reflect general effects of motor training. The next section examines how dance training shapes brain structure, function, and connectivity, highlighting how practice uniquely shapes the neural systems involved in dance.

What Sets Dancers Apart? Effects of Dance Training

Cognitive capacities including sensorimotor differences, memory, timing, and special learning methods have been shown to modify with dance training (Bläsing et al., 2012). Sensorimotor control is enhanced with dance training, and dancers exhibit better postural control and balance skills than non-dancers (Golomer et al., 1999; Rein et al., 2011). Expert dancers are able to control complex movement in part by optimizing motor synergies, efficiently combining movements in a way that reduces energy costs and muscle tension (Lepelley et al., 2006). This also functions to increase their accuracy of repeating complex movements and trajectories. Dance training is even said to alter the balance of sensorimotor control, shifting dominance from visual reliance to proprioceptive input (Golomer & Dupai, 2000). Golomer and Dupai found that dancers relied more heavily on proprioceptive feedback than non-dancers, particularly when visual information was limited. Dance training enhances the internal sense of body positioning, recalibrating the body's different sensory systems. Bläsing et al., 2012, compared dancers and non-dancers in static and dynamic equilibrium tasks: maintaining balance while the body is stationary, compared to maintaining balance while the body is in motion (while turning, jumping, etc.). Dancers out-performed non-dancers at dynamic equilibrium tasks, but not static tasks. This points to multimodal integration for dynamic equilibrium tasks, suggesting a task-specific training influence of dance on dynamic balance (Bläsing et al., 2012). Another study compared semi-professional dancers—individuals with advanced training and regular performance experience but who do not rely solely on dance for their income—in their ability to keep timing in a four-minute piece while modulating the presence of musical accompaniment, finding only a 5% difference in movement timing with or without music (Stevens et al., 2009). The ability to time movement correctly is modulated by motor expertise, with better and more accurate synchronization for familiar movements amongst professional ballet dancers (Honisch et al., 2009). Additionally, dancers show increased connectivity in cortico-basal ganglia motor learning loops compared to non-dancers, which are involved in the control of body posture, movement, and action selection (Nambu, 2004; Li et al., 2015).

In relation to learning and memory, dancers demonstrate an increased encoding ability of movement items compared to non-dancers (Smyth & Pendleton, 1994). In this study, participants were asked to observe and later reproduce two types of movement sequences: familiar ballet movements and unfamiliar "nonsense" movements—arbitrary gestures that do not belong to any known dance vocabulary. Despite the lack of familiarity or meaning in the nonsense movements, dancers exhibited longer memory spans for both ballet and nonsense movements. Dancers' movement memory is not limited to their trained style, but extends to novel, arbitrary movements as well, suggesting that dance training enhances a domain-general ability to encode, retain, and reproduce complex movement patterns, even in the absence of familiar structure or meaning. To better encode their movement, dancers often employ a variety of techniques. One of these strategies is called "marking," and involves rehearsing the dance with reduced energy expenditure, indicating body movements with the hands (Bläsing et al., 2012). These types of techniques aid in recall and serve as mental imagery cues amongst expert dancers, facilitating increased learning and memory.

Having explored some of the unique neuroplastic effects of dance training, it is evident that dancers possess distinct cognitive and motor abilities shaped by years of practice, suggesting that expertise not only alters motor execution networks, but also perceptual and integrative processes associated with action understanding. To examine how expertise shapes the AON more broadly, the following section examines the effects of movement expertise via neuroimaging studies.

Experience-Dependent Plasticity: Influence of Movement Expertise on Action Observation

A study was conducted establishing the influence of motor expertise on the AON (Calvo-Merino, 2005). This study used fMRI, measuring the brain activity of participants while they watched an action that they had learned to do and an action they had not. The participants were expert ballet dancers, expert capoeira dancers, and non-experts. When expert dancers observed movements in the style they'd been trained in, the researchers found greater bilateral activations in the premotor cortex, intraparietal sulcus, right superior parietal lobe, and left posterior superior temporal sulcus compared to when watching movements they were not trained in– all of which areas are associated with the action observation network. These findings indicate evidence that the AON has the ability to combine observation of other's actions with one's own personal motor repertoire and expertise (Calvo-Merino et al., 2005). The research suggests that the AON is equipped to differentiate between styles of dance, indicating sensitivity to abstract movement organization. Although all participants in the study were exposed to identical actions, the mirror regions of their brains exhibited distinct responses based on their ability to perform those actions, implying experience-dependent tuning of the AON.

A 2006 study by Cross et al. also examined the effects of dance expertise on the AON in relation to dancer's ratings of their own ability. In this study, ten expert dancers underwent weekly fMRI scans during the process of learning a 20-minute dance work entitled "Skylight" (Dean, 1982). During the scan, dancers were instructed to watch short dance clips (half were Skylight choreography, half were unrehearsed but similar movement), and *imagine* themselves performing the choreography. At the end of every short clip, the dancers rated how well they believed they could perform the material. Participants completed this task each week over the course of the six-week rehearsal period. The results were the following: the further in the rehearsal process, the more dancers rated their own ability to perform the rehearsed material, but not the unrehearsed material. This correlated with increased brain activity when the dancer imagined performing movement that they had physically embodied. Two regions of the brain were identified as modulatory as a function of the dancer's ratings of their own ability: the inferior parietal lobule and the left ventral premotor cortex, which the authors nicknamed 'the seat of embodiment.' Cross et al. found that the observation and internal simulation (imagination) of dance by dancers caused activation in regions of the brain classically associated with action simulation and action observation, with higher activation for movement they had physically embodied (2006).

Experience-dependent plasticity highlights how the AON is shaped by motor expertise. To deepen understanding of how the brain engages with dance, it is necessary to turn to the domain of neuroaesthetics, which examines the cognitive and emotional mechanisms underlying the aesthetic experience.
methodologies.

Neuroaesthetics

Although still in its infancy, the field of neuroaesthetics—coined by Semir Zeki in the late 1990s (Zeki, 1999)—has attracted the attention of neuroscientists, psychologists, artists, and philosophers worldwide. Research in neuroaesthetics seeks to understand and scientifically examine the complexity of aesthetic experience from a neurobiological perspective.

While neuroaesthetics represents a recent scientific approach to understanding aesthetic experience, the study of aesthetics itself has a rich history dating back centuries. The early British empiricist, Edmund Burke, was one of the first to put forth an explicitly physiological explanation for aesthetic experiences. He connected themes of sublimity and beauty to biological mechanisms of pain and pleasure (Burke, 1757/1948). In contrast, Immanuel Kant, writing later in the 18th century, famously rejected any associations between aesthetic experience and bodily sensation through his transcendental perspective (1790/1987). Consequently, any emerging conceptual link between physiology and aesthetics was ignored until later in the 19th century, as noted by Moore, 2002. With the development of Darwin's theory of natural selection (1859/2009), some began to argue that human capacity for aesthetic appreciation stemmed from sexual selection, implying a functional basis rooted in neural reward systems, a return to earlier ideas linking physiology and aestheticism. These exciting developments in neuroaesthetic ideas were soon eclipsed, this time by the rise of behavioral psychology, in which the study of human cognition was reduced to observable behavior. A psychological approach to aesthetics regained momentum towards the end of the 20th century, supported by the rise of neuroimaging technology and new methodologies for studying the brain. Now, it is believed that a dynamic interaction of various cognitive processes, including perception, memory, decision-making, reward, and emotion is involved in the appraisal of aesthetic experience (Kirsch et al., 2016). While non-invasive neuroimaging techniques like EEG have existed for decades, recent advances in imaging resolution and analysis have revolutionized the field by enabling scientists to study brain changes specifically during aesthetic experiences—an area of research that has only gained attention in recent years.

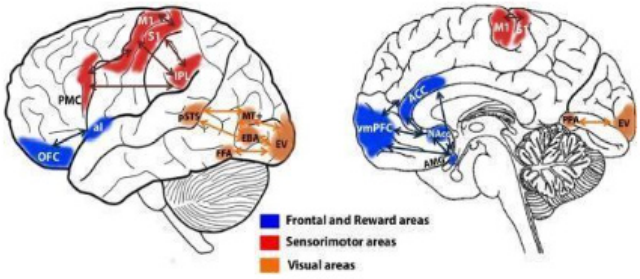
An Evolutionary Perspective of Aesthetic Appraisal

One influential theory is that the neural network that allows us to appreciate art evolved from a fundamental biological system for evaluating the importance of objects in our environments. Brown et al. 2011 argue that the neural circuits

activated during the aesthetic evaluation of art significantly intersect with circuits responsible for assigning value to various evolutionarily significant stimuli, including the attractiveness of a potential mate or the desirability of food. They argue that aesthetic judgement may have provided reproductive or survival advantages. From this perspective, aesthetic judgement may have emerged as a repurposing of neural mechanisms originally designed to support adaptive decision-making. Kirsch et al., 2016 agrees with this, suggesting that our ability to evaluate artistic works is grounded in the same neural processes that allow us to make biologically-adaptive decisions. The theory has strong explanatory power in that it connects aesthetic experience to well-established, evolutionarily conserved brain systems. It offers a biological understanding of how art can evoke powerful emotional responses in us, by framing it as an extension of survival-based valuation. One limitation of this view is that it may oversimplify the aesthetic experience by inherently tying it to survival. Artistic expression is complex and often involves symbolism and cultural knowledge, which may extend beyond the explanatory reach of valuation assignment alone. Nevertheless, this theory remains relevant to current neuroaesthetics research, particularly its emphasis on reward processing, a core theme in understanding how the brain engages with art. While the evolutionary perspective emphasizes the adaptive value of aesthetic judgement, contemporary neuroscientists build on this framework, seeking to map the specific neural correlates underlying aesthetic appraisal.

Neural Correlates of Aesthetic Experience

Chatterjee and Vartanian (2014) propose a neurological framework for studying aesthetic experience, conceptualized as an *aesthetic triad*: a link between three core neural systems involved in aesthetic processing. This model links



the emergence of aesthetic experience to the interaction between three neural systems: sensory-motor processes, emotion-valuation, and meaning-knowledge. This view suggests that aesthetic experience arises from the interactions between these systems, rather than activity from a single brain region.

Kirsch et al., 2016 builds on this framework with neuroimaging data. Figure 2 is a representation of the neural circuitry involved in aesthetic judgment tasks (Kirsch et al., 2016).

Figure 2: *Neural circuitry implicated in aesthetic evaluation.*

The reward processing system– the orbitofrontal cortices, ventromedial prefrontal cortex, anterior cingulate, amygdala, anterior insula, and nucleus accumbens– is consistently implicated in the appraisal of aesthetic experience (Nadal et al., 2012; Chib et al., 2013; Cattaneo, 2019). Kirch's model also elaborates on the sensorimotor system, demonstrating involvement from the primary motor cortex, somatosensory cortex, inferior parietal lobule, and premotor cortex (Kirsch et al., 2016). These areas are involved in embodied responses and perception, aligning with the sensory-motor branch of the aesthetic triad. Finally, the visual areas– including the extrastriate body area, motion integration area, early visual cortex, parahippocampal place area, and posterior superior temporal sulcus– contribute both perceptual and contextual information, an overlap between the sensory-motor and meaning-knowledge domains of the triad.

Neuroaesthetics in Dance Observation

This field aims to explore the neural underpinnings of the artistic experience, which includes not only the artist, but crucially, the artist's observer. By examining the neuroaesthetics of dance observation, we ask the question: what neural mechanisms underlie the observer's capacity to perceive the beauty and artistic expression in dance? Jola et al., 2012 identifies two approaches as ways to investigate the experience of watching dance: phenomenological and neuroscientific. The phenomenological approach explores the subjective experience of watching dance, while the neuroscientific approach focuses on the physical brain changes that occur while viewing dance. There is a case to be made for marrying these two approaches to gain a more holistic understanding of the viewer's experience of dance (Jola et al., 2012). A combination of approaches to these questions can reveal much about a viewer's perception of art and the underlying neurophysiological changes associated with that perception.

Dance Observation by the Non-Dancer.

There is no complete explanation of why we like to watch dance, nor can an appreciation for an art form be reduced to quantifiable measures. However, research on human movement perception has vastly improved in recent years, illuminating aspects of what makes dance an enriching audience experience (Orgs et al., 2018).

Calvo-Merino and colleagues were the first to conduct a neuroimaging study to investigate the neural underpinnings of the dance observer's experience (2008). In their fMRI study, participants watched dance movements while engaging in an unrelated task and were later rated how much they enjoyed the movements. Their findings correlated stronger aesthetic

Kirsch et al. (2015) investigated how motor familiarity influences aesthetic appraisal by having participants train over four days on different sets of dance sequences. Each day, participants physically rehearsed one set, passively watched a second, listened to the music of a third, while a fourth set remained untrained. Functional MRI scans and self-reported affective and physical ability ratings were collected both before and immediately after the training period. The study found that participants reported higher liking and perceived ability ratings for sequences they had physically practiced or passively observed compared to untrained sequences. Crucially, increased enjoyment ratings for these dance stimuli were associated with greater activity within the AON. Specifically, brain regions such as the nucleus accumbens, parts of the thalamus, bilateral superior temporal, and right middle temporal gyri showed heightened activation when participants rated movements as most aesthetically pleasing. Similarly, Cross et al. (2011) reported increased activity in the parietal portions of the AON corresponding with greater enjoyment during observation of dance.

One study investigating this question asked non-dancer participants to watch videos of dance performance and rate their enjoyment of the piece and their ability to perform the movements. Participants reported higher enjoyment of movements that they rated as more difficult for them to perform, compared to movements they rated as easier (Cross et al., 2011). Essentially, the *less* the observer could perform the action being performed, the *more* they enjoyed watching it. This finding, nicknamed the 'Cirque du Soleil Effect,' stems from the idea that we enjoy watching awe-inspiring, difficult movements because they are impressive. High physical skill made seemingly effortless is an ability few can achieve, and many like to watch. Employing findings about the AON would remind us that in the instant we watch other people perform an action, the same action is simulated in our own minds. Therefore, when we watch dance being performed, our minds simulate that same mesmerizing, awe-inspiring, beautiful movement.

Decades before the discovery of a human mirror-neuron system, *The New York Times* dance critic John Martin wrote this on the experience of watching dance: "We shall cease to be mere spectators and become participants in the movement that is presented to us, and though to all outward appearances we shall be sitting quietly in our chairs, we shall nonetheless be dancing synthetically with all our musculature" (Martin 1939/1965).

His notion of "dancing synthetically" has inspired thinkers to come up with a new term: *kinesthetic empathy* (Reynolds & Reason, 2012). It refers to the feeling many experience while watching dance: that they themselves are participating in the dance, feeling movement sensations and emotions (Jola et al., 2012). In one study investigating this, Jola and colleagues connected kinesthetic empathy with spectators' pleasure in watching dance. They combined participants' subjective reports of dance performance with measures of cortical excitability, and found increased enjoyment of a dance piece associated with greater kinesthetic and empathetic engagement (Jola et al., 2012).

Aesthetics and Expertise

Similar to the context of movement production, plasticity plays a role in movement perception– our understanding and appraisal of art is influenced by our expertise and training. In addition to the previously discussed motor and mirror system regions (premotor cortex, intraparietal sulcus, superior parietal lobe, and posterior superior temporal sulcus), the Calvo-Merino et al. (2005) study also reported activations in areas more traditionally associated with emotion, reward, and social cognition. The ventromedial frontal lobe, anterior/middle and posterior cingulate, and parahippocampal gyrus were also found to be influenced by dance expertise, with heightened activity when expert dancers observed movements in the style they'd been trained in (Calvo-Merino et al., 2005). The activity in the ventromedial frontal cortex is routinely associated with emotional processing, particularly with rewarding or pleasurable stimuli (Steele & Lawrie, 2007; O'Doherty et al., 2003). It stands to reason that expert dancers might derive increased enjoyment from observing their own dance style compared to non-experts. When observers perceive actions as "meaningful" rather than meaningless, the parahippocampal gyrus exhibits heightened activity (Decety et al., 1997). Moreover, the parahippocampal gyrus has been implicated in regulating social behavior/engagement (Decety & Chaminade, 2003, as cited in Calvo-Merino et al., 2005). This suggests that expert dancers derive increased social resonance and a more personal relevance when watching movement from their own stylistic repertoire.

These dance expertise effects on observation also extend to the visual system. When viewing a dance film, the eye movement fixation time of dance experts were much shorter than non-dancer observers, suggesting an enhanced visual processing speed as a result of experience (Stevens et al., 2010).

Methodological Challenges; Future Directions

It is essential to acknowledge the inherent complexities and nuances involved in studying the intersection of dance, neuroscience, and aesthetics. There are significant challenges in studying the experience of dance viewers, as modern neuroimaging does not yet allow for comprehensive study during real-life dance events. The way many researchers have studied the observation of dance involves showing participants sequences of abstract clips of movement that only last a couple seconds, and it can be argued that this is merely a snapshot of the dance viewing experience (Jola et al., 2012). In actual practice, a dance audience is transported to a different world, with costumes, music,

Additionally, there is a complication of "liveness" in dance– no two performances are ever the same and that is part of the beauty of the art form. Examining the experiential, ephemeral aspect of observing dance in a naturalistic setting presents significant challenges. How will researchers reconcile the nature of subjective dance viewership experience with current methodology limitations for studying underlying neurophysiological changes? Future research could explore this through new methodological approaches, including the use of real-time neuroimaging techniques during live performance. This could provide insight into real-time neural responses while overcoming some of the spatial limitations of traditional brain imaging. Integrating wearable devices could also address this limitation, including ones that measure heart rate variability, skin conductance, etc. This could provide a more holistic view of the observers' physiological responses, a complement to neuroimaging data. The devices could be comfortably worn by participants, allowing researchers to take continuous measurements without disrupting the flow of live performance. As real world performance can be difficult to replicate in a lab setting, integrating immersive technologies, like virtual reality, could allow researchers to create more realistic dance viewing experiences. Variables could be manipulated within a virtual reality world, such as dancer-audience proximity and audience interaction.

Finally, with the rise of artificial intelligence, there is interest in exploring authentic biological motion in non-biological agents, to enhance the naturalness of humanoid robots. Robots are being increasingly tasked with human interaction in complex fields, including healthcare and education. Achieving authentic biological motion will help robots feel more natural and approachable. As robots become more integrated into human life, the aesthetics of their movement could shape the landscape of human-robot interactions.

Conclusion

Dance offers a unique vantage point on the profound impact of movement and aesthetics on our cognitive and emotional faculties. The brains of dancers are altered from years of expert training, demonstrating changes in cognition, motor control, somatosensation, learning, memory, perception, and motor simulation. Based on the research reviewed here, there are compelling new insights in the field of dance-neuroscience and neuroaesthetics. This research will encourage multidisciplinary research across neuroscience, psychology, and the arts. It will bolster our understanding of the cognitive and emotional dimensions of the artistic experience, promoting a deeper appreciation of dance and related art forms. Additionally, it may support the exploration of dance as a therapeutic modality, offering insights into dance's neurological and psychological benefits. For dancers and choreographers, these findings could enrich their understanding of how audiences perceive and respond to movement. Ultimately, this line of research promotes a more comprehensive understanding of how our moving bodies and brains work together to shape human artistic expression. Further developments in this field will not only enrich appreciation of dance as an art form, but provide broader insights into the human mind and its profound ability to create art that moves people.
available to children in their environment and their language acquisition (Rivero, 2012).

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The Influence of Emotion Regulation and Psychological Flexibility as Features in Resilience

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Acknowledgments

I would like to thank Dr. Elizabeth Glaeser for her endless support during this project as well as her patience with the research process. I would also like to thank Dr. Richard Gallagher. His passion and empathy were a constant comfort and helped me remember why I go through the effort.

Existing research discussing Resilience-Based Interventions (RBI) for the treatment of Autism Spectrum Disorder (ASD) has placed considerable emphasis on improving the resilience of families with autistic children, highlighting the cultivation of protective factors and the need for social support networks in the sometimes difficult process of raising these children. However, there is a noticeable gap in research when it comes to interventions and strategies aimed at directly improving the resilience of these autistic children. The few interventions developed for this group have focused almost exclusively on improving resilience by strengthening the protective factor of social support through behavioral modification and social skills training, although these results have been mixed. This paper argues that it would instead be prudent to integrate aspects of Acceptance and Commitment Therapy (ACT) to strengthen Psychological Flexibility (PF) as well as mindfulness practices that promote healthy Emotion Regulation (ER) in ASD youth into RBIs.

Key Words: Resilience, Resilience-Based Interventions, Autism Spectrum Disorder, emotion regulation, psychological flexibility, behavioral rigidity, acceptance and commitment therapy, meltdown

Conflict of Interest: There are no conflicts of interest to report.

Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by difficulties in emotion regulation (ER) and behavioral rigidity. The prevalence of ASD has been increasing over the years, with recent estimates suggesting it has a prevalence of 1 in 36 children in the United States (Maenner et al., 2020). Individuals with Autism Spectrum Disorder encounter a range of challenges that significantly impact their lives, such as extreme difficulty in regulating responses to stress, greatly increased sensory sensitivities, and executive functioning challenges (Kaboski, McDonnel, and Valentino, 2017). Additionally, autistic adolescents frequently use maladaptive ER strategies, the most frequent of which is avoidance, wherein they make efforts to abstain from situations they find uncomfortable or distressing (Mazefsky and White, 2014). Avoidance in those with ASD is also worsened by behavioral rigidity and spurred on by psychological inflexibility in the attempt to avoid the stress of new situations through strong adherence to familiar routines. ER and Psychological Flexibility (PF) are foundational aspects of resilience and, as they are frequently restricted in those with ASD, make resilient behavior especially difficult in this population. This literature review examines the current state of Resilience-Based Interventions (RBIs) for ASD youth which focus primarily on social skills training, the promising results of a mindfulness and Cognitive Behavioral Therapy (CBT) based intervention called the EASE Program in improving ER, and the successes of various Acceptance and Commitment Therapy (ACT) programs serving to decrease behavioral rigidity and strengthen PF in patients with ASD. The hope is that the implementation of therapies emphasizing these two foundational factors could be integrated into RBIs to minimize avoidance and allow ASD youth to have better responses to that which they previously avoided.

Social Skills Training and Aggression: The Current State

of ASD-Specific RBIs

Within current literature, success in resilience-based treatments for autistic youth has been limited to reducing aggressive behaviors (Shochet et al., 2022; Mackay, 2017; Habeyeb et al., 2017). Although these results were initially promising, they primarily viewed aggression more so as a product of poor social skills and interpersonal relationships than as an intrinsic symptom of ASD connected to nearly all aspects of the condition. In this theme, Schochet's intervention was centered on a School Connectedness Committee which aimed to increase feelings of social belonging as measured by the Psychological Sense of School Membership Scale (PSSM) in hopes this newfound social support would decrease depressive symptomology (Shochet et al., 2022). The other two interventions viewed aggressive behavior in ASD as a result of inadequate resilient responses to stressors. They argued that it can therefore be primarily mitigated by strengthening protective factors in resilient responses, primarily social support (Mackay, 2017; Habeyeb et al., 2017). It is important to note that aggression, like attention, is one of the most common symptoms in mental health disorders, and with ASD's high comorbidity rate, it is difficult to determine how and to what extent co-occurring disorders influence aggressive behaviors in autistic individuals. In these studies, the stated goals of treatment were not to reduce aggression but instead to increase resilience and decrease depressive symptomatology; however, according to the metrics used to measure them, such as the Children's Depression Inquiry and the Behavior Assessment System for Children, 2nd Edition (BASC-2), these goals were not met (Mackay, 2017; Habeyeb et al., 2017).

Although these studies did not develop an effective depression treatment, their reduced aggression-related results were seen as beneficial to parents and teachers dealing with what they perceived as difficult children. Mackay, Shochet, and Orr's (2017) randomized pilot trial for the prevention of depression found that their intervention had no effect on depression or emotional and behavioral functionality but that there was a significant effect in parent reports of adolescent coping efficiency. Additionally, the resilience-building program implemented by Habayeb, Rich, and Alvord (2017) to examine resilience differences across autistic children with different comorbid diagnoses reduced aggression but did not improve patient flexibility, anxiety, depression, social skills, executive functioning, or even resilience (as measured by the BASC-2). Patient self-reports were consistently less positive than parental reports in each study. It appears that the implementation and treatment content of these programs placed a stronger emphasis on guiding children to be less combative, rather than improving their psychological well-being.

Each program (Shochet et al., 2022; Mackay, 2017; Habeyeb et al., 2017) included weekly sessions that emphasized maintaining orderly and socially appropriate behavior through Social Skills Training (SST). Habeyeb et al.'s (2017) study operated on the belief that resilience in ASD populations depended on the development of what they called "social competencies." Their weekly meetings, referred to as social skills group therapy sessions, included topics such as personal space, leadership, reading verbal and nonverbal cues, initiating and maintaining conversations, and good sportsmanship (Habeyeb et al., 2017). Interestingly, the penultimate sessions in the two other studies were both titled "Keeping the Peace" (Shochet 2022; Mackay 2017). In the longest-running intervention, Schochet et al.'s (2022) school-based resilience approach, very few sessions focused on internal topics like self-talk and personal strengths, and these were not emphasized to the same degree as those covering interpersonal topics. This is likely because the intervention was developed on the belief that autistic children should direct their greatest efforts toward building support networks. Session topics like keeping calm and problem-solving, which are necessary for healthy ER, were viewed as important only in their ability to decrease conflict with peers (Shochet et al., 2022).

Social Skills Training (SST) can be an effective intervention for those on the autism spectrum, but it must be done with great care to increase meaningful social connection without encouraging the complete masking or camouflaging of autistic traits that can lead to feelings of shame and autistic burnout, a state in which those with ASD experience debilitating levels of mental, emotional, and physical exhaustion due to the constant effort required to exist in a society that often does not meet their needs (Bradley, 2021; Mantzalas et al., 2023). These SST-based RBIs may have inadvertently taught patients to use emotion regulation to avoid disruptive social behavior for the sake of others, when emotion regulation can be more meaningfully used to cope with the intensity of their own feelings in healthy ways. In the aforementioned studies (Shochet et al., 2022; Mackay, 2017; Habeyeb et al., 2017), these researchers did not account for emotion regulation as a foundational element of resilience that is essential to its operation. Instead they focused on social support, which is only a protective factor serving to strengthen pre-existing resilience.

The crux of resilience is not the strength of the stressor but the level of the reaction, and one's reaction is largely determined by their emotion regulation. Emotion regulation (ER) is the ability to modify an emotional state to promote adaptive behavior (Gross, 2015). Healthy ER helps individuals adjust the severity of their emotional response and react in ways appropriate for the situation, as those with ASD have greater difficulty with ER than the general population (Mazefsky and White, 2014). It is thought that ER impairment in ASD populations is likely due to the complex interactions between multiple ASD symptoms. These key symptoms are sensory sensitivity, psychological and behavioral rigidity, rumination, and the prevalence of

alexithymia: a trait common to those with ASD wherein a person has difficulty understanding, processing, and communicating what emotions they are experiencing (Mazefsky and White, 2014).

It is important to note that ASD youth have more negative responses in frustrating situations than neurotypical youth and remain upset for longer (Mills et al., 2022). At a surface level, this may reflect poor frustration tolerance, but reframed it shows an ASD-specific limited resilience as resilience necessitates the opposite behaviors (i.e., responding well and recovering quickly). A low frustration tolerance does not denote a weaker will. Autistic individuals experience the same levels of emotional distress as those without ASD but do so much more frequently, often as a result of the key symptoms mentioned above. The maximum amount of distress ASD youth can tolerate is determined by the strength of their ER. The stronger their ER, the better they will respond to what are often substantial daily stressors and the faster they will recover. Interventions that strengthen ER in patients with ASD should therefore increase resilience.

When working with ASD youth, one must be cognizant of the effect of impaired ER. Failure to understand that autistic children cannot always regulate their emotional state or choose their reactions can cause the child much greater psychological distress than the reaction itself. To the outside viewer, ASD-related ER impairment in children often looks like deliberate misconduct (Mazefsky and White, 2014). Adults will state that the child is unreasonably irritable, that it is impossible to know what will cause an outburst, and that they must always have their way or else they will throw a fit. These "fits" are what psychologists today most commonly call meltdowns and are rarely deliberate (Phung et al., 2021). Meltdowns are perhaps the most well-known and clearly visible examples of ASD-related ER impairment but are not the only examples as ER struggles can manifest in a variety of different ways such as autistic burnout (Bradley, 2021) and shutting down (Belek, 2018). These behaviors are unhelpful and unpleasant experiences for the child but are made worse by the reactions they are met with. These were the behaviors that previous SST-based RBIs saw as disruptive to social cohesion at best and aggressive at worst. These programs framed the autistic individual's external expression of emotion, however disproportionate, as a maladaptive behavior inhibiting healthy interpersonal relationships. This is not untrue, as frequent meltdowns can make it more difficult for ASD youth to get along with their peers. However, in the pursuit of minimizing these outbursts, SST-based RBIs may have influenced ASD youth to suppress their own feelings in order to maintain social harmony. This ultimately prioritizes the sustained upkeep of socially acceptable behavior over addressing the causes of their discomfort and their ability to communicate and cope with it effectively. This might be relevant in explaining why the ASD youth in the SST-based RBIs showed no change in their self-reports but were perceived as more amicable and cooperative by their parents and teachers.

Emotion Regulation and the EASE Program

Research on interventions to increase ER in ASD populations does not seem to be plagued by the same issues as most research on RBIs. These SST-based RBIs appeared to have a narrower perspective of resilience, focusing only on factors like social support that strengthen resilience instead of the underlying mechanisms governing it like ER. This phenomenon led to studies that did not address the root cause of behavioral problems or decrease depressive symptoms, although the participants outwardly appeared better behaved and less aggressive (Shochet et al., 2022; Mackay, 2017; Habeyeb et al., 2017). One established program, the Emotional Awareness and Skills Enhancement (EASE) Program, reduced aggressive behavior but also decreased depression and ER impairment without shaming the child. Additionally, the EASE study's alternative approach was more effective at increasing resilience through improved ER skills than the SST-based RBIs (Conner et al. 2019). Doing so presents a model of improving resilience through emphasizing mindfulness and radical acceptance, the culmination of which allows ASD youth to recognize and respond to their emotional distress in ways that benefit them through mindfulness practices and cognitive behavioral techniques (Beck et al., 2022).

The EASE program was developed from a theoretical model that aimed to combine emotional awareness, mindfulness strategies, distress tolerance, and emotion regulation strategies. These goals were worked into a 16-week program with four modules called the ABCD model wherein A stood for Awareness, B stood for Be Accepting, C stood for Change, and D for Distract (Conner et al. 2019). Each module consisted of two to four individual sessions discussing ER strategies under that umbrella topic. In addition to the sessions on the ABCD model, there were two introductory sessions to provide an overview of the program and two concluding sessions to encourage the continued implementation of the learned skills.

The first few sessions of the EASE program emphasize a mindfulness-based approach, as one cannot effectively regulate their emotions without understanding them. These sessions introduce basic somatic therapy and mindfulness exercises as a form of meditation with two goals: to be aware of one's emotions and to be aware of one's body (Conner et al. 2019). It is this action that could incidentally lead to substantially increased resilience outcomes. Resilience involves returning to positive emotions after negative experiences which can be difficult for people with ASD as they often do not know what emotion they are experiencing or how to move on from it. This process is the result of the combined effects of alexithymia and rumination respectively. Alexithymia denotes an inability

to understand one's own emotions, while rumination refers to a difficult-to-escape continuous cycle of negative thoughts (Ibrahim et al., 2019). Alexithymia and rumination are common features of ASD and make resilient responses especially difficult, as emotions cannot improve if they are not readily identifiable and feelings cannot improve if they are not allowed to change. The EASE Program's results regarding ASD-related rumination are in line with previous studies, such as a 2016 systematic review that found that Mindfulness Based Interventions (MBIs) can significantly reduce rumination in adults with ASD (Cachia et al., 2016). Additionally, although it is not specifically related to those with ASD, a 2018 systematic review on the topic of MBIs in the treatment of alexithymia across four studies and 460 participants found they could significantly reduce alexithymia (Norman et al., 2018). Even before the second treatment module, the EASE study outlined the possibility to simultaneously and holistically decrease the effect of these two harmful ASD features.

The Role of Psychological Flexibility

While the EASE training may enhance aspects of emotion regulation, it does not directly address resilience. Resiliency is often thought of as useful when adapting to large-scale trauma, but with autistic youth, seemingly insignificant adverse stimuli can elicit significant negative reactions (Black, Stevenson, and Segers, 2017). In this case, resilience would not be limited to major changes like adapting to the death of a parent or moving out of state, but instead common daily challenges like buying the wrong kind of milk, preparing food differently, and not being picked up on time. The ability to adapt to these daily changes is vital for autistic youth as greater life changes occur with age. Efforts to increase resilience in this aspect would be focused on strengthening the ability to cope with the stress of discomfort and decrease psychological inflexibility and behavioral rigidity.

Psychological inflexibility serves as a form of avoidant behavior in which individuals abstain from situations that have the potential to be stressful or unpleasant, often through the creation of strict routines marked by repetitive rigid behaviors in which the only priority is the sustained absence of discomfort (Hayes, 2019). As those on the autism spectrum experience substantial sensitivities to common stimuli such as sound, taste, and touch, the lengths they will go to avoid them can be equally substantial and lead to the major impairment of daily functioning. These rigid behaviors can manifest in children's refusal to brush their teeth because of the taste of their toothpaste, continuing to wear the same dirty clothes every day because their other clothes have irritating fabric, or avoiding social interaction because people are too loud. These rigid behaviors are rewarded and reinforced in the short term with the absence of discomfort, but the long-term negative consequences are severe (Conner et al., 2020). These avoidant behaviors often lead to chronic exhaustion, social isolation, decreased ability to cope, and failure to achieve life goals. This makes avoidance through psychological inflexibility one of the most harmful maladaptive coping mechanisms used by those on the autism spectrum. Decreasing these avoidant behaviors provides an opportunity to increase resilience in autistic youth.

Avoidant behavior is extraordinarily common in a wide variety of mental health disorders (Akbari et al., 2022). While several treatments are aimed at its reduction, the challenge comes with adapting these interventions to fit those on the autism spectrum. Fortunately, there exists a type of therapy proven to decrease avoidant behavior and in which the main aim is to decrease psychological inflexibility. Acceptance and commitment therapy (ACT) is influenced by CBT and encourages individuals to recognize their values and commit to actions in pursuit of valued life goals despite the immense difficulties necessary to achieve them (Hayes et al., 2006). Addressing psychological inflexibility is a core aspect of ACT, yet it is rarely used to treat those with ASD and, like with resilience-based interventions, has been almost exclusively used to treat the parents and caregivers of autistic youth rather than to help autistic youth themselves.

Confronting avoidant behaviors is a central component of acceptance and commitment therapy (Hayes et al., 2006). An ACT approach prompts clients to consider what they are avoiding, the beliefs that fuel their avoidance, and what opportunities are missed when they engage in that behavior. This allows clients to distinguish between maladaptive forms of avoidance, like social isolation, and simple life preferences, such as a disinclination toward overly loud or crowded spaces. The goal is not to force clients to brave dangerous or intolerable situations but to increase their sense of agency and autonomy when they have to decide whether or not to persist. Therefore, an ACT approach does not preclude measures to alleviate sensory distress or create more accessible environments for autistic youth within reason, such as allowing an ASD child with increased sensory sensitivity and social anxiety to wear their own soft clothes to gym class. While this does allow a child to avoid rough textures and some social interaction, it is a reasonable tradeoff considering how unpleasant the experience would be and how little ASD youth would have to gain. This ability to accommodate the needs of ASD youth also has the added benefit of preventing any unintentional shaming of these children for their needs.

While allowing children this type of leeway opens up the possibility of taking advantage of a teacher or caregiver's generosity, it should also be noted that unless an ASD child is having an ASD-related meltdown, it is nearly impossible to know how much stress they are under, how uncomfortable they are, or what aspects of their ASD could be affecting them at that moment. The child could be exhibiting

greater personal resilience by standing under the buzz of fluorescent lights or showing immense strides in psychological flexibility by wearing a new pair of socks no one can see. Because it is difficult to know how emotionally strained a child is or how much progress they are making, teachers and caregivers must have mutually engaged conversations with deep consideration to determine what accommodations should and should not be extended to the child.

Randomized control studies testing Acceptance and Commitment Therapy for those with ASD have been primarily organized by a single team led by Dr. Johan Pahnke (Pahnke et al. 2012; Pahnke et al. 2022) and have shown promising results in the reduction of avoidant behaviors in ASD. The largest study to date exploring ACT as a treatment option for those with ASD was conducted in Sweden in 2022. The study included 39 adults with a mean IQ of 108 and a diagnosis of ASD. The subjects were split into two groups with the control group receiving standard CBT, and the experimental group receiving their specialized ACT-based intervention they titled NeuroACT. The intervention's main focus was the reduction of psychological inflexibility through weekly group therapy with six different modules focusing on relevant topics such as stress and avoidance, acceptance and avoidance, and support of executive function (Pahnke et al., 2022). Between groups, it showed a significant reduction in psychological inflexibility, behavioral avoidance, perceived stress, and cognitive fusion as well as a significant improvement in quality of life (Pahnke et al., 2022). These positive outcomes are worthy of further research, especially considering there are so few studies investigating this kind of treatment for this population.

Future Directions

Given the efficacy of interventions such as EASE and ACT at improving emotional regulation and psychological flexibility among autistic youth, future research on resilience in those with ASD could shift its focus toward building the foundations of resilience through ER and PF targeted interventions before strengthening it with SST. NeuroACT and the EASE Program accomplished the goals that SST-based RBIs initially sought but did not achieve. An intervention pursuing the effects of the EASE Program and the benefits of the NeuroACT program could create a more comprehensive intervention that would allow youth with ASD to face everyday stressors more easily and experience greater positive outcomes for their efforts.

Resilience requires healthy coping mechanisms, and avoidance has been consistently shown to be maladaptive. To increase resilience one needs to decrease avoidance, which, within ASD populations, manifests primarily as psychological inflexibility. The NeuroACT program was effective at decreasing behavioral avoidance by increasing psychological flexibility. This is important in a resiliency study because one's ability to weather hardship cannot be determined if behavioral rigidity prevents them from facing hardship. As current research has primarily focused on adults, future steps would be to expand and adapt this treatment to younger populations with ASD. This pediatric research could examine how ACT affects PF and behavioral rigidity. Longevity studies could be implemented to see how well they persist in difficult actions over time as they gain more independence with age and therefore more opportunities to engage in behavioral rigidity without parental supervision.

There is a possibility that research into the interaction of ER and PF could create a model explaining limited resilience in those with ASD. This ASD resilience model would posit that emotion regulation is the underlying process governing resilient behavior and that psychological inflexibility is the primary maladaptive coping mechanism used by this population to avoid actions that require emotion regulation, thereby preventing opportunities for improvement. The increased difficulty those with ASD have with these mechanisms is the primary contributor to decreased resilience in individuals with ASD. This model suggests a cycle beginning with poor ER leading to the avoidance of stressors and the avoidance of stressors leading back to the atrophy of already poor ER. Therefore, the failure to recognize these cyclical factors and their interaction is why previous singularly focused SST-based RBIs for ASD youth were less successful than anticipated. ASD-focused RBIs should instead focus their efforts on treatment that would concurrently enhance ER and PF.

Successful interventions following these pillars could create a new direction for resilience-based interventions and open up new possibilities for ASD treatment, allowing for the exploration of designs of new models that better explain ASD symptomatology and their interactions. Future research could look into the bi-directionality of those two factors and eventually see how they link to other ASD symptoms. A possibility may be a three-point ASD model where difficulties in social interaction, emotion regulation, and psychological inflexibility are better understood in the context of their interaction which could make SST programs more empathetic and holistic. Having ASD youth spread their effort across these three points would take pressure off the sometimes unreasonable expectation of masking autism and wholly changing the way they interact with peers, as is often demanded by SST programs. This easing of social pressure would work concurrently with the strengthening of ER and PF to ameliorate ASD-related burnout and meltdowns while decreasing depression and avoidance. The validation of mindfulness and non-judgmental acceptance could also decrease the feelings of shame that pediatric ASD patients experience when they fail to meet the expectations of a neurotypical society, allowing those with ASD to live more fulfilling lives and decrease the challenges of their self-imposed restrictions.

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Rethinking Loneliness: A Perspective on Norm Deviation Beyond the Collectivism-Individualism Framework

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Acknowledgments

We want to thank Professor Eunsoo Choi for reviewing and offering feedback to our review article.

The degree to which cultures differ in experiencing loneliness has been studied in depth by researchers. This literature proposes a novel approach to conceptualizing loneliness by introducing the idea of norm deviation and how deviating from normative standards leads to loneliness. When individuals perceive themselves as deviating from normative standards, their basic psychological needs—autonomy, competence, or relatedness, as outlined in self-determination theory—may go unmet. This unmet need can, in turn, foster feelings of loneliness. Building on this theoretical framework, the present review explores how social support and SDT-related processes may moderate the relationship between norm deviation and loneliness. While social support is well known to mitigate loneliness, this research focuses on the source and nature of support, offering a more nuanced view of its role. Finally, to better understand how norm deviation is experienced across cultural contexts, this review highlights the value of incorporating qualitative research methods. Such approaches can capture cultural nuances and lived experiences often overlooked in quantitative loneliness research.

Keywords: loneliness, norm deviation, culture, social support, self-determination

Introduction

Loneliness is the subjective distress felt from an undesired absence of mutual understanding and connection with others, which can lead to further issues like impaired cognitive function (Van Staden, & Coetzee, 2010; Heu, van Zomeren, & Hansen, 2021). Despite its subjective nature, loneliness is a universally experienced phenomenon. The prevalence of loneliness for adolescents ranged from 9.2% to 14.4% depending on all countries around the world, while for adults, the rate increased to 24.2% (Surkalim et al., 2022). While loneliness has been linked to serious mental and physical health risks, including depression, cardiovascular issues, and premature mortality, this paper instead focuses on examining the underlying psychological and social mechanisms that shape the experience of loneliness (Heu, van Zomeren, & Hansen, 2019; Holt-Lunstad et al., 2015; Hawkley et al., 2009; Hawkley, & Cacioppo, 2010; Caspi et al., 2006). Understanding these mechanisms is essential for effectively addressing loneliness and, in turn, reducing the risk of related health conditions.

Existing studies on loneliness have primarily focused on understanding the nature of loneliness, its negative psychological and social consequences, and the personal and social factors influencing it. In particular, numerous studies have attempted to compare experiences of loneliness across collectivistic and individualistic cultures, often using quantitative measures such as surveys (Barreto et al., 2021; Özdemir, & Tuncay, 2008; Taniguchi, & Kaufman, 2022). Individualism is a culturally based construct, which emphasizes independence, self-orientation, and personal achievement. In comparison, collectivism centers itself on interdependence, group harmony, prioritizing the needs of others of the self (Schermer et al., 2023). However, analyzing loneliness through the lens of individualism and collectivism places relatively little emphasis on how individuals perceive and internalize the cultural norms of their society. This internalization involves not only adopting and interpreting these values, but also embedding them into one's self-concept, guiding behavior and shaping expectations within social relationships. Even within the same culture, the impact of cultural norms can vary significantly among individuals. Therefore, we argue that when examining diverse experiences of loneliness, it is essential to consider

not only the collectivist/individualist cultural framework but also other relevant variables including norm deviation, social support, and self-determination.

One such factor is the extent to which individuals perceive themselves as deviating from the norms of their respective cultures—that is, the degree of norm deviation. The more individuals perceive themselves as deviating from their cultural norms, the more likely they are to experience unmet basic psychological needs, such as autonomy, competence, and relatedness, which in turn can lead to loneliness (Heu, 2023; Heu et al, 2021; Hemberg et al., 2022; Nielsen, Nielsen, & Lasgaard, 2024; Kirwan et al., 2023). These needs are central to psychological frameworks such as self-determination theory (SDT), which emphasizes the role of need satisfaction when fostering psychological well-being and regulated behavior (Ryan & Deci, 2000). According to SDT, when an individual's needs are satisfied, they are more likely to thrive; otherwise when unmet, they are more vulnerable to negative emotional states, such as loneliness. Importantly, norm categories—such as behavioral or emotional norms—and the social consequences of norm violations vary across cultural orientations, for instance, in the degree of tolerance for norm deviations (Stamkou et al., 2019; Mu et al., 2015). In collectivist cultures, emotional restraint and behaviors that promote group harmony are often expected, and deviating from these norms (e.g., expressing negative emotions) typically results in social disapproval or exclusion. In contrast, individualist cultures tend to place greater value on personal expression and autonomy, making norm violations in such contexts less likely to result in severe social penalties. Prior research also indicates that individuals who identify strongly with their cultural group are more susceptible to the influence of that group's norms (Jetten et al., 2006; Jetten, Postmes, & McAuliffe, 2002). They may be more likely to internalize or strive to embody culturally valued behaviors, which may result in stronger emotional reactions (e.g., guilt, shame), when perceiving themselves as deviating from those norms. How one navigates through social relationships and interprets experiences like loneliness can be affected by heightened sensitivity. Collectively, these studies substantiate that cultural norms differ across societies and that individuals interpret and respond to these norms differently. Therefore, to capture the multifaceted nature of loneliness, it is essential to examine both cultural-level and individual-level normative frameworks, rather than relying solely on dichotomies such as individualism versus collectivism.

Social support is another key factor to consider, as it directly influences basic psychological needs outlined earlier in this paper. The current review posits that both social support and unmet satisfaction of these needs play a role in the relationship between norm deviation and loneliness. While previous studies have predominantly emphasized the beneficial effects of social support on loneliness relatively few have addressed the possibility that social support may not always mitigate loneliness, depending on the cultural and contextual circumstances (Vasileiou et al., 2019; Bauer & Rokach, 2004; Taniguchi & Kaufman, 2019; Spek, 2024). Evidence suggests that from whom and how social support is received—both of which are shaped by cultural norms—significantly impact the fulfillment of basic psychological needs (Lin & Kingminghae, 2014; Rodrigues, Gierveld, & Buz, 2014; Van Veeren, 2013). This perspective implies that not all forms of social support are equally beneficial, suggesting the existence of both effective and less effective types of social support, depending on the cultural and contextual factors. This review adopts a more nuanced perspective, considering both the positive and potentially adverse effects of social support on loneliness.

Overall, while previous research has predominantly conceptualized loneliness through the dichotomy of individualism and collectivism, this study critically examines these frameworks, highlights their limitations, and introduces a more nuanced approach by examining how perceived norm deviation, basic psychological need satisfaction, and the quality of social support interact to shape experiences of loneliness across cultural contexts.

1. Loneliness and Culture

Loneliness has been classified and conceptualized in various ways in past studies (Lykes & Kemmelmeier, 2014; Hawkley & Cacioppo, 2010; McKenna-Plumley, Turner, Yang, & Groarke, 2023). This highlights the complexity of loneliness and emphasizes the need for a framework that incorporates not only individuals' emotions, but also broader cultural and social dynamics that shape how loneliness is experienced and interpreted. Researchers such as Heu et al. (2019) have emphasized that loneliness does not simply result from being socially isolated in a physical or objective sense. Similarly, Van Staden and Coetzee (2010) highlight the importance of distinguishing between the experiences of loneliness and solitude, as well as related but distinct concepts like social isolation and withdrawal. These perspectives collectively suggest that loneliness is not a straightforward construct but rather an intricate psychological experience that is shaped by both internal perceptions and nuanced distinctions from conceptually similar states. Recognizing this complexity is crucial, as it underlines the need to approach loneliness not merely as a matter of social quantity, but of subjective quality and interpretation.

A variety of individual-level factors have been linked to loneliness, including personality traits and social skills. Individuals with anxiety, shyness, low self-esteem, or an external locus of control tend to be more prone to loneliness (Doman & Le Roux, 2010; de Jong Gierveld, 1998). While these personal characteristics are important, they do not fully explain the variability in how loneliness is experienced across different populations. Cultural factors, in particular, offer a critical lens for understanding how norms, values, and social expectations

shape perceptions of loneliness. The present research focuses on these cultural dimensions, which may moderate or amplify feelings of loneliness in ways that go beyond individual traits.

These different cultural backgrounds influence how people view the world and what their values are (Jetten, Postmes, & McAuliffe, 2002). Such cultural differences also affect how loneliness is experienced and interpreted. The degree, frequency, and experience of loneliness may be shaped by cultural contexts with different expectations regarding social relationships. Much of the literature in cultural psychology has focused on the distinction between individualistic and collectivistic cultures. In individualistic cultures, people are typically viewed as individuals separate from others, with personal achievement, competitiveness, and impersonal social relationships being highly valued (Ostrov, & Offer, 1978). In contrast, individuals in collectivistic cultures are viewed as deeply interconnected with others and typically have access to a broader network of relationships and social support (Taniguchi, & Kaufman, 2022). For example, in cultures that emphasize the importance of romantic relationships, individuals are more likely to feel loneliness when they fail to meet those cultural expectations (Seepersad at el., 2008). US students reported having higher levels of romantic loneliness than did Korean students, suggesting that romantic expectations have a greater impact on one's loneliness in the United States (Van Staden, & Coetzee, 2010).

Heu and colleagues (2019) conceptualized the idea that cultural contexts differently shape individuals' experiences of loneliness by introducing the concept of social embeddedness, which refers to the extent to which individuals are expected to be integrated into and maintain close ties within their social groups. Different cultural systems, such as individualism and collectivism, promote different expectations regarding social embeddedness (Heu, van Zomeren, & Hansen, 2019). Specifically, they proposed that individualistic cultures tend to emphasize personal autonomy and have less demanding expectations for maintaining close social ties, whereas collectivistic cultures impose stronger expectations for individuals to maintain interconnected and supportive relationships within their groups. In other words, loneliness can result from discrepancies between individuals' ideal levels of social embeddedness and their actual experiences.

Building on this conceptualization, it is essential to examine how the experience of loneliness differs across collectivistic and individualistic cultural contexts. However, past research has produced mixed findings regarding which cultural contexts—collectivistic or individualistic—are associated with greater experiences of loneliness. Some studies have suggested that individualistic cultures, such as those in North America, are more strongly associated with loneliness (Ostrov & Offer, 1978), while collectivistic cultures are linked to lower levels of loneliness (Taniguchi & Kaufman, 2022). For example, Bauer and colleagues (2004) found that Czech students, supported by strong family and friendship networks characteristic of their cultural context, were better protected against loneliness compared to Canadian students. Conversely, other research has revealed the opposite trend. For instance, Lykes and Kemmelmeier (2014) found that individuals from more collectivistic cultures reported higher levels of loneliness. Given that collectivistic cultures place a high value on interpersonal connections, the loss of these ties may be particularly distressing, thereby intensifying feelings of loneliness (Lykes & Kemmelmeier, 2014; Liu et al., 2021; Taylor et al., 2004).

However, it is important to acknowledge that these findings may partly reflect cultural differences in the reporting of loneliness rather than true differences in loneliness experiences. In some collectivistic cultures, admitting to feelings of loneliness may be socially undesirable, potentially leading to underreporting. This highlights the need to consider not only cultural values such as collectivism and individualism but also other sociocultural factors that may influence both the experience and expression of loneliness.

Furthermore, interpreting loneliness experiences solely through the collectivistic/individualistic cultural framework fails to sufficiently account for individual differences within a given culture. For example, In a study conducted with Turkish university students, 60.2% reported experiencing loneliness during their transition to university life (Özdemir & Tuncay, 2008). While Turkish culture is traditionally characterized by strong norms of interdependence, this finding suggests that cultural norms alone may not uniformly protect individuals from loneliness. Instead, it may reflect individual differences in the extent to which people internalize and prioritize interdependent relationships. In particular, individuals who place greater importance on close interpersonal bonds may experience heightened loneliness when they encounter situations, such as moving away from family support systems, that challenge their cultural expectations of social connectedness. This individual-level variability may partly explain the mixed findings regarding loneliness levels across collectivistic and individualistic cultures. In other words, prior research may have overlooked the diverse ways individuals internalize and respond to cultural norms.

In sum, loneliness is a complex and context-dependent psychological experience, shaped not only by individual traits or levels of social interaction but also by subjective interpretations of social expectations and norms. This complexity highlights the importance of considering how deviations from perceived social norms—rather than mere social absence—may play a critical role in the development of loneliness, a topic further explored in the following section.

2. Norm Deviation and Loneliness

Cultural norms regarding social relationships (e.g., the expected frequency of visiting one's parents) emerge from

shared beliefs and values within social groups (Li & Van den Steen, 2021; Nyborg et al., 2016). They play a crucial role in understanding loneliness because they influence how individuals navigate and assess their social relationships (Heu, van Zomeren, & Hansen, 2021; Gampe & Daum, 2018), behaviors (Heu, 2023; Brauer & Chaurand, 2010), and evaluations of themselves (Heu, 2023; Brauer & Chaurand, 2010). For example, in cultures with more stringent norms regarding familial visits, the frequency of visiting one's parents once a week may be perceived as either insufficient or excessive (Heu, van Zomeren, & Hansen, 2021). This is because individuals may experience greater expectations from interpersonal relationships or heightened sensitivity to deviations from established relationship norms (Kinias et al., 2014; Mooji, 2022, Heu, van Zomeren, & Hansen, 2021; Schermer et al., 2023). Throughout the paper, the influence of norm deviation on loneliness and possible mechanisms will be discussed.

Heu and colleagues (2021) assert that there are two types of norms, namely, culture-level norms and individual-level norms. Culture-level norms usually "describe more objective social realities and are what is done by, or should be done according to, most cultural members". On the contrary, individual-level norms refer to "internalized norms or individual perceptions of shared norms, which may or may not reflect social realities" (Heu et al., 2021, p. 65). Culture-level norms are associated with a greater risk of loneliness compared to individual-level norms (Heu et al., 2021). However, individual differences should not be overlooked, even if a culture has restrictive norms and shows high loneliness on a cultural level, this does not imply that every individual in this culture will show high loneliness (Heu, van Zomeren, & Hansen, 2021). Thus, both cultural and individual-level norms should be considered.

Not everyone adheres to social norms. Norm adherence depends on the content of the norm and who follows it (Heu, 2023). While collectivist cultures have shown to adhere more to behavioral norms, individualist cultures show higher adherence to emotional norms (Vishkin et al., 2023), highlighting how cultural orientation shapes norm adherence. Additionally, reaction to norm violations vary across cultures, indicating cultural norms are perceived differently depending on cultural context (Stamkou et al., 2019; Mu et al., 2015). Past research has shown that individuals who show higher identification to a culture or in-group are more likely to conform to the group's norms and self-stereotype themselves in line with them (Jetten et al., 2006; Jetten, Postmes, & McAuliffe, 2002). These studies demonstrate that how people interpret and respond to social norms varies depending on both the type of norm - such as emotional versus behavioral - and individual factors like the degree of identification with one's culture.

The importance of differentiating cultural and individual level norms have been discussed, along with how norm adherence depends on one's culture and identification with it. Although research examining the association of these concepts with loneliness is limited, there have been efforts to explore this connection. Heu (2023) proposed the framework of Norm Deviations and Loneliness (NoDeL), suggesting that deviating from normative standards may lead to loneliness by triggering negative psychological states, such as feelings of unfulfilled relational needs. In line with this, qualitative studies observing loneliness experiences report that participants often felt lonely when they failed to meet normative expectations (Heu et al, 2021; Hemberg et al., 2022; Nielsen, Nielsen, & Lasgaard, 2024; Kirwan et al., 2023). Previous research has also shown that following culturally appropriate patterns of emotions contributes to psychological well-being, emphasizing the importance of cultural fit for mental health (De Leersnyder, Kim, & Mesquita, 2015). Additionally, it is well established that normative standards and cultural values shape social expectations (Luhmann, Buecker, & Rüsberg, 2023) and that discrepancies between expectations and reality contribute to loneliness (Peplau & Perlman, 1982; Lee 2024; Van Staden & Coetzee, 2010; Heinrich & Gullne, 2006). By extension, cultural mismatch - deviating from culturally expected norms - may lead to negative psychological outcomes such as loneliness, as supported by qualitative findings on norm deviation and loneliness.

To elaborate on this hypothesis, it is important to consider two key components: social support and basic psychological needs. As we will examine further, social support plays a critical role in fulfilling these basic needs and when such support is lacking - often as result of cultural mismatch - these needs may go unmet. This suggests that the deprivation of frustration of basic psychological needs contributes to the experience of loneliness.

3.1 Social Support

Social support is defined as the perceived and actual availability of social resources provided by people who we value or rely on (Gottlieb & Bergen, 2010; Sarason et al., 1983) and affects loneliness. Its influence is so profound that deprivation of a supportive social network is categorized into a unique form of loneliness, termed social loneliness (Van Staden & Coetzee, 2010). Several studies have observed that social support alleviates loneliness (Vasileiou et al., 2019; Bauer & Rokach, 2004; Taniguchi & Kaufman, 2019; Spek, 2024). A study examining the relationship between mortality rate and loneliness in different countries found that although Mexico and South Korea were both categorized as collectivist countries, South Korea showed a higher mortality rate (Park & Zhu, 2024). Researchers discussed this finding by emphasizing social support may have played a critical role. Mexico showed a lower socio-economic status compared to South Korea. "Due to scarcity of resources, people with lower SES must depend on others for survival", leading to more engagement in social networks and exchange of prosocial behaviors (Park & Zhu, 2024, p. 799). Past research has shown that higher household income was associated with less social contact and more time alone (Bianchi & Vohs, 2016), supporting the researchers' claim. Therefore, the

researchers concluded that while both Mexicans and Koreans experienced high levels of loneliness, strong social support among Mexicans acted as a protective factor against mortality, whereas Koreans, despite similar loneliness levels, showed higher mortality rates. These findings highlight the influence of social support, emphasizing its role in not only buffering loneliness, but meeting individual's basic psychological needs. To further elaborate on our hypothesis, researchers focused on two interrelated components, social support and basic psychological needs, which proposes that social support facilitates the satisfaction of those needs. If they are unmet, individuals are more likely to experience loneliness.

However, the benefits of social support appear to manifest selectively under certain circumstances. A study observing loneliness and exchange of social support among Dutch and Spanish adults showed contradictory results regarding the aftermath of instrumental social support (Rodrigues, Gierveld, & Buz, 2014). For Spanish adults, who place greater emphasis on interdependence, instrumental social support significantly mitigated loneliness. This is likely because of their stronger emphasis on family relationships, leading to expectations of receiving support from family members. When these expectations were unmet, it resulted in heightened feelings of loneliness. In line with these results, Taniguchi and Kaufman (2019) showed higher interdependence leads to believing social ties are more desirable; thus reducing loneliness when receiving social support.

However, the opposite pattern was observed among the Dutch sample. Dutch adults, who value independence more highly, perceived instrumental social support as undermining their independence, which negatively influenced their loneliness. Instead, emotional social support was shown to be more effective in addressing loneliness within this sample (Rodrigues, Gierveld, & Buz, 2014). Related to this, past research revealed a negative relationship between expectation of emotional support from family in times of need and loneliness, which was stronger among individualistic countries (Taniguchi & Kaufman, 2022). Individualistic and collectivistic cultures differ in the various types of social norms they prioritize, in which individualistic cultures emphasize emotional norms, whereas collectivistic cultures underscores behavioral norms (Vishkin et al., 2023). As a result, emotional support tends to have greater influence in impacting individualistic cultures, as emotional expressions are deemed more culturally relevant. In contrast, collectivistic cultures place greater value on instrumental support, aligning with their emphasis on observable and socially visible behaviors. Summarizing the findings from Taniguchi and Kaufman (2019, 2022), Rodrigues et al. (2014) and Park and Zhu (2024), people from individualist cultures, which place greater value on emotional norms, tend to benefit more from emotional social support, whereas those from collectivist cultures, where behavioral norms are prioritized, find instrumental social support more effective. Thus, the aftermath of social support is shaped by an individual's cultural norms and whether the support aligns with those norms.

A probable explanation for the differing outcomes of social support lies in the adverse effects of cultural norm deviation. The loneliness felt by the participants in Rodrigues and colleagues' study (2014) can be attributed to a mismatch between normative expectations of social support and the support they perceived as instrumental social support had different consequences on loneliness depending on cultural orientation: Dutch adults, who valued independence, experienced greater loneliness when receiving instrumental support, as they perceived it as undermining their autonomy. This demonstrates how the method in which social support is given significantly shapes its psychological outcomes. For social support to be effective, it must align with the recipient's cultural expectations. Lin and Kingminghae (2014) showed social support from peers with the same nationality had stronger effects alleviating loneliness among international students compared to support from those with different nationalities. Co-national ties mitigated loneliness when students perceived a stronger cohesive feeling with their fellow colleagues. These findings support our argument that cultural adherence influences the experience of loneliness, emphasizing the importance of "who" provides social support. Therefore, both the manner and the source of social support can either mitigate or exacerbate its impact.

Building on this, it is important to consider which psychological processes are activated by the discrepancy between expected and perceived social support, and how these processes contribute to influencing the experience of loneliness. Self-determination theory may offer an explanation for this phenomenon.

3.2 Self-Determination Theory

Self-determination theory emphasizes the importance of attainment of basic psychological needs for personality development and behavioral self-regulation (Ryan & Deci, 2000). The three basic psychological needs forming the basis of self-determination theory are autonomy, competence, and relatedness (Ryan & Deci, 2000; Deci & Ryan, 2012). Basic psychological needs frustration refers to when an individual's basic psychological needs are not satisfied and contributes to mental ill-being (Vansteenkiste & Ryan, 2013; Ferrand & Martinent, 2021). The influence of basic psychological need frustration is universal (Chen et al., 2014) and it is connected with loneliness. Past research has shown basic psychological needs frustration is associated with higher levels of loneliness (Karababa & Tayli, 2020; Chen et al., 2014; Saricali & Guler, 2022). Additionally, individuals reporting higher needs for relatedness, autonomy, and competence were more likely to report loneliness when these needs were unsatisfied (Lenny, Doleck, & Bazelais, 2019).

Social context affects how the basic psychological needs are satisfied, one of them being the presence of social support. Krabbenborg and colleagues (2017) demonstrated homeless

young adults who perceived higher social support reported higher autonomy, relatedness, and competence, which eventually lead to better quality of life. Other studies have also shown social support fostered basic psychological needs (Ryan & Solky, 1996; Ryan & Deci, 2010; Ryan & Deci, 2000; King, Haw, & Wang, 2024).

Culture also influences the satisfaction of these needs. Heu and colleagues (2021) proposed the culture-loneliness framework asserting "loneliness can thrive whether cultural norms about social relationships are lenient or restrictive". Lenient norms encapsulates a broader range of acceptable social behaviors and relationships, which allow individuals greater autonomy towards how they connect with others (e.g., freedom in maintaining social ties). However, restrictive norms enforce more rigid expectations in how relationships are created and maintained, which may limit one's personal choice by prioritizing obligations (e.g., family, community). Typically, individuals seek agency and relatedness but how these are satisfied depends on the cultural environment (Heu, van Zomeren, & Hansen, 2021). A moderate amount of restrictiveness fosters both agency and relatedness, eventually preventing excessive isolation of any type. People with lower levels of perceived autonomy who live in highly restrictive cultures tend to experience greater loneliness, which is an effect that connects to broader evidence suggesting that individuals in more restrictive countries report higher levels of loneliness (Heu et al., 2021; Mooji, 2022).

The impact of cultural restrictiveness can also be understood through the concept of value internalization. According to the self-determination theory, it is not the value themselves, but the degree to which they are internalized that predicts well-being (Deci & Ryan, 2012). Internalizing the satisfaction of basic psychological needs fosters self-regard, self-regulation, vitality, and feelings of connectedness (Ryan & Solky, 1996; Ryan & Deci, 2010). However, the ease of internalization varies by cultural orientation. People in vertical societies, which are characterized by hierarchy and control, experience greater difficulty internalizing autonomy values compared to those in horizontal societies (Deci & Ryan, 2012), and as noted earlier, vertical societies report higher levels of loneliness (Goh et al., 2023). Building on these findings, it is proposed that cultures with stricter attitudes toward norm deviations may hinder the internalization of basic psychological needs, thereby contributing to the elevated loneliness observed in these environments.

A research in organizational psychology has demonstrated that people with higher person-organization fit report higher levels of autonomy, relatedness, and competence need satisfactions (Greguras & Diefendorff, 2009). Researchers explain that the alignment between employees' and organizations' values enables organizations to provide the resources needed for employees to satisfy their psychological needs. Expanding on this study, it is proposed that individuals' alignment with cultural norms and psychological needs shape the experience of loneliness. As previously discussed, the adherence to culturally endorsed values play a crucial role in meeting basic psychological needs, and aligning with these cultural values and norms has been consistently shown to mitigate loneliness. Therefore, when individuals experience norm deviation, it is likely to lead to need frustration, ultimately resulting in greater loneliness.

The positive association between need satisfaction and psychological well-being is universal. Deci and Ryan's study (2012) demonstrated autonomy-supportive contexts satisfy autonomy needs, leading to higher well-being regardless of cultural orientation. Other research has shown need-supportive teaching was positively associated with well-being regardless of cultural, economical, and political contexts (King, Haw, & Wang, 2024). Therefore, loneliness research should focus on whether the social support provided meets the culturally drawn expectations of the individuals. Then, researchers should observe how the mismatch or concordance between perceived and expected social support exacerbates or fosters self-determination. We emphasize cultural research on loneliness should not focus on which culture experiences higher loneliness, rather they should investigate the impact of norm deviation on loneliness research along with the moderating and/or mediating effects of social support and self-determination.

Discussion

Recent research on loneliness has been overly focused on determining which culture experiences more loneliness. This review aimed to propose that loneliness derives from unmet satisfaction of basic psychological needs induced by norm deviation and mismatch of expected and received social support, which have been supported by the studies presented throughout the literature.

Each culture has different cultural and social norms (Li & Van den Steen, 2021; Nyborg et al., 2016) and the extent to which individuals adhere to these influences their psychology including loneliness experiences (Heu et al, 2021; Hemberg et al., 2022; Nielsen, Nielsen, & Lasgaard, 2024; Kirwan et al., 2023; De Leersnyder, Kim, & Mesquita, 2015). Individualistic cultures show higher adherence to emotional norms while collectivistic cultures show more adherence to behavioral norms (Vishkin et al., 2023). Additionally, individuals conform to a group's social norm the more they identify with the culture or in-group (Jetten et al., 2006; Jetten, Postmes, & McAuliffe, 2002). These results support that adhering to a cultural norm depends on the interaction between the individual and the culture.

To better understand the relationship between norm deviation and loneliness, it is important to examine how social support and the satisfaction of basic psychological needs influence loneliness. Past research has shown that emotional support exerts a greater influence in individualistic cultures, whereas instrumental support has a stronger impact in collectivistic

cultures (Taniguchi & Kaufman, 2019; Rodrigues et al., 2014; Park & Zhu, 2024). These findings align with those of Vishkin et al. (2023), who reported that individuals from individualistic cultures tend to adhere more to emotional norms, while those from collectivistic cultures adhere more to behavioral norms. Therefore, when the type of social support aligns with an individual's culturally influenced needs, it tends to be more effective in alleviating loneliness.

When individuals do not deviate from cultural norms and the social support they receive aligns with what they expected, their basic psychological needs may be better satisfied, which in turn can alleviate loneliness. Although there is limited research directly examining the influence of norm deviation and mismatches between expected and received social support on loneliness, studies in organizational psychology have shown that individuals with higher person–organization fit report greater satisfaction of autonomy, relatedness, and competence needs (Greguras & Diefendorff, 2009). Furthermore, past research has demonstrated that frustration of basic psychological needs is associated with higher levels of loneliness (Karababa & Tayli, 2020; Chen et al., 2014; Saricali & Guler, 2022). Building on these findings, it can be proposed that norm deviation and unmet social support contribute to the frustration of basic psychological needs, which in turn leads to increased loneliness.

Conclusion

While this paper highlights the impact of norm deviation, basic psychological needs, and social support on loneliness, further investigation is necessary to understand how these findings can translate into practical, individualized interventions. For instance, even if norm deviation is shown to exacerbate loneliness, additional research is needed to determine how norm deviation can be addressed or adjusted to develop interventions aimed at alleviating loneliness. This paper relies heavily on theoretical frameworks that connect cultural norms, self-determination theory, and loneliness, which may limit the generalizability of its claims. To confirm the validity of the hypotheses presented throughout the literature, future studies must comprehensively examine the various factors influencing norm deviation (e.g., social support) and their interplay. More specifically, research should first examine the norms that exist within each culture and the consequences of norm deviation through qualitative studies, such as interviews. Later, they should empirically test these through quantitative studies, like surveys. This allows researchers to quantify the relationship between the extent of norm deviation and loneliness experiences. Such research will be critical for designing holistic approaches that not only enhance theoretical understanding but also ensure practical applicability in addressing loneliness.

Further research should investigate the psychological mechanism behind loneliness and an effective way to do so is using qualitative studies. To mention some examples, papers written by Heu et al. (2021), Hemberg et al. (2022), and Kirwan et al. (2023) applied qualitative research methods to collect data about individuals' loneliness experience. For research examining subjective emotional experiences such as loneliness, qualitative methods can offer deep insights—especially when the relationships between variables, such as the link between norm deviation and loneliness, remain ambiguous. Questionnaires tend to not sufficiently consider aspects of different cultures as they are centered to Western cultures (Heu et al., 2021). Therefore, these surveys fail to reflect the true experiences of people with non-Western backgrounds as their responses are limited to Western-based perspectives. However, qualitative research helps compensate for these limitations by studying the latent aspects of the unexplored cultures and capturing the personal experiences with norm deviation more precisely. For instance, interviews allow researchers to identify which cultural norms exist and what are the social and psychological consequences arising when deviating from them. These cannot be observed when using quantitative methods alone because individuals cannot share their own experiences. Therefore, relying on qualitative study methods, such as interviews, to reveal how norm deviation instigates loneliness from a cross-cultural perspective may provide meaningful insights on how to approach this issue.

Although qualitative studies offer valuable insights, they also present certain limitations. These research methods' findings are difficult to generalize due to typically smaller sample sizes compared to quantitative research. Consequently, achieving statistically significant conclusions can be more challenging. Therefore, qualitative research should be used to establish a foundational framework for understanding cultural norm deviation and loneliness, and then be reinforced and tested through quantitative methods which cover up these drawbacks.

In addition to these methodological considerations, this literature review itself has certain limitations. First, there is a lack of empirical research directly examining the relationship between norm deviation and the satisfaction of basic psychological needs, particularly in the context of loneliness. As a result, this literature review had to draw upon adjacent fields, such as organizational psychology, to infer these connections (e.g., research on person–organization fit and need satisfaction). While these studies provide a useful foundation, they may not fully capture the cultural or interpersonal nuances specific to norm deviation in social or cross-cultural contexts. This reliance on indirect evidence limits the specificity and applicability of the conclusions drawn in the review.

Moreover, while this review emphasizes the role of norm deviation in loneliness and critiques the dominant focus on the individualism–collectivism paradigm, it does not account for other contributing factors. Important variables such as social structure of a culture, age of an individual, and the influence of social media may also play significant roles in shaping experiences of loneliness and should be considered in future investigations.

Although these limitations exist, this paper contributes

to research on loneliness from a cross-cultural perspective by proposing a new approach. It draws on a range of supporting studies that vary in methodology (qualitative and quantitative) and sample background. Additionally, it introduces several psychological theories, such as self-determination theory and the norm deviation and loneliness framework, effectively connecting past knowledge with this new perspective. This framework is especially relevant in today's increasingly multicultural world. As societies become more culturally diverse, it becomes less feasible to categorize individuals strictly as collectivist or individualist when designing interventions for loneliness. Therefore, this proposed framework may offer a more nuanced and flexible approach for addressing loneliness across diverse cultural contexts.

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The Relationship Between Impulsivity Traits and Choice On Alcohol Use During a Quit Attempt

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Acknowledgements: I would like to thank my Graduate Mentor Wave-Ananda Bakersville and Faculty Advisor Dr. Lara Ray. This study was supported by the National Institute on Alcohol Abuse and Alcoholism (R21AA027180 to LAR). This clinical trial is registered on clinicaltrials.gov, (NCT04249882).

IRB Approval: The initial trial had ethical approval from the University of California, Los Angles (UCLA) IRB: 19-001735 (05/2020). Written, informed consent to participate was obtained from all participants.

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Abstract

Impulsive personality traits and impulsive choice are indicators of alcohol use disorder (AUD). Research on the relationship between impulsivity and relapse risk among individuals with an AUD is relatively scarce and unclear. The current study is a secondary analysis examining the predictive effect of impulsivity on alcohol use and craving during a 6-day quit attempt. Treatment seeking individuals with an AUD (N=49) were randomized to either oral naltrexone (50 mg QD), varenicline (1 mg BID), or matched placebo. Randomized participants completed a weeklong medication titration period, followed by a 6-day quit attempt. During the initial screening visit, participants completed the UPPS-P impulsivity scale and the Monetary Choice Questionnaire to assess discounting rates, k. The Timeline Followback assessed quantity and frequency of alcohol use in the past 30-days. During the quit attempt, participants completed daily assessments on previous day alcohol consumption and craving. Multiple linear models examined baseline impulsivity as a predictor of alcohol outcomes. Baseline impulsivity traits did not significantly predict drinking outcomes or craving during the quit attempt ($p>.025$). Lack of premeditation predicted average alcohol craving, albeit trend-level ($B=-0.338$, $p<.05$). Lack of premeditation and overall k did not predict alcohol use or craving during the quit attempt. Impulsive traits and choice did not predict alcohol relapse in individuals with AUD. This study was among the first to test trait and behavioral impulsivity during a 6-day abstinence period. A longer follow-up may reveal associations between impulsivity and drinking outcomes, aiding development of interventions targeting AUD.

Keywords: alcohol-use, impulsive personality traits, impulsive choice, relapse, AUD

Introduction

Alcohol-related mortality remains high in the United States, as rates of alcohol-related deaths continue to rise (APA, 2023). This is a significant public health concern as 90% of individuals with Alcohol Use Disorder (AUD) relapse at least once in their lifetime (NIAAA, 2023). By understanding several predictors of alcohol use relapse such as impulsivity, we can further address this current public health crisis. Impulsivity is a pertinent factor for understanding alcohol relapse due to the lack of inhibition, yet it is understudied (Reyes-Huerta et al., 2018). Preclinical models have found that enhanced impulsivity in mice correlates with an increase in motivation to consume alcohol and increased risk of relapse highlighting the importance of the evaluation of impulsivity in clinical applications (Loos et al., 2013). To better understand the impact of impulsivity in clinical applications, it is essential to first understand what is meant by impulsivity. Impulsivity can be defined as acting in response to a stimulus without taking into account the consequences (Meda et al., 2009). Recent research has indicated impulsivity to be a broad umbrella category with a lack of unified constructs (Ray et al., 2021; Sliedrecht et al., 2021). Impulsivity can generally be categorized into two categories: behavioral and self-report impulsivity (Sliedrecht et al., 2021). To further differentiate between these two categories, it has been proposed that there are three different aspects of impulsivity in humans: self-reported impulsivity, impulsive choice (behavioral), and impulsive action (behavioral;Broos et al., 2012). One type of self-reported impulsivity, trait impulsivity, is measured by The Urgency-Premeditation-Perseverance-Sensation Seeking-Positive Urgency (UPPS-P), designed to assess the 5 traits of impulsivity: negative urgency or the tendency to act rashly in response to negative affect, positive urgency or the tendency to act rashly in response to positive affect, lack of premeditation or acting before thinking, perseverance or the ability to finish a task, and sensation seeking or seeking out new/exciting experiences (Sliedrecht et al., 2021; Hershberger et al., 2017; McCarty et al., 2017). Existing literature suggests that urgency (positive and negative) is related to problematic alcohol use, whereas the lack of premeditation is related to alcohol dependence (Hershberger et al., 2017).

Furthermore, negative urgency, positive urgency, and lack of premeditation are risk factors for alcohol consumption and maintenance of AUD (McNamara et al., 2023). Previous literature examining the predictability of these impulsivity traits to drinking outcomes revealed that a lack of premeditation is a significant predictor to drinking quantity (Tran et al., 2018). Additionally, drinking problems were highly correlated with negative and positive urgency (Coskunpinar et al., 2013). Thus, we focused on the following traits: negative urgency, positive urgency, lack of premeditation. Existing literature on the predictability of impulsivity traits and alcohol relapse suggests an association between impulsivity and alcohol use, however, the nature of this association remains inconclusive (Sliedrecht et al., 2021). For instance, various studies using the Barratt Impulsivity Scale have found no statistical significance in predicting relapse to drinking (Sliedrecht et al., 2021). Whereas, another study utilizing the UPPS-P impulsivity found a statistically significant association with alcohol relapse (Quoilin et al., 2018). Further research is required to investigate the efficacy of the UPPS-P impulsivity scale in predicting alcohol relapse in individuals with AUD.

Having described the gaps in self-reported impulsivity, it is important to consider behavioral impulsivity, specifically impulsive choice. Impulsive choice is often measured using a delayed discounting task (Herman et al., 2018). Delayed discounting (DD) can be defined as the decline of the present value of a reward if the reward is delayed upon being received (Odum, 2011). This is further characterized using the following hyperbolic equation, $V = A / (1 + kD)$,where V is the present value of the reward, A is the amount of the reward, D is the time of delay with a minimum value of 1, and k is a free parameter found by fitting the data to the hyperbolic equation (Odum, 2011). The hyperbolic effect is displayed as the present value of rewards declines steeply for short delays, but more marginally for longer delays (Odum, 2011). There is substantial evidence showing that individuals with AUD tend to have steeper rates of DD, reflecting a greater preference for immediate rewards (Bobova et al., 2009). Researchers have argued that preferences for immediate rewards may be associated with a lack of self-control (Rupp et al., 2016). Furthermore, it is believed that steeper rates are what lead to the dependence of alcohol use (Bickel et al., 2012). In other words, individuals with AUD tend to have higher levels of DD or a lack of self-control which makes relapse a more prevalent issue (Bobova et al., 2009). Generally, there is limited research regarding the relationship between DD and alcohol relapse. Three prior studies have examined the relationship between DD and alcohol relapse. The first study found that DD was associated with relapse, second found no statistically significant association, and the third found no extractable data for the relationship (Bernhardt et al., 2017; De Wilde et al., 2013; Tucker et al., 2016).

Understanding alcohol relapse is key to treating AUD. However, there is limited research on the predictability of impulsivity traits and DD on alcohol relapse (Sliedrecht et al., 2019). This is important because these cognitive mechanisms exemplify inhibitory processes (Jauregi et al., 2018; Jones et al., 2013). Typically, relapse is due to disinhibition, thus, these mechanisms are critical in understanding relapse. The present study aims to elucidate the relationship between impulsivity traits, delayed discounting, and alcohol use among individuals with an AUD during a 6-day quit attempt. The 6-day quit attempt allows for the assessment of early abstinence, which can provide additional insight into the potential for relapse

risk during a critical period of abstinence. Delayed discounting and impulsivity traits were assessed at the initial randomization visit, while alcohol craving and alcohol use were assessed daily using electronic reporting.

As such, the first specific aim of the study was to test whether impulsivity traits (positive urgency, negative urgency, and lack of premeditation) predict drinks per drinking day (DPDD; the number of drinks they consumed during the days they drank), percent days abstinent, and average alcohol craving during a 6-day quit attempt. The second aim of the study was to examine if delayed discounting predicts drinks per drinking day (DPDD), percent days abstinent, and average alcohol craving.

Methods

Trial Design:

The current study is a secondary analysis of data collected during a two-week early efficacy paradigm trial to screen medication for AUD (Ray et al., 2020). The medications used in the parent trial were Naltrexone and Varenicline. Naltrexone is an FDA approved drug used for AUD, and Varenicline is an FDA approved drug used for nicotine use disorder with empirical support for off-label use for AUD. 53 treatment seeking individuals with AUD were double-blind randomized to either oral Naltrexone (50 mg QD), Varenicline (1 mg BID), or matched placebo. On study day 1, participants completed a battery of individual difference measures and began a weeklong medication titration period for Days 1-7. On Day 8 participants attended an in-person visit, and was officially the first day of abstaining, starting their 6-day quit attempt. During the quit attempt period (Days 8-14), participants completed electronic daily diary assessments (DDA) on the previous day alcohol consumption and craving.

Participants:

A sample of treatment seeking individuals with current DSM-5 AUD from [] were recruited through online, newspaper, and mass transit advertisement. Study inclusion criteria were: (1) between age of 21 and 65; (2) met diagnostic criteria (four or more symptoms in past 12 months) for moderate or severe AUD using DSM-5 (DSM-5, 2013); (3) have intrinsic motivation to quit or reduce drinking within the next six months; (4) report heavy drinking levels, ≥ 14 standard drinks per week for men and ≥ 8 standard drinks per week for females, in the 28 days prior to initial screening visit; and (5) have reliable internet access. Exclusion criteria were: (1) meet current (past 12 month) DSM-5 diagnostic criteria for a psychoactive substance use disorder other than alcohol and nicotine; (2) lifetime DSM-5 diagnosis of schizophrenia, bipolar disorder, or any psychotic disorder; (3) test positive on the urine-drug screen for anything besides cannabis; (4) have clinically significant alcohol withdrawal symptoms as indicated by a ≥ 10 on Clinical Withdrawal Assessment for Alcohol Revised (CIWA-R; Sullivan et al., 1989); (5) have an intense fear of needles or have had any adverse reaction to needle puncture; (6) if female; be pregnant, nursing or planning to be pregnant or use of an unreliable method of birth control; (7) have a medical condition that could interfere with safe study participation; (8) currently taking an psychotropic medication that would compromise participant safety; (9) currently using Naltrexone or Varenicline; and (10) have any other circumstances that would compromise safe study participation.

A total of 120 participants consented to participate in the initial screening visit. Of those participants, 74 were deemed clinically eligible and completed a medical screening visit with the study physician. A total of 49 individuals were randomized to Naltrexone (n=15), Varenicline (n=17), or placebo (n=17). Included in the present analysis are the 49 individuals who completed at least one daily diary report during the quit attempt period.

Screening and Trial Procedures:

The practice quit paradigm was conducted at an outpatient research clinic at the []. Recruited individuals were called and read a brief description of the study. Interested individuals completed an initial phone screening interview and eligible participants were invited to the laboratory for an in-person behavioral visit. At the start of all in-person visits, participants were required to have a BrAC 0.00 g/dl and a urine toxicology screen negative for all drugs except cannabis. Eligible participants, after the initial visit, completed an in-person medical screening visit entailing laboratory tests and a physical exam conducted by the study physician. Participants meeting all study eligibility were randomized to one of three treatment conditions: 1 mg BID Varenicline, 50 mg QD Naltrexone, and placebo. Randomization was stratified by sex, smoking status as indexed by question 1 of the Fagerstrom Test for Nicotine Dependence ("How often do you smoke";FTND; Heatherton et al., 1991); and drinking status as defined as heavy drinkers (≥14 or more drinks per week for males and ≥7 drinks per week for females) or very heavy drinkers (≥35 drinks per week for males and ≥28 for females). Research staff, providers, and participants remained blind to the medication conditions during the trial. Participants underwent a week-long medication titration period followed by a 6-day quit attempt (days 8–14).

Baseline Assessment:

During the initial in-person screening visit, participants completed a set of assessments for individual differences and eligibility screening, which included demographic information, substance use history, and diagnoses using the Structured Clinical Interview for DSM-5 (SCID-5; American Psychiatric Association, 2013), and FTND to assess smoking status. During the in-person visit on Day 1 (randomization), participants completed additional individual difference measures which included the Monetary Choice Questionnaire (MCQ;

Kirby & Maraković, 1996) to assess delayed discounting of rewards, Urgency-Premeditation-Perseverance-Sensation Seeking-Positive Urgency Scale (UPPS-P; Lynam et al., 2006) to assess impulsivity behavior, and Timeline Follow Back (TLFB; Sobell & Sobell, 1992) to assess quantity and frequency of alcohol, cigarette, and marijuana use in the last 28-days.

Electronic Daily Diary Assessment:

Each morning during the 6-day quit attempt, participants were asked to retrospectively report on their previous day experiences by completing an electronic DDA survey. Daily reminder texts or emails containing links to the DDA survey were sent to participants each morning during their 6-day quit period. At the start of each daily survey, participants were asked if they drank alcohol the day prior. If they endorsed the previous day's drinking, they reported on drinking type, drinking quantity, and reported on craving prior to drinking and during alcohol consumption. If participants endorsed no previous day drinking, they reported on past day craving.

Electronic Daily Diary Assessment:

All descriptive and statistical analyses were completed in SPSS Statistical Software on the sample of participants who completed at least one DDA during the quit period (N=49). The UPPS-P negative urgency, positive urgency, and lack of premeditation subscales were calculated by summing the 4 items that corresponded to each subscale (Dugré et al., 2019). For the MCQ, individual participant responses were reported as 0s for preference for small reward and 1 for preference for large reward relative to the question. These scores were inputted into an automatic delayed discounting scoring sheet (Kaplan et al., 2016). The scoring sheet calculates the rate of discounting, k, using a discounting hyperbolic equation (Mazur, 1987). This is done for three sets of reward categories in the MCQ: small, medium, and large rewards. Baseline drinks per drinking day and percent days abstinent were calculated using the TLFB assessing participants' drinking patterns over the 30-days prior to the first in-person visit. A single item urge rating on a scale of 0 to 10 ("How strong was your urge to use alcohol yesterday?") was averaged over the 6-day quit attempt which was used to index alcohol craving over the quit period. Similarly, daily reports of drinking during the quit attempt were used to calculate drinks per drinking day and percent abstinence days which were then averaged over the course of the 6-day quit attempt.

To examine baseline impulsivity (i.e., indexed by the UPPS-P and MCQ) as a predictor of alcohol use and craving during the 6-day quit attempt, multiple multilinear regression analysis were used. Medication condition, gender, and baseline drinking variables were covariates in each model. Additionally, socioeconomic status was controlled for in the MCQ model. The subscales created for the UPPS-P were treated as a family given the interrelation and a similar approach was used for the subscales calculated for the MCQ; therefore, the two models were considered the multiple comparisons. Thus, the Bonferroni method was utilized to correct for the multiple comparisons; $\alpha = .025$ level of significance was used for rejecting each null hypothesis.

Results

Participants:

Participants were on average 41.29 (SD = 11.48) years of age, out of which, 51.0% identified as male (n = 25) and 49% identified as female (n = 24). Participants consumed on average 5.60 (SD = 2.97) drinks per drinking day and had an average of 24.86 (SD = 22.12) percent days abstinent in the past month. Refer to Table 1 for a full description.

Impulsivity Traits Predict Alcohol Use:

A multilinear regression was utilized to examine the association between impulsivity traits (i.e., negative urgency, positive urgency, and lack of premeditation) and drinks per drinking day during the 6-day quit attempt. Medication condition, gender, and baseline drinks per drinking were covariates in the models. The covariates were not correlated with the outcome variables. Baseline negative urgency, as indexed by the UPPS-P, did not significantly predict DPDD during the 6-day quit attempt ($p=.62$). Baseline DPDD significantly predicted DPDD during the quit attempt ($R2=.19$, $B= .38$, $p=.015$). Baseline positive urgency, and lack of premeditation also did not predict DPDD during the 6-day quit attempt ($p>.025$). Baseline DPDD significantly predicted DPDD during the quit attempt for positive urgency and lack of premeditation models ($p<.025$). Multicollinearity was assessed for positive and negative urgency with DPDD, and no issues regarding multicollinearity were detected for DPDD. For further results, reference Table 2.

Following, we examined the association between impulsivity traits and percent days abstinent. Medication condition, gender, and baseline percent days abstinent were covariates in these models. The covariates were not correlated with the outcome variables. All impulsivity trait predictors did not significantly predict percent days abstinent during the quit attempt ($p>.025$), further results found in Table 3. Furthermore, multicollinearity was assessed for positive and negative urgency with percent days abstinence, and no issues regarding multicollinearity were detected for percent days abstinence. We also examined the association between impulsivity traits and alcohol craving during the 6-day quit attempt. Medication condition, gender, and baseline percent days abstinent were covariates in these models. The covariates were not correlated with the outcome variables. Negative urgency and positive urgency did not significantly predict average alcohol craving; however, lack of premeditation significantly predicted average alcohol craving during the 6-day quit attempt ($p>.025$), further results found in Table 4. Finally,

multicollinearity was assessed for positive and negative urgency with average alcohol craving, and no issues regarding multicollinearity were detected for average alcohol craving.

Delayed Discounting Predicts Alcohol Use:

A multilinear regression was used to examine the association between overall rate of discounting (k) and drinks per drinking day during the 6-day quit attempt. Medication condition, gender, socioeconomic status, and baseline drinks per drinking day were covariates in the model. Overall k, as indexed by the MCQ, did not significantly predict DPDD during the 6-day quit attempt (p=.48) and neither did baseline DPDD (p>.025), further results found in Table 2. We then assessed the association between overall rate of discounting (k) and percent days abstinent during the 6-day quit attempt. Medication condition, gender, socioeconomic status, and baseline percent days abstinent were covariates in this model. Regarding percent days abstinent, overall k did not significantly predict percent days abstinent during the quit attempt (p=.52), further results found in Table 3. Lastly, we examined if overall k predicted average alcohol craving during the quit attempt. Medication condition, gender, and socioeconomic status were covariates in this model. Overall k did not significantly predict average alcohol craving during the quit attempt (p>.025), further results found in Table 4.

Discussion

Given the inconclusive empirical support for the predictive relationship between impulsivity and alcohol relapse, this study examined whether impulsivity traits and choice could predict alcohol relapse during a 6-day quit attempt. The following impulsivity traits were assessed using the UPPS-P impulsivity behavioral scale: negative urgency, positive urgency, and lack of premeditation. Aside from lack of premeditation predicting alcohol craving, the three assessed personality traits did not significantly predict alcohol relapse during the 6-day practice quit attempt. These findings are in agreement with Sliedrecht et al. (2021), as the results revealed no relationship between impulsive personality traits and alcohol relapse. However, these findings differ from findings of Quoilin et al. (2018), in that the results revealed no statistically significant relationship between impulsive personality traits and relapse as indexed by UPPS-P. These results suggest that impulsive traits, as measured by UPPS-P, may not be a primary predictive factor for alcohol relapse in the current study sample.

Furthermore, impulsive choice was assessed via a delayed discounting using the MCQ to which overall k was calculated using an empirically supported scoring sheet. Overall k did not significantly predict alcohol use or alcohol craving during the 6-day quit attempt. These findings are in line with De Wilde et al. (2013) and differ from Bernhardt et al. (2017), as there was no statistically significant relationship between delayed discounting and relapse. The results suggest that impulsive choice may not be a strong predictor of alcohol relapse, and that examining impulsive action, the third facet of impulsivity, may be a worthwhile direction for future research.

The study highlights important strengths that contribute meaningfully to the existing literature on the relationship between impulsivity and alcohol relapse. This study is one of the first to test trait and behavioral indexes of impulsivity during a period of early abstinence. Additionally, our study offers further insight into the relevance and application of the UPPS-P and MCQ indices of impulsivity in a sample of individuals higher on the spectrum of AUD severity (i.e., moderate to severe).

Despite the study's strengths, several limitations exist, including the conditions of participants prior to the quit attempt, as participants were abstinent the week prior to the quit attempt. This may suggest some expectancy bias as participants knew they needed to be abstinent; thus, they may have been underreporting their alcohol consumption due to memory limitations. Future studies may want to utilize ecological momentary assessment (EMA) which asks participants to report multiple times per day which might reduce recall bias, although this places added participant burden. Additionally, our study's null results may be due to the lack of a unified conceptualization of impulsivity and measurements of impulsivity tending to provide some variability. The variation in conceptualization can be unified within a single, multi-faceted framework, much like how the UPPS-P model organizes distinct traits, but for the three components of impulsivity. An additional limitation of the study was the small sample size, which lowers the statistical power of the study. Finally, the study design included a 6-day quit attempt. This may have been a short period of time to evaluate early abstinence and its relationship to impulsivity. A two-week period of abstinence may better highlight the relationship between impulsivity and relapse risk, as findings in the parent paper suggest a change in cognitive factors such as higher motivation to change behavior was observed in the thirteen days leading to the quit attempt (Ray et al., 2024).

While the obtained findings add to the limited research on the comparative efficacy of the utilized impulsivity indices, we encourage future research to evaluate the relationship between a combination of impulsivity factors and AUD relapse, rather than examining each factor in isolation. Understanding this relationship can provide more directed treatment towards helping improve impulsive control and reducing the risk of relapse in AUD. This can guide the development of targeted interventions aiming to slow the progression of AUD and improve rehabilitation outcomes, which could help attenuate the public health crisis.

Conclusion

In this study, we conducted analysis utilizing data obtained from a two-week early efficacy paradigm trial on AUD medication. The specific aims of the study were to test whether impulsivity traits predicted DPDD, percent days abstinent, and average alcohol craving during a 6-day quit attempt and examined if delayed discounting predicted DPDD, percent days abstinent, and average alcohol craving. Study analysis revealed null results as neither impulsive personality traits nor impulsive choice showed an association with alcohol relapse. In general, evidence suggests impulsivity to be an important predictor of AUD (Szczypiński et al., 2021). However, there is a wide array of mixed findings on the role impulsivity plays in early abstinence and the potential risk for relapse in alcohol consumption. Thus, it is crucial for future studies to further examine impulsivity as a predictive measure of alcohol relapse to aid the development of interventions for AUD treatment.

Table 1. Sample demographic and clinical characteristics (N = 49)

Variable	Means (SD) or N (%)
Age	41.29(11.48)
Sex (M/F)	51.0/49.0
Race (%)	
Black	12 (24.5%)
White	22 (44.9%)
Asian	3 (6.1%)
American Indian	1 (2.0%)
Pacific Islander	1 (2.0%)
Mixed	8 (16.3%)
Other/Unknown	2 (4.1%)
Hispanic/Latino	13 (26.5%)
Income (%)	
< $15,000	14 (28.6%)
$15,000 ≥ and < $30,000	6 (12.2%)
$30,000 ≥ and < $45,000	6 (12.2%)
$45,000 ≥ and < $60,000	10 (20.4%)
$60,000 ≥ and < $75,000	6 (12.2%)
$75,000 ≥ and < $90,000	3 (6.1%)
$90,000 ≥ and < $105,000	3 (6.1%)
$105,000 ≥ and < $120,000	1 (2.0%)
>$120,000	1 (2%)
Past Month Drinks per Drinking Day	5.60 (2.97)
Past Month Percent Day Abstinent	24.86 (22.12)

Note: Data are presented as mean ± standard deviation or as number of participants (percent of sample). SCID, Structured Clinical Interview for DSM Disorders

Table 2. Impulsivity Traits Predict Drinks per Drinking Day

Negative Urgency	**R^2**	***B***
Gender	.061	-.089
Medication	.064	.056
Baseline Drinks Per Drinking Day	.192	.383
Negative Urgency	.197	.06
Positive Urgency	**R^2**	***B***
Gender	.061	-.067
Medication	.064	.062
Baseline Drinks Per Drinking Day	.192	.407
Positive Urgency	.203	-.102
Lack of Premeditation	**R^2**	***B***
Gender	.061	-.075
Medication	.064	.040
Baseline Drinks Per Drinking Day	.192	.397
Lack of Premeditation	.207	-.121
Overall K	**R^2**	***B***
Gender	.061	-.092
Medication	.064	.067
SES	.151	-.230
Baseline Drinks Per Drinking Day	.233	.359
Overall K	.242	-.104

Table 3. Impulsivity Traits Predict Percent Days Abstinence

Negative Urgency	**R^2**	***B***
Gender	.000	-.004
Medication	.003	-.059
Baseline Percent Days Abstinence	.054	.186
Negative Urgency	.070	-.134
Positive Urgency	**R^2**	***B***
Gender	.000	-.014
Medication	.003	-.059
Baseline Percent Days Abstinence	.054	.225
Positive Urgency	.054	-.007
Lack of Premeditation	**R^2**	***B***
Gender	.000	-.014
Medication	.003	-.062
Baseline Percent Days Abstinence	.054	.223
Lack of Premeditation	.055	-.024
Overall K	**R^2**	***B***
Gender	.000	-.018
Medication	.003	-.036
SES	.005	.050
Baseline Percent Days Abstinence	.060	.231
Overall K	.069	-.655

Table 4. Impulsivity Traits Predict Alcohol Craving

Negative Urgency	**R^2**	***B***
Gender	.007	-.087
Medication	.008	.035
Negative Urgency	.028	.141
Positive Urgency	**R^2**	***B***
Gender	.007	-.068
Medication	.008	.043
Positive Urgency	.027	-.140
Lack of Premeditation	**R^2**	***B***
Gender	.007	-.070
Medication	.008	-.002
Lack of Premeditation	.090	-2.018
Overall K	**R^2**	***B***
Gender	.007	-.086
Medication	.008	.055
SES	.069	.236
Overall K	.071	-.044

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Interrupting the Pathway From Early Trauma Exposure to Childhood-Onset Obsessive-Compulsive Disorder: The Promise of Schema Therapy

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Acknowledgments

I would like to thank Dr. Elisabeth Sandberg for her guidance on this paper during her Principles of Experimental Design course and for the help of teaching assistants Jordan Gunn and Conor Smithson for their willingness to provide helpful feed back and an swer my many questions. I would also like to thank my parents for supporting me to the very best of their abili ties as I navigated OCD throughout my own childhood and adolescence.

Obsessive-compulsive disorder (OCD), often emerging during childhood and adolescence, is a debilitating condition characterized by intrusive thoughts and compulsive behaviors. Current research suggests a significant relationship between early trauma and OCD development in youth, with EMSs serving as a key psychological mechanism. Taken together, various studies link childhood trauma, EMSs, and OCD along a unified developmental trajectory, particularly implicating schemas in the "Disconnection and Rejection" and "Impaired Autonomy and Performance" domains. Although treatment methods such as cognitive-behavioral therapy (CBT) and exposure and response prevention (ERP) are considered the gold standard treatments for OCD, schema therapy (ST) is increasingly studied as a potential intervention that specifically targets EMSs—especially in trauma-exposed youth. Recent studies, though limited by some methodological constraints, suggest that ST could disrupt the trauma-EMS-OCD pathway by directly targeting the negative beliefs and harmful thought patterns that often lie at the root of OCD. High-quality studies are warranted to determine the efficacy of ST for trauma-exposed youth with OCD and to explore its full potential as a treatment for this particularly vulnerable population. This review synthesizes current literature on EMSs, trauma, and OCD and evaluates ST as an emerging treatment for youth that warrants further research.

Key Words: Obsessive-compulsive disorder (OCD), childhood trauma, early maladaptive schemas (EMSs), schema therapy, intervention

Introduction

Despite modern advancements in the treatment of obsessive-compulsive disorder (OCD), many children and adolescents continue to experience OCD's debilitating symptoms and life-disrupting impacts. OCD is an anxiety disorder defined by recurrent, unwanted mental obsessions and impairing, ritualistic compulsions that are rigidly performed to reduce the distress associated with obsessions (Krebs & Heyman, 2015). Obsessions commonly involve themes related to contamination, orderliness, harm, and sexuality while common compulsions include checking, ordering, repeating, and reassurance-seeking behaviors (Krebs & Heyman, 2015). The disorder affects an estimated 0.25%–4% of children and adolescents (Krebs & Heyman, 2015; Nazeer et al., 2020), with half of all OCD cases beginning in youth and more than 40% becoming chronic if left untreated (Walitza et al., 2011). Such data highlight childhood as a critical window to address obsessive-compulsive symptoms before they escalate and cause long-term impairment into adulthood. This concern is particularly urgent for the estimated 10% of OCD-diagnosed youth who do not achieve remission through standard treatments (Younus et al., 2024), underscoring the need for more foundational,

developmentally informed interventions. Schema therapy (ST) is one such treatment that targets early maladaptive schemas (EMSs) formed from unmet childhood needs. Preliminary evidence suggests that ST holds promise for addressing the root causes of OCD and can be effectively adapted to meet the needs of children and adolescents.

OCD Amongst Youth

Given the intrusive nature of obsessions and the disruptive features of compulsions, OCD often leads to marked distress, disturbance, and impairment in youth (Walitza et al., 2011). Researchers have found that quality of life across multiple measures of well-being is significantly lower for children and adolescents with OCD than for youth in the general population (Collucia, 2017; du Plessis et al., 2021). OCD symptomatology can lend itself to tremendous functional impairments in social, home, and academic domains for affected youth (Collucia et al., 2017; Sahoo et al., 2017; Storch et al., 2010). For instance, obsessive thought patterns may make it difficult for children and adolescents to break into socialization processes with peers, and disruptive compulsions can greatly interfere with their ability to participate in family activities (Sahoo et al., 2017). In some cases, the disorder can result in measurable deficits in achievement. For example, health and education records reveal that individuals diagnosed with OCD are less likely than their non-disordered counterparts to reach each level of education from primary to postgraduate schooling (Pérez-Vigil et al., 2018).

Trauma Exposure and Risk of OCD

Although OCD and its devastating impacts entail various risk components, research has highlighted exposure to trauma as an especially significant predictor of early-onset OCD (Lafleur et al., 2011). Trauma can be operationally defined as exposure to at least one terribly frightening experience (e.g., actual or threatened death, sexual violence, a natural disaster, etc.) in which the individual was either directly affected by the event or had to witness the event happening to someone else (Lafleur et al., 2011). In one study, researchers found that trauma exposure prevalence was 11% among OCD-diagnosed youth participants but only 1% for the non-disordered control group (Lafleur et al., 2011), suggesting that exposure to trauma is likely a robust risk factor for the development of OCD in childhood and adolescence. Moreover, contemporary reviews investigating this relationship find a consistently strong positive correlation between adverse childhood experiences (such as emotional and sexual abuse and neglect) and obsessive-compulsive symptoms and symptom severity (Destrée et al., 2021; Ou et al., 2021). Although the studies included in these reviews do not measure OCD symptoms exclusively among children and adolescent samples, the significant proportion of adults with OCD who experienced symptom onset before the age of 18 (Walitza et al., 2011) suggests that childhood traumatic experiences are also meaningfully correlated with OCD symptoms in children and adolescents.

This review synthesizes various research findings into a theoretical pathway that describes how obsessive-compulsive symptoms may emerge and builds a case for ST as a promising intervention capable of disrupting this progression. The first section explores the connection between early trauma exposure and the development of early maladaptive schemas (EMSs), illuminating how adverse experiences may shape the dysfunctional beliefs central to ST's therapeutic focus. The next section connects EMSs to OCD, offering additional evidence that EMSs may act as key mechanisms underlying the disorder and reinforcing the need for treatments like ST that specifically target such schemas. Building on the trauma-EMS-OCD pathway, the final section discusses empirical support for ST and considers its potential to interrupt OCD progression in youth.

Early Trauma and EMSs

While some of the specific underpinnings of the childhood trauma-OCD relationship remain unclear, the extant literature supports the broad theory that children and adolescents may respond to early traumatic events through the development of coping strategies that become maladaptive, manifesting as OCD psychopathology (Wang et al., 2023). One such mechanism connecting childhood trauma exposure to OCD development is early maladaptive schemas. EMSs are pervasive and dysfunctional emotions, thoughts, and beliefs about oneself and others that have arisen due to unmet needs in early life (Young et al., 2003 as cited in Dostal & Pilkington, 2023).

EMSs are encompassed by five distinct domains. The first domain is Disconnection & Rejection, which involves schemas related to emotional deprivation, social isolation, mistrust, and beliefs about personal defectiveness (Young et al., 2003 as cited in Dostal & Pilkington, 2023). A young person impacted by this domain may hold beliefs like "There is something inherently wrong with me" or "The people I love will always leave me" (Young et al., 2003 as cited in Dostal & Pilkington, 2023). The second domain is Impaired Autonomy & Performance, which involves schemas related to incompetence, vulnerability to harm, and expectations of failure (Young et al., 2003 as cited in Dostal & Pilkington, 2023). Someone struggling with this domain may have ongoing thoughts such as "Something terrible is going to happen to me" or "If I try this on my own, I will not succeed" (Young et al., 2003 as cited in Dostal & Pilkington, 2023). The remaining three EMS domains include Impaired Limits, which involves schemas related to entitlement and poor self-control; Other-Directedness, which involves schemas related to self-sacrifice and approval-seeking; and Over Vigilance & Inhibition, which involves schemas related to pessimism and overcritical views

of the self (Young et al., 2003 as cited in Dostal & Pilkington, 2023).

EMSs are said to stem from inadequate care during early life, and a significant body of research takes this assertion a step further, establishing the connection between childhood trauma and EMS development. Multiple cross-sectional studies have revealed significant correlations between childhood maltreatment/abuse and the expression of EMSs (Kaya Tezel et al., 2015; Lumley & Harkness, 2007; Yiğit et al., 2018). For example, Kaya Tezel et al. (2015) found that physical abuse/neglect and emotional abuse/neglect were significantly correlated with all five EMS domains, and sexual abuse was significantly associated with all domains except the Over Vigilance & Inhibition domain in one adult sample. Yiğit et al. (2018) found a significant overall relationship between childhood maltreatment and EMSs in an adolescent sample, specifically concluding that physical and emotional abuse predicted EMSs in the Disconnection & Rejection and Impaired Autonomy & Performance domains. Similarly, Lumley and Harkness (2007) discovered that childhood maltreatment and abuse were associated with EMSs in the Disconnection & Rejection and Impaired Autonomy & Performance domains in a sample of depressed adolescents. Such research suggests that early trauma exposure affects nearly all EMS domains, but especially those related to mistrust, shame, and vulnerability to harm–emotions that are understandably shaped by experiences such as abuse and neglect. These distressing schemas may, in turn, contribute to the development of obsessive thoughts and the perceived need to cope through compulsions—offering insight into how trauma is connected to OCD and underscoring the value of schema-focused interventions.

EMSs and OCD

In addition to the numerous studies linking childhood trauma to the development of EMSs, there is an abundance of research connecting EMSs to OCD. Although there is some evidence linking EMSs within all five domains to OCD symptomatology (Kizilagac, 2019), the data most consistently indicate that EMSs that fall into the Disconnection & Rejection and Impaired Autonomy & Performance domains have the strongest associations with OCD (Kim et al., 2014; Kwak & Lee, 2015; Yoosefi et al., 2016). For example, a cross-sectional study by Kim et al. (2014) discovered that OCD samples as compared to healthy controls had significantly higher scores for EMSs including defectiveness/shame, social isolation/alienation, and failure (all of which are encompassed by the Disconnection & Rejection and Impaired Autonomy & Performance domains). In their respective cross-sectional studies, Kwak and Lee (2015) and Yoosefi et al. (2016) further validated that EMSs within the Disconnection & Rejection domain were significantly more activated in OCD samples than in controls. Such patterns may arise because maladaptive schemas such as overestimation of personal risk, perceived incompetence, and a diminished sense of coping ability can give rise to obsessive thoughts and fears, ultimately driving individuals to use compulsions as a means of avoiding distress and negative outcomes (Dostal and Pilkington, 2023). For example, a child with the contamination subtype of OCD might obsessively think, "If I'm not perfectly clean, I'll get sick and die"—a belief linked to the vulnerability to harm EMS within the Impaired Autonomy & Performance domain; they may then try to cope through a compulsive behavior like excessive handwashing. Similarly, a child with the harm subtype of OCD may obsessively wonder, "What if I lose control and hurt the people I love?"--a thought linked to the personal defectiveness EMS within the Disconnection and Rejection domain; they may then attempt to cope through compulsive checking behaviors to ensure they have done no harm. Therefore, by challenging EMSs (especially those encompassed by the Disconnection & Rejection and Impaired Autonomy & Performance domains) through schema-targeting interventions, it may be possible to disrupt the deeper patterns engendering obsessive-compulsive symptoms in youth.

The Trauma-EMS-OCD Pathway

Overall, current research clearly links childhood trauma to EMSs and, in turn, connects EMSs to OCD, outlining a coherent theoretical pathway between these components. Across multiple studies, EMSs that fall under the Disconnection & Rejection and Impaired Autonomy & Performance domains have proven to be particularly significant mechanisms in this pathway (Kim et al., 2014; Kwak & Lee, 2015; Lumley & Harkness, 2007; Yiğit et al., 2018; Yoosefi et al., 2016), providing a mediatory explanation for the well-documented relationship between traumatic childhood experiences and obsessive-compulsive symptomatology. It is of important note, however, that while the aforementioned studies provide strong evidence for a linkage between the different components, such research is nearly exclusively cross-sectional, limiting the ability of researchers to establish definitive causality along the trauma-EMS-OCD pathway.

Standard OCD Treatments & Limitations

Given the clear theoretical link between childhood trauma, EMSs, and OCD, it becomes critical to evaluate whether current treatment modalities adequately address these underlying mechanisms. Though Cognitive Behavior Therapy (CBT) supplemented with Exposure and Response Prevention (ERP) is typically considered the first-line treatment for individuals with OCD (Eisen et al., 2010 & Foa et al., 2005 as cited in Thiel et al., 2016), other approaches–such as family-based psychotherapy (Demaria et al., 2021)

and mindfulness training (Key et al., 2017)–have also been used to address OCD symptoms. These treatments help individuals manage obsessions as they arise through various methods (e.g., mindfulness techniques, family support, exposure, etc.), but they tend to focus on symptom management rather than addressing the fundamental causes that give rise to obsessive-compulsive symptoms in the first place. For instance, CBT and ERP joint interventions generally involve a learning component to bring critical awareness to unhelpful thoughts and behaviors (CBT) along with structured exposure to anxiety-inducing stimuli whilst refraining from compulsive rituals (ERP) (Eisen et al., 2010); however, this treatment typically does not explore the early traumatic experiences or deeply held beliefs that may trigger obsessive thoughts or drive compulsive behaviors. Although considered the "gold standard," CBT and ERP fail to provide satisfactory relief for approximately 10–37% of patients (Schruers et al., 2005), highlighting the need for additional therapeutic options that target the deeper origins of OCD. For such CBT-resistant cases, a different kind of intervention known as schema therapy (ST) is being studied as a potential option.

Schema Therapy

ST is well-documented in its ability to address both the underlying causes and symptomatic manifestations of OCD (Thiel et al., 2016). Integrating aspects of attachment theory, psychodynamic approaches, and gestalt therapy (Kellogg & Young, 2006 as cited in Thiel et al., 2016), ST is a form of psychotherapy that targets deeply-rooted unhealthy thought patterns and negative conceptualizations of the self (EMSs) that have arisen in response to unmet needs in childhood. ST aims to replace EMSs and manage the dysfunctional emotional and behavioral consequences of EMS activation (schema modes) through various psychotherapeutic modalities including psychoeducation, family interventions, and experiential techniques (Peeters et al., 2021). Where other interventions primarily focus on managing symptoms as they occur, ST targets the deeper underpinnings of OCD, allowing individuals to confront and restructure the maladaptive schemas that give rise to obsessions and compulsions (Thiel et al., 2016). As such, ST may be particularly beneficial for treatment-resistant cases of OCD in which surface-level interventions fall short and more foundational therapeutic work is needed. Additionally, because of its focus on attachment and early life, ST may be especially well-suited for youth populations, as adverse childhood experiences in these individuals are more recent and may be more readily addressed through early intervention.

ST in Practice

ST is typically delivered in a one-on-one psychotherapy setting with a clinician prompting the patient to discuss their maladaptive patterns, unmet needs, and core beliefs and then guiding them through interactive activities such as imagery rescripting and chair work (Peeters et al., 2021). By design, ST seeks to address the deeper roots of EMSs, allowing it to disrupt the trauma-EMS-OCD pathway and decrease obsessive-compulsive symptoms. ST facilitates exploration into the origins and entrenched patterns of EMSs so that individuals can confront the fundamental causes of their unhealthy coping and feel supported in replacing maladaptive beliefs and behaviors with healthier alternatives. In practice, this could look like a practitioner guiding a patient who felt rejected by their parents during childhood through a role-play scenario using chair work (Karimipour et al., 2021). While sitting in one chair, the patient may be instructed to act the way their parents did in reality (e.g., assuming a rejecting attitude), and in the other chair, they may be instructed to act the way they wish their parents had acted (e.g., assuming an accepting attitude). Such an activity could help modify maladaptive schemas within the Disconnection & Rejection domain and ultimately lead to downstream reductions in obsessive-compulsive behavior. By revising deep wounds through activities like this and getting at the origins of specific EMSs, ST has been clinically proven to improve OCD outcomes (Karimipour et al., 2022).

ST in Research

While most of the empirical data on ST highlights its efficacy in treating personality and mood disorders (Kellogg & Young, 2006; Taylor et al., 2017), a few studies have demonstrated its promise as a treatment for OCD. One recent study conducted by Abdelrazek et al. (2023) tested the impact of a short course of ST on the symptom severity of a clinical sample of adults diagnosed with OCD (n=12). Using the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS), a highly reliable semi-structured interview tool, researchers collected data on both obsessive and compulsive symptoms at baseline and after each of three ST sessions. They discovered that OCD severity scores decreased in a dose-response manner at every data collection point and found a statistically significant difference between overall Y-BOCS scores at baseline and after the final ST session (Abdelrazek et al., 2023). They postulated that these dramatic outcomes stemmed from ST increasing awareness of EMSs and improving emotional coping, thereby weakening the EMS mechanism and leading to improved OCD symptoms.

In a 2016 pilot study with similar aims, Thiel et al. investigated how exposure and response therapy augmented with ST impacted the OCD symptom profiles of a sample of CBT-resistant adults diagnosed with OCD (n=10). Subjects underwent a 9-week intervention period with two therapy sessions per week in which they became increasingly exposed to ST techniques like psychoeducation processes,

schema mode work, flashcard exercises, chairwork, and imagery rescripting. The researchers used the Y-BOCS structured interview measure in addition to the Compulsive Inventory-revised (a self-report questionnaire) to assess symptoms at baseline, post-treatment, and follow-up. Comparisons between scores at baseline and after the treatment period revealed statistically significant improvements in both obsessive and compulsive symptoms that remained stable at follow-up (Thiel et al., 2016). In analyzing participant reports about the study, the researchers suggest that the treatment's positive impacts may be attributable to the way ST helped individuals identify the triggers of their maladaptive behaviors and understand their symptoms through the lens of the schema mode model; this led to the disruption of the EMS mechanism, a sense of distance from symptoms, and better compliance with exposure therapy sessions, resulting in improved OCD symptoms overall (Thiel et al., 2016).

While studies by Abdelrazek et al. and Thiel et al. demonstrate the potential of ST in alleviating OCD symptoms, their exclusively adult samples slightly limit the applicability of the findings to this review's population of interest. As both sets of authors describe, the effectiveness of ST seemed to largely rely on participants' ability to understand and work through the complexities of their EMSs; therefore, it is important to note that children and adolescents may not possess the same degree of self-awareness and emotional maturity necessary to reap the exact same benefits from such interventions. Despite these considerations, preliminary research efforts to adapt ST for youth samples suggest interest in extending this therapeutic approach to groups across the age spectrum.

Researchers have already shown how ST can be adapted to meet the emotional and intellectual needs of younger individuals, promoting positive outcomes for youth with mental illness. Although no studies on ST for children and adolescents have specifically included samples with OCD, ST has proven to be an effective intervention for youth with internalizing disorders and behavioral issues. In one study, Karimipour et al. (2022) guided an adolescent sample with internalizing behavioral problems (n=30) through 14 weekly group schema mode therapy sessions. While the majority were joint sessions with both the adolescents and their parents, four sessions included only the adolescent participants, and two were geared toward just the parents. Each session's contents included activities like imaginary interviews, chair work, schema mode flashcards, "clever and wise" imagery techniques, and self-compassion practices. Parent reports via the Child Behavior Checklist (a behavior assessment scale) pre- and post-treatment revealed statistically significant improvements in adolescents' internalizing behavioral problems as compared to controls (Karimipour et al., 2022). Though this study did not target the specific disorder and symptoms of interest, it demonstrates ST's efficacy in modifying unwanted behaviors in children and adolescents and its feasibility as a treatment for young populations.

Methodological Considerations in Schema Therapy Research

Despite the compelling empirical support for ST in the literature, the included studies by Abdelrazek et al. (2023), Thiel et al. (2016), and Karimipour et al. (2022) contain some common yet notable methodological challenges. All three studies utilized convenience sampling to gather participants and had small sample sizes (ranging from n=10 to n=30), increasing the chances of biased sampling and limiting the external validity of the findings. Additionally, the Abdelrazek et al. (2023) and Thiel et al. (2016) studies did not include control groups which prevented them from establishing an untreated baseline and determining a definitive causal relationship between ST and symptom improvement, reducing internal validity. Such constraints are common and often difficult to avoid in clinical psychology research, given the challenge of recruiting participants with particular characteristics/conditions and the ethical concerns posed by withholding a potential treatment from a control group. Where possible, future studies may address these concerns by expanding the scope of research (e.g., partnering with federal organizations, drawing from public health records, etc.) to enable larger and more representative samples. Researchers may also consider implementing active control groups (e.g., randomly assigning some participants to CBT and ERP instead of ST) in their studies so that no participant goes without treatment.

Future Directions in Schema Therapy Research

While the evidence suggests that ST is an effective intervention for adult OCD populations (Abdelrazek et al., 2023; Thiel et al., 2016) and for children and adolescents with other mental health issues (Karimipour et al., 2022), a gap in the literature exists where these two categories converge. Taken together, therefore, the studies of Abdelrazek et al. (2023), Thiel et al. (2016), and Karimipour et al. (2022) provide a salient opening for research on the efficacy of ST for children and adolescents with OCD. In consideration of this knowledge gap and the aforementioned threats to study validity, research investigating the impact of ST on a large and representative sample of OCD-diagnosed youth is warranted. Such an inquiry could serve as a notable contribution to the literature on OCD treatments by illuminating the potential for ST to address the EMS mechanism in young sufferers of OCD (particularly those who have experienced trauma), consequently disrupting this pathway early on.

Though ST models demonstrate great treatment potential, the costly and time-consuming nature of in-person therapy sessions may impede the accessibility of ST, particularly amongst the socioeconomically vulnerable and disproportionately trauma-exposed populations for whom

ST could prove most beneficial. However, with the recent development of technologically administered therapeutic interventions, there are promising new avenues to access ST including computer- and phone application-based ST programs that entail far fewer barriers to utilization (Jacob et al., 2018; Stefan et al., 2023). Additionally, artificial intelligence has continued to grow its capacity in psychosocial spheres, paving the way for AI modalities related to ST (Croitoru et al., 2024). Future research could explore how technological advancements in the delivery of ST may benefit youth with OCD, helping struggling children and adolescents lead lives with fewer obsessive-compulsive symptoms.

Conclusion

Reframing OCD in the context of trauma exposure and EMSs offers a powerful lens to understand the disorder's origins and consider meaningful points of intervention for youth. The trauma-EMS-OCD pathway delineates an evidence-based, theoretical model in which trauma exposure contributes to EMSs that, in turn, increase vulnerability to obsessive-compulsive symptoms. By directly targeting these underlying schemas, ST shows robust therapeutic promise, particularly for trauma-exposed youth with OCD who may not find relief through standard interventions. However, the lack of empirical studies specifically examining ST for children and adolescents with OCD raises the need for targeted research in this area.

This review contributes a novel integration of trauma, schema theory, and treatment, emphasizing the need to move beyond conventional symptom management toward deeper schematic restructuring for the treatment of OCD. ST's adaptability for youth populations positions it not only as a practical therapeutic intervention but also as a developmental tool with broader clinical and social implications; if caregivers, teachers, and communities understand how EMSs shape vulnerabilities to mental health disorders, they can more easily foster adaptive and nurturing schemas that support long-term well-being. Future work should investigate the developmental timing and wide-reaching potential of early schema work, when EMSs are presumably most malleable. In doing so, the field may begin to shift life trajectories and expand the reach of early mental health support–finally getting us closer to disrupting pediatric OCD at its source.

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Understanding Personality Development Through Genetic and Environmental Contributions

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Personality development arises from the ongoing interactions between genetic predispositions and environmental experiences throughout a person's life. This literature review synthesizes findings from published behavioral genetic studies, longitudinal twin and adoption research, molecular analyses, and environmental psychology to interpret how genetic, environmental, and gene-environment interaction processes contribute to the stability and transformation of personality traits. Evidence from twin studies and meta-analyses confirms that traits such as Extraversion, Neuroticism, and Conscientiousness are moderately to highly heritable. Nonetheless, this heritability remains unexplained at the molecular level, a gap known as the "missing heritability" problem. In contrast, non-shared environments, including unique life events and personal relationships, are found to be more influential than shared family environments in shaping personality development, particularly during critical developmental periods. The review also explores gene-environment interactions, including how personality traits mediate stress perception and how genetic predispositions influence the selection and interpretation of environmental contexts. Despite evident advancements, the field is plagued by an overreliance on Western populations, broad and imprecise environmental constructs, and insufficient integration of epigenetic discoveries. This review concludes that advancing a comprehensive understanding of personality requires integrative, developmentally sensitive, and culturally inclusive research that connects behavioral genetics, environmental psychology, and emerging genomic technologies.

Keywords: Personality development, behavioral genetics, non-shared environment, gene-environment interaction, epigenetics

Understanding Personality Development Through Genetic and Environmental Contributions

For decades, psychologists, geneticists, and social scientists have been intrigued by the investigation of personality development and stability, particularly in gaining insights into the origins and evolution of personality traits. Determining the course of these processes provides practical insights into the individual differences observed in behavior, cognition, and emotional regulation throughout a person's life. The Five-Factor Model (FFM), developed by Costa and McCrae (1992), is one of the most empirically supported frameworks for characterizing personality traits. The FFM defines individual personality using five broad and stable dimensions: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness. Neuroticism refers to emotional instability and a predisposition to psychological distress, such as anxiety, sadness, and vulnerability. Extraversion represents traits associated with sociability, assertiveness, and a tendency toward experiencing positive emotions. Openness to Experience involves active imagination, aesthetic sensitivity, and intellectual curiosity. Agreeableness reflects interpersonal tendencies such as trust, altruism, and empathy, whereas Conscientiousness concerns self-discipline, organization, and goal-directed behaviors. These dimensions provide a generalizable framework for understanding typical personality functioning and its implications for behavior across the lifespan (Costa & McCrae, 1992). General findings reveal that the prominence of Extraversion, Conscientiousness, and Neuroticism tend to predict effects on one's mental health, relationships, education, and employment (Briley & Tucker-Drob, 2014). These traits structure how individuals react to their environments and engage with the world around them. Still, identifying the bases that contribute to the stability and change of personality traits remains a continuous investigation. Over several decades, empirical studies have consistently demonstrated that both genetic and environmental factors significantly influence personality. However, the relative contributions of these influences, and more significantly, how they interact, remain the subject of ongoing investigation, debate, and theoretical refinement.

Behavioral genetic research within twin, adoption, and family studies consistently shows evidence that personality traits are 40% to 60% heritable, suggesting that genetic factors account for a substantial proportion of individual differences (Power & Pluess, 2015). Increasing evidence also suggests that personality is not a fixed concept; it evolves in response to environmental demands, developmental transitions, and life experiences (Bleidorn et al., 2016). These results facilitated the transition from dichotomous "nature versus nurture" discussions to more integrative models exploring how genetic markers and environmental factors influence trait development. Additionally, advancements in molecular genetics and epigenetics have presented new methodological possibilities for exploring the biological foundations of personality while introducing new questions about the intricacy of gene-environment interactions. Despite technological advancements, challenges persist: specific genetic variants linked to personality traits remain inaccessible, environmental constructs are often vaguely defined, and the field continues to rely heavily on research from White, Educated, Industrialized, Rich, and Democratic (WEIRD) populations, thereby limiting the generalizability of previous discoveries.

This review synthesizes prior research on the genetic and environmental impacts on the development and stability of personality, focusing on how these elements interact across time and context. The review is structured in four parts. First, it examines empirical evidence for the genetic contributions to personality stability, highlighting both additive and non-additive genetic effects. Second, it examines the role of environmental influences, particularly non-shared environments, in shaping personality development during critical life transitions. Third, it investigates gene-environment interactions and correlations, which help explain how genetic predispositions guide environmental exposure and interpretation. Finally, it critiques current methodological limitations and outlines emerging trends and future directions for advancing the field. This integrative approach clarifies how personality traits are maintained and changed and encourages future research in this field to become more specialized. It identifies approaches for future research that more accurately reflect the complexity of human development, offering a blueprint for further exploration and discovery.

Genetic Contributions

Genetic influences are paramount in the stability of personality traits, with an increasing number of findings supporting the conclusion that inherited predispositions guide consistent behavior patterns. Bouchard's (1993) combined findings, based on Minnesotan monozygotic twins reared apart, found notable similarities in personality profiles despite differences in upbringing. These similarities suggest that shared genes, rather than shared environments, are more strongly associated with trait similarities. This evidence suggests that personality is partially influenced by genetic makeup. This finding is also apparent in the later work of Briley and Tucker-Drob (2014), who synthesized data from longitudinal twin and adoption studies, reporting that genetic effects account for 40% to 50% of the variance in the FFM traits. Furthermore, their research suggests that as one's age increases, the genetic influence on personality traits becomes increasingly pronounced, indicating that the consolidation of personality in adulthood is partially genetically determined (Briley & Tucker-Drob, 2014). Their findings also revealed the influence of non-additive genetic effects, such as gene-gene interactions, highlighting the depth and intricacy of the genetic predisposition behind trait development.

Plomin et al. (2016) expanded this framework by identifying the top ten replicated findings in behavioral genetics, affirming that nearly all psychological traits are heritable and that shared environmental effects—often presumed to be influential—are surprisingly minimal. However, despite this convergence of evidence, a significant gap remains between heritability estimates derived from twin studies and the limited number of specific genetic variants identified through molecular genetic approaches. Researchers term this discrepancy the "missing heritability" problem, which challenges the ability to specify the biological mechanisms that express genetic influence. Bratko, Butković, and Vukasović Hlupić (2017) further supported the heritability estimates in previous twin studies. Likewise, their meta-analysis emphasized the methodological limitations of relying heavily on classical twin designs, such as potential overestimations of genetic influence due to unmeasured confounds (Bratko, Butković, & Vukasović Hlupić, 2017).

While the chosen literature provides vigorous support for the idea that genetic factors contribute significantly to the stability of personality traits, these studies largely remain correlational in nature. Often, these results cannot establish causal relationships necessary to reveal underlying mechanisms, support predictions, and enable effective interventions by establishing direct relationships between variables. Like much of psychology research, it relies predominantly on Western samples, which limits generalizability to more diverse populations. These gaps highlight the pressing need for additional research.

Environmental Contributions

As researchers seek to explain the variance in personality not attributed to genetic factors, they focus on the environmental influences on personality development. Increasing empirical evidence suggests that non-shared environmental experiences, which are unique to the individual and not shared among siblings or twins, play a particularly significant role in personality development across the lifespan. These influences include distinct interpersonal relationships, occupational demands, individual responses to life events, and other experiences embedded within specific

social, cultural, and environmental contexts that shape personality in dynamic and enduring ways. One of the most robust empirical examinations of environmental effects was by Hopwood et al. (2011), who utilized a three-wave longitudinal twin design within the Minnesota Twin Family Study. The Multidimensional Personality Questionnaire (MPQ) assesses four broad dimensions: Negative Emotionality (NEM), reflecting emotional instability and stress reactivity; Agentic Positive Emotionality (PEM-A), associated with ambition and social dominance; Communal Positive Emotionality (PEM-C), capturing warmth and empathy; and Constraint (CON), indicating self-control and risk avoidance. (Hopwood et al., 2011). Their results revealed pronounced changes in NEM and CON between late adolescence and early adulthood, followed by trait stabilization into the late twenties. This aligns with the maturity principle, which posits that individuals develop emotional stability and self-regulation as they assume adult roles and responsibilities. This finding, therefore, further reinforces the aforementioned results, as lived experiences uniquely shape personality development.

In addition, Su and Yu (2023) provided a recent synthesis of environmental influences by examining the interplay of social context and personality through twin studies. They argued that environmental effects are distinct across individuals and vary in prominence depending on developmental stage, sociocultural setting, and interaction with genetic predispositions. Their review emphasized that proximal environmental factors, such as parenting quality, peer relationships, educational experiences, and romantic partnerships, can have a profound impact during sensitive periods of personality development. Their findings demonstrate that environmental exposures can reinforce or impair dispositional tendencies, depending on how they align or conflict with an individual's inherent traits (Su & Yu, 2023). Despite these promising insights, one of the most persistent limitations in environmental research is the inability to control genetic confounding sufficiently. Many studies rely on general population samples and do not employ genetically sensitive designs (e.g., twin, sibling, or adoption studies), ultimately threatening confidence in attributing causality to environmental effects. For instance, a classic suggestive gene-environment correlation between harsh parenting and child aggression may not be purely environmental but rather reflect genetically influenced child behaviors that evoke specific parental responses.

Furthermore, while non-shared environments are increasingly acknowledged as central to personality differentiation, shared environmental influences remain under-theorized and inconsistently addressed. Most behavioral genetic studies report minimal shared environmental contributions to adult personality; however, this conclusion may stem from methodological limitations, such as age restrictions in samples, broad operationalization of environmental variables, or lack of longitudinal tracking of early-life contexts. Some researchers argue that shared environments may have delayed or indirect effects, influencing trajectories in ways that only manifest under specific conditions, such as during stress or transition. Additionally, cultural context is a critical yet often overlooked dimension in environmental personality research. The overwhelming reliance on WEIRD (Western, Educated, Industrialized, Rich, and Democratic) populations limits the generalizability of findings, as it overlooks how environmental influences—such as collectivist vs. individualist values, economic inequality, or exposure to conflict—may interact with personality development in non-Western societies. Culturally embedded environmental variables, such as collectivist versus individualist social structures, intergenerational value transmission, or culturally sanctioned expressions of emotion, may shape trait trajectories in ways that have yet to be adequately theorized or tested. Cultural norms shape the content and structure of environments, modulating the desirability and expression of traits such as Conscientiousness or Neuroticism, thereby influencing developmental trajectories in complex ways.

Lastly, environmental research in personality psychology often suffers from conceptual ambiguity. The term "environment" is frequently used in broad or vague ways, incorporating everything from neighborhood safety to parenting style to national GDP, without clear theoretical frameworks to distinguish their mechanisms of influence. Without specificity, the ability to design effective interventions or identify modifiable risk factors is severely limited. Future studies must prioritize precision in environmental measurement, incorporate gene-by-environment interaction modeling, and engage in longitudinal, cross-cultural designs to clarify how environments shape, reinforce, or constrain personality traits across time. Doing so would improve theoretical understanding and enhance practical applications, such as tailoring educational approaches, workplace supports, or clinical treatments to individuals' environmental contexts.

Gene-Environment Interactions

Recent studies of gene-environment interactions (G×E) provide a substantial framework for understanding how biological and environmental influences jointly contribute to the development and expression of personality traits. Unlike models that treat genetic and environmental influences as additive and independent, G×E models emphasize the reciprocal and dynamic relations, wherein genetic predispositions can influence exposure to and interpretation of environmental experiences. Conversely, environments can moderate the expression of genetic traits. Using twin data, the empirical work by Luo et al. (2015) provides a compelling example of G×E dynamics in personality. The researchers investigated the relationship between personality traits and stress perception, revealing that approximately 70% of the variance in stress reactivity could be due to genetic factors (Luo et al., 2015). However,

personality traits moderated this genetic influence: individuals high in Neuroticism perceived events as more threatening and responded with greater distress, whereas those high in Conscientiousness employed more adaptive coping mechanisms, such as planning and self-regulation (Luo et al., 2015). These findings depict how environmental challenges, such as perceived stress, do not affect individuals uniformly; rather, the impact of environmental exposure is contingent on individual dispositional profiles, supporting the Diathesis-Stress model in personality psychology.

Theorists such as Plomin and colleagues (2016) have traced how genetic traits influence responses to the environment and the types of environments individuals encounter through genotype-environment correlations (rGE). The interactions include passive rGE (e.g., a child inherits both a genetic predisposition for extraversion and an extraverted home environment), evocative rGE (e.g., a temperamentally difficult child evokes more punitive parenting), and active rGE (e.g., a sensation-seeking adolescent gravitates toward risky peer groups). Jaffee and Price (2008) argued that such rGEs complicate causal claims in environmental psychology by demonstrating that individuals' genetic dispositions partly influence the distribution of environments rather than randomly assigned environments. This insight holds relevance in the study of psychiatric risk and maladaptive personality traits, where the observed effects of harsh parenting, peer rejection, or socioeconomic adversity may reflect a bidirectional interaction between inherited tendencies and environmental feedback (Jaffee & Price, 2008). Their research advocates using genetically informed designs, such as adoption or longitudinal discordant twin studies, to control confounding factors and accurately determine the environmental contributions to various outcomes (Jaffee & Price, 2008).

Despite advances in G×E research, several critical gaps persist. Firstly, few studies simultaneously measure both genetic susceptibility and environmental exposure with sufficient granularity to detect interaction effects, particularly in naturalistic settings (Bratko et al., 2017). Many G×E models rely on simplistic environmental proxies (e.g., "life stress" or "parenting quality") that fail to capture the complexity, timing, and intensity of real-world experiences (Bratko et al., 2017). Additionally, the longitudinal stability of G×E effects remain underexplored. While traits like Neuroticism and Conscientiousness have moderated environmental sensitivity, it remains unclear whether these interactions persist across time or vary depending on the developmental stage (Bratko et al., 2017). For instance, adolescents may be more susceptible to environmental modulation of genetic traits than older adults due to heightened neuroplasticity and identity formation processes. Another limitation is that most G×E studies rely on samples from WEIRD societies, potentially overlooking the interaction between culturally specific environments and genetic propensities (Bratko et al., 2017). For example, Assertiveness or Emotional expressiveness may generate different environmental responses and, thus, different developmental trajectories depending on societal standards and expectations. Moreover, current G×E research has yet to fully incorporate epigenetic mechanisms that may mediate the environmental influence on gene expression. Early tribulation, chronic stress, and social enrichment are correlated with epigenetic modifications, such as DNA methylation, which can activate or silence gene expression without altering the DNA sequence (Bratko et al., 2017). These changes may help explain how environmental inputs become biologically embedded, exerting lasting influence on personality traits. Nevertheless, the integration of epigenetic data with behavioral G×E models remain limited by methodological complexity and the high cost of collecting genomic data. Future research must move beyond twin correlations and single-environment predictors toward multivariate, time-sensitive, and culturally diverse designs that integrate molecular genetics, behavioral data, and life-history context (Bratko et al., 2017). Doing so would advance the field's capacity to define how nature and nurture interact to influence trait levels and shape the developmental pathways through which personality unfolds across the lifespan.

Critiques and Emerging Trends in Research

Despite significant strides in understanding the biological and environmental foundations of personality, research in this domain still faces several conceptual and methodological challenges that hinder the advancement of theory and application. One of the most persistent and widely discussed issues is the "missing heritability" problem. This phenomenon entails that heritability estimates derived from behavioral genetic studies (typically 40–60% for personality traits) vastly exceed the proportion of variance explained by specific genetic variants identified through genome-wide association studies (GWAS), which has substantial implications. For example, while twin studies consistently demonstrate moderate to high heritability for traits such as Extraversion and Conscientiousness (Briley & Tucker-Drob, 2014; Bouchard, 1993), GWAS findings have thus far identified only small-effect loci that cumulatively explain a fraction of this heritability (Plomin et al., 2016). This discrepancy highlights the complexity of the genetic architecture of personality, suggesting that most traits are polygenic, influenced by thousands of variants with individually negligible effects and that non-additive effects, such as gene-gene interactions or epistasis, may contribute more than previously estimated. Researchers increasingly turn to polygenic risk scores, machine learning techniques, and deep sequencing to close this gap. Nonetheless, these approaches remain in the early stages and require large, diverse, and longitudinal datasets for validation.

In addition to this molecular-level uncertainty, ongoing methodological critiques have long served as a cornerstone of heritability research, targeting the over-reliance on twin studies. Critics argue that classical twin designs may

inflate genetic estimates by assuming equal environments for monozygotic and dizygotic twins and failing to account for gene-environment correlation (rGE) effects. While informative, twin studies alone cannot resolve questions about causality or biological mechanisms, necessitating the incorporation of complementary designs such as adoption studies, molecular genetic data, and within-family longitudinal models. For instance, adoption studies allow researchers to compare the similarity of adopted children to their adoptive and biological parents, providing insights into the relative contributions of genetics and environment to personality. Moreover, many of the most-cited twin studies, including the Minnesota Twin Family Study, are now decades old and composed of predominantly white, middle-class, Western samples, raising concerns about their relevance to contemporary, multicultural populations. As Bratko et al. (2017) note, findings based on such samples may not generalize to individuals from different cultural backgrounds or socioeconomic conditions, in which environmental variability and contextual pressures are more pronounced—for instance, individuals growing up in unstable political environments, low-income households, or collectivist cultures may experience different developmental influences on personality. The underrepresentation of global and non-WEIRD populations also limits the field's capacity to assess how culturally specific environments interact with biological predispositions to shape personality traits.

Another major critique involves the conceptual vagueness and inconsistent operationalization of environmental constructs in personality research. Terms such as "life experiences," "parenting," or "stressful environments" are often broadly defined, making it difficult to pinpoint which environmental mechanisms exert meaningful influence on personality development. Additionally, temporal aspects of environmental exposure—such as the duration, frequency, and developmental timing—are frequently ignored or oversimplified. Researchers risk mischaracterizing how experiences form traits over time if they do not consider the timing, duration, and intensity of individuals' exposure to specific environments. These limitations become even more severe since many studies do not distinguish between shared and non-shared environmental influences or incorporate designs that can isolate their respective contributions. As a result, conclusions concerning environmental impacts are often correlational and susceptible to reverse causation or gene-environment confounding.

In response to these critiques, emerging trends in personality research are shifting toward more integrative and multidimensional approaches. These include advancements in genomic technologies, such as whole-genome sequencing, which enables a comprehensive analysis of an individual's genetic makeup, and polygenic score modelling, which aggregates the effects of multiple genetic variants to predict an individual's risk for a particular trait or disorder. The incorporation of epigenetic data enables the study of how environmental factors influence gene expression, as well as neuroimaging and ecological momentary assessment (EMA), to examine personality in context and in real time. Continuing to increase cross-disciplinary collaborations among behavioral geneticists, developmental psychologists, and computational scientists increases the chances of designing more comprehensive models that reflect the plasticity, complexity, and cultural embeddedness of personality development. Additionally, researchers are now emphasizing developmental timing more, exploring how transitions such as adolescence, emerging adulthood, or parenthood serve as critical windows during which genetic and environmental influences may reorganize and recalibrate personality trajectories. Collectively, these trends reflect a growing recognition that the field must evolve beyond simple heritability estimates and static trait models toward dynamic, context-sensitive frameworks that can capture the reciprocity of multiple variables over time.

Future Directions

Future research on personality development must progress beyond isolated investigations of genetic or environmental influence toward integrative, interdisciplinary models that better capture the complexity of human development. One of the most imperative areas for advancement is addressing the missing heritability problem, which continues to cast uncertainty on the molecular foundations of personality. Although twin and family studies consistently estimate moderate heritability for traits such as Extraversion, Neuroticism, and Conscientiousness (Briley & Tucker-Drob, 2014; Plomin et al., 2016), molecular genetic research has struggled to identify specific variants that collectively account for this variance. However, the potential of advanced genomic tools, including genome-wide association studies (GWAS) with much larger and more diverse samples, whole-genome sequencing, and polygenic scoring methods capable of aggregating the effects of thousands of loci, is immense. These tools can bridge the gap in our understanding of personality. In doing so, researchers will move closer to mapping the complete genetic architecture of personality and elucidating how it interacts with contextual factors over time. Additionally, identifying genes is only one piece of the puzzle; future work must also integrate functional analyses of these genes to determine how they influence neural systems, hormonal pathways, and psychological processes that underlie dispositional behavior.

Equally critical is the need to precisely characterize environmental influences, doing so in ways that account for developmental timing, intensity, and duration. Current environmental assessments often lack granularity, relying on broad proxies like "stress" or "parenting quality" that obscure more specific mechanisms of action. A more thorough investigation of non-shared environmental factors is urgently needed, as they continue to explain a significant portion of the variance

epigenetic research remains underutilized in mainstream personality psychology due to logistical and analytic challenges. Future studies must prioritize collecting longitudinal epigenetic data and invest in developing analytic frameworks that can connect gene expression patterns with trait development across time and contexts. Furthermore, research should examine whether epigenetic changes moderate the effects of gene-environment interactions, potentially amplifying or mitigating dispositional tendencies in response to environmental input.

Finally, there is a growing imperative to ensure that future personality research is culturally inclusive, developmentally sensitive, and translationally relevant. The overrepresentation of WEIRD populations in genetic and psychological studies limits both the generalizability of findings and the equity of their applications. Future research should include diverse samples across socioeconomic, racial, and cultural contexts to capture human variability and identify population-specific patterns of personality development. Future studies must also account for the influence of culturally structured environments on trait development, recognizing that expressions of personality may vary significantly depending on cultural norms, values, and emotional display rules. Additionally, as the science of personality becomes increasingly biologically informed, researchers must remain vigilant to the ethical implications, including genetic privacy, risk prediction, and stigmatization. Integrating ethical foresight with methodological innovation is crucial, as this will ensure that personality science contributes to theoretical advancement and the development of personalized interventions, therapeutic frameworks, and educational supports that improve well-being across the lifespan. In summary, the future of personality research lies in embracing its multidimensional nature, which encompasses biology, context, time, and culture, while continually refining its tools to reflect the complexity of the human condition.

Conclusion

Personality development is a dynamic, lifelong interaction between genetic predispositions and environmental contexts. The literature reviewed here provides robust evidence that personality traits such as Extraversion, Neuroticism, and Conscientiousness are moderately to highly heritable. Genetic factors significantly contribute to both trait stability and individual differences. Studies using classical twin designs, longitudinal meta-analyses, and molecular techniques have consistently affirmed the central role of heritability, revealing the nuanced and polygenic nature of genetic influence. These findings do not imply a fixed personality but rather a biological foundation that is continuously shaped and reshaped through dynamic environmental interactions.

Environmental research has revealed that non-shared experiences—those uniquely encountered by individuals even within the same family—significantly influence personality development, particularly during sensitive life transitions such as adolescence and early adulthood. While shared environments seem to have minimal long-term impact, this does not diminish the importance of context. Instead, it underscores the urgent need for more precise and developmentally informed models of environmental influence. Furthermore, gene-environment interactions and correlations provide a critical framework for understanding how dispositions and experiences co-evolve. Individuals do not passively receive environments; they actively shape, interpret, and select them in ways that reflect and reinforce their genetic makeup.

Despite these advances, several conceptual and methodological gaps remain. The missing heritability problem continues to challenge molecular genetic approaches, while the field's reliance on WEIRD samples limits the cross-cultural generalizability of its findings. Additionally, vague environmental definitions and a lack of longitudinal epigenetic research hinder efforts to map causal pathways between context and trait change. Future research must adopt integrative frameworks that combine genomic, psychological, environmental, and cultural dimensions to advance the science of personality. For example, this can be achieved by leveraging extensive data and epigenetic tools, refining environmental measurement, and expanding studies to diverse global populations.

Ultimately, synthesizing findings across behavioral genetics, developmental psychology, and molecular biology enriches our theoretical understanding of personality development and paves the way for personalized interventions in education, therapy, and healthcare. By examining the reciprocal interactions of nature and nurture, researchers and practitioners can more effectively support individuals across the lifespan—recognizing both the persistent stability and the transformative potential of personality.

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Investigating Language Acquisition Between Children at Low vs. High-Risk of Autism: Parent's Labeling and Description Use During Parent-Child Interactions

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Evidence shows parents enhance their child's word learning abilities by providing labels and descriptions of novel objects, an approach that has been applied in interventions for parents of children with attentional difficulties and developmental disabilities to encourage simplified language input and increase the child's attention during interactions. Using parent-child transcripts from the CHILDES database, this project investigates whether there are any differences in labeling and description use between typical and at-risk infants. This study uses data from Quigley and McNally's (2013) study involving 10 typically developing infants with no known developmental risk factors and no family history of autism and nine at-risk infants who had an older sibling diagnosed with autism. We found when mothers' total number of utterances (i.e., how talkative the mother was) were controlled, labeling between groups was trending towards significantly different ($p = 0.053$) with mothers in the high-risk group providing less labels than mothers in the low-risk group. Additionally, a significant difference was found in how parents used descriptions with mothers in the high-risk group providing less descriptions compared to mothers in the low-risk group ($p = 0.005$). These results show that parents of children at high-risk of developing autism adjusted their communicative frame to fit their children's needs, specifically by providing fewer complex sentences to create a simplistic way of introducing and describing new words to their child's environment. .

Keywords: Language development, developmental disorders, labeling, description use, parent-child interactions

Introduction

Prior research has found that parents tailor their speech and interactions to facilitate their child's early word learning (Adamson et al., 2015) such as how they label and describe objects (LaTourrette & Waxman, 2019; Booth, 2015). However, parents of children with developmental disabilities may communicate with their child differently due to attentional difficulties (Mohan et al., 2022). Studies have shown that parents of children with ASD, for example, adjust their communicative frame to increase their child's attention (Adamson et al., 2001, 2015). Yet, how parents of children with developmental disabilities adjust their utilization of language inputs during parent-child interaction remains underexplored, particularly in terms of specific strategies such as labeling and description use. Therefore, the current study examined whether there are differences in labeling and describing objects during parent-child interactions, specifically between parents of typically developing children and parents of children at risk of developing Autism Spectrum Disorder (ASD). This investigation can help clarify how parents support language development differently depending on their child's developmental profile.

Definitions, Examples, and Differences

Providing descriptions is a method in which parents facilitate children's early word learning. Descriptions can be composed of simple properties (e.g., body shape, prototypical color) of an object (Saylor et al., 2016) or complex properties like causal properties (e.g., function of an object; Booth, 2009; Booth, 2015). For instance, when describing a dog, a parent might say, "This dog has a long tail," which is a non-causal description because it simply notes observable features about the dog. In contrast, saying, "This dog wags its long tail to show it's happy," is a causal description, as it explains the function or reason behind the dog's behavior: to show it's happy. Both types of description are valuable for children's language acquisition, but causal descriptions have been found to possess a facilitative effect on language acquisition due to its ability to enhance and attract attention during interaction (Booth, 2015). This finding is further supported by research showing

young children attending more to causal than non-causal events (Mascalzoni et al., 2013). Beyond what a parent says, these findings emphasize the critical role of verbal input structure in facilitating children's language acquisition. These studies primarily involve typically developing children, however, so it remains less clear whether parent-child interactions involving children with developmental disorders follow similar patterns.

Attention and Language Acquisition

The effectiveness of providing descriptions in language learning depends, in part, on children's attentional processes, making attention a useful bridge to understanding broader mechanisms of word acquisition. Specifically, attention is important for children's language acquisition because children must attend to what is being said and what is being labeled to acquire the word. McDuffie et al. (2006) found a relationship between labeling and attention; specifically, that listening to verbal labels increased visual attention in typically developing toddlers. Particularly, joint attention, the coordinated attention between two people and an entity of interest (Carpenter et al., 1998), serves as a mediating factor between parent-child interaction and language acquisition. For example, a parent might make a link between a novel word (i.e., label) to the child such as "bell" and its referent (i.e., the actual bell visible to the child) more transparent by calling attention to an object such as shaking the bell. By successfully following the parents' cues utilized to call attention to the referent, children become more efficient with their word learning (McDuffie et al., 2006). Therefore, parents can support this process by either introducing a new word into the child's ongoing stream of attention or following the child's lead when producing labels (Adamson et al., 2015). This results in parents adapting a more effective approach based on their children's attention when including language inputs during parent-child interactions (Dunham et al., 1993; Brigham et al., 2010), further proving how the underlying mechanism of attention serves as a bridge between parental input and their child's word learning.

However, less is known about how variations in children's attentional capacities, such as those linked to developmental disorders, might influence parents' interaction strategies. Prior research has alluded to potential differences in communication strategies between parents of typically developing children and those with developmental disorders (Mohan et al., 2022), further reflecting how linguistic adjustments showcase parents' efforts to adapt to their children's responsiveness and engagement. For example, parents of children with ASD were found to have used a comparatively lower number of nouns, verbs, conjunctions and case markers compared to parents of typically developing children (Mohan et al., 2022). Therefore, understanding these nuances could reveal important differences in how parents of children with developmental disorders may adapt specific communication strategies to their child's developmental needs.

ASD and Language Acquisition

Given the importance of attention in early word learning, it is important to understand how this mechanism functions for children with developmental disabilities compared to typically developing children and how it may shape parent-child communication strategies. For example, children with ASD have early communication problems that contribute to difficulties in early language acquisition (Eigsti et al., 2011; Vogindroukas et al., 2022). One cause may be due to their attentional deficits, such as difficulties in joint attention skills which involve initiating and responding to bids for shared attention—gestures or behaviors used to direct another person's focus to an object or event (Meindl & Cannella-Malone, 2011). Due to these attentional difficulties, children with ASD have limited interest and attention to new objects, limiting parents' opportunities to engage the child long enough to present any language input and introduce novel words (Adamson et al., 2010). This highlights how early impairments in attention can create a foundational barrier to language learning for children with ASD, urging parents to alter their language inputs in response to their child's unique attentional needs. Studies have shown parents' adaptations in their communicative frame during interactions such as how parents of children with ASD make objects more perceptually salient or repeat the word (i.e., label) more often as they bid for joint attention (Adamson et al., 2001; 2015), promoting young children's efficiency in learning new words (Schwab & Lew-Williams, 2016). Therefore, when parents repeat novel words, they are better able to capture their child's attention and facilitate their early word learning. These findings suggest that although children with ASD may experience attentional difficulties, parents' adaptation of their language inputs can play a compensatory role in supporting their children's language acquisition.

Despite the positive effect that labeling and description use have on language learning in typically developing populations (LaTourrette & Waxman, 2019; Booth, 2015), there is inconclusive evidence within the atypical population in relation to the associations between attention and language inputs. In one study, two-year-olds diagnosed with ASD were compared with comprehension-matched, typical children. Results indicated that attention to a novel object increased with labeling in the atypical group (McDuffie et al., 2006). This suggests that labeling can sometimes enhance attentional engagement in children with ASD. In contrast, when comparing preschoolers with typical development, Williams syndrome, and ASD, verbal labels did not increase attention to unfamiliar objects for the autism group as opposed to their counterparts (Vivanti et al., 2016). Additionally, Hani et al. (2013) found no significant differences in parents' labeling between children with ASD and typically developing children. These results reveal that the effect of verbal labels on attention may not be consistent across different studies or developmental profiles. Therefore, these mixed findings underscore the need for more research on how parents use verbal labels and how adjusting

their labeling during parent-child interactions affect the responsiveness and attentional engagement of children with ASD. Moreover, while some research has examined the use of verbal labels, no literature to date has directly investigated the role of description use (e.g., causal vs. non-causal) in parent-child interactions and its relationship with language acquisition for children with developmental disorders. Given this gap, further research is warranted to explore how both labeling and description use are used by parents of children with ASD—and how these strategies may support early language development. Understanding these patterns can shed light on the nuances of parent-child interactions and how parents of typically developing children and atypical children could differ in their language inputs during parent-child interactions.

Current Study

It is unclear whether parents of children with a high-risk for ASD adapt their use of language inputs differently from parents of low-risk children. Therefore, the current study aimed to address this gap by examining mother-child interactions of low-risk and high-risk children. Using transcripts from the CHILDES database, we asked 1) do mothers of infants with a high risk of developing ASD label and describe referents more often during parent-child interactions than mothers of infants with low risk? and 2) does infants' risk of developing autism predict how often their mothers label and describe referents during parent-child interactions? Our first question aimed to explore differences in labeling and description use between mothers of high-risk and low-risk infants, shedding light on how risk profiles may shape parent-child communication. We expected that mothers in the high-risk group label and describe referents more often during their interactions with their infants as opposed to mothers in the low-risk group based on prior research on how labeling and repetition support attention and consequently language acquisition for children with ASD (Adamson, 2015; McDuffie et al., 2006).

Our second research question delves deeper on these differences by investigating whether a child's risk of developing ASD predicts the frequency of these language inputs, providing insight into how parents may adapt their communication strategies to their child's developmental needs. We expect risk profile (high-risk and low-risk) to predict how often mothers provide labels and descriptions of referents during their interactions with their infants.

Together, both questions offer a comprehensive understanding of how risk profile influences parental language input, both at the group level and in terms of individual variations, enriching our knowledge about parents' communicative strategies during parent-child interactions. Furthermore, by investigating the influence of heightened risk for developing autism on parental language input, we can build solid foundational evidence that informs future research to compare low-risk infants (or typically developing) to those officially diagnosed with autism. This approach helps in highlighting early communicative differences that may be present before an official diagnosis, inspiring practitioners to develop timely interventions that can benefit children's language development.

Method

Corpus and Participants

Participants were 10 typically developing infants (three girls and seven boys; low-risk group) with no known developmental risk factors and no family history of ASD and nine infants at risk of autism (seven girls and two boys) which includes two infant identical twin girls. The original researchers included the identical twins to validate their observational method. They found the mother's language behavior to be consistent across both of her twin infants, suggesting that the testing condition elicited natural interactions reflective of her typical speech style. The high-risk group (HR) was defined as having a higher genetic risk of developing autism due to having an older sibling(s) diagnosed with ASD. One child in the low-risk group (LR) and three children of the HR group have subsequently received a diagnosis of ASD after three years.

The transcripts used in this study are parent-child interactions from Quigley and McNally's (2013) longitudinal study in the Child Language Data Exchange System database (CHILDES; MacWhinney, 2000). These transcripts were specifically chosen as they were the most recent study that included a control group (i.e., typically developing infants), allowing us to compare differences between the mother-infant interactions between a low-risk and high-risk group. Mother-infant dyads and their interactions were filmed once every four weeks mostly in their homes but occasionally in a free-play room at a developmental lab at the university. To obtain semi-naturalistic behavioral information, the mothers were asked to interact with their infants as they naturally would, and the experimenters did not provide any toys or props. Filming occurred between the ages of three and 12 months for each infant with an average of seven to eight visits total for each parent-child dyad.

Each visit was filmed for 15 minutes. However, the first three minutes of the recording was not used for analyses due to the families still adjusting to the filming set-up and mothers and infants were beginning to establish their interaction. After this three-minute period, the next continuous five minutes of interaction where the infants were not fussing or crying were transcribed using the CHAT system (MacWhinney, 2000) and uploaded to CHILDES. A total of 203 transcripts were available from the corpus and analyzed in the current study.

Coding Procedure

Each participant was assigned a participant ID number, and each transcript was assigned a visit number (one to 203). Transcripts were randomly assigned to coders who were trained with a coding manual (Appendix A) that specified both the annotation procedure and exclusion criteria.

First, we reviewed the transcripts and implemented an exclsion criteria. The exclusion criteria ensured coding focused on meaningful and contextually relevant instances of labeling and description use that were aimed to teach a new word to the child. Utterances involving the child's name or shortened name, or other people's names were excluded, as these do not contribute descriptive or referential information essential for assessing language inputs aimed to teach the infant new words. Similarly, nicknames (e.g., "sweetie") and phrases used as nicknames (e.g., "little sleepyhead," "creepy boy") were omitted, as they lack descriptive specificity about objects or events in the child's environment. Common phrases such as "good girl" or "good job" were also excluded because they primarily function as evaluative or reinforcing statements rather than labels or descriptions. Finally, utterances that included the mothers' singing were not coded but highlighted for potential future directions, as singing often involves scripted or repetitive language that may not reflect the parent's intentional use of language to support the child's learning. Then, coders went line-by-line through the transcripts to indicate the presence of parents' labeling occurrences and description use. If labeling or description use was present, coders identified the label in the utterance or identified the type (i.e., causal or non-causal) of description using the guidelines on the coding manual.

Labels

Coders marked the presence of a label if a parent talked about the proper name of an object or any physical being in an utterance. Labels did not need to be present in the current environment of the mother and child during the interaction. This can range from toys the mother referred to during play (e.g., ball) to a child's body part (e.g., nose), or an object that the mother would refer to from a past event.

Description Use (Casual)

Coders marked any causal description used in the utterances and labeled "CAUSAL" within the description use column. These were descriptions that added effective powers to an object, such as conceptual properties of the referent or functional information about the referent (Booth, 2009; 2015). Additionally, based on past research involving causal adverbials and their positive effects in learning, examples can also include sentences. Causal description utterances could also contain an "if-then" statement or a "because" statement based on prior research showing that causal adverbials have positive effects on learning (e.g., "And why was she called Goldilocks? Because she had beautiful hair;" Curran & Van Horne, 2019).

Description Use (Non- Casual)

Coders marked any non-causal description used in the utterances that added value to the label presented by the parent and provided additional perceptual and non-conceptual information about the referent (Booth, 2009). These descriptions were typically one-word and could range from different classes such as color, size, pattern, etc., or any adjectives the parent used to describe a noun's perceivable features in the utterance. Typically, non-causal descriptions can occur more than once in a single utterance, so coders were instructed to note all instances of non-causal descriptors.

Reliability Procedure

Each coder was randomly assigned one-third of the 203 transcripts to code. To assess reliability, all 203 transcripts were coded in its entirety by a second coder. A random sample of 46 transcripts were selected for the reliability analysis. Reliability was excellent (Krippendorff, 2004; $M_{alpha} = 0.97$, range = 0.91-1.0). Disagreements were resolved through discussion between the primary and secondary coders and included in the final dataset for analysis.

Data Analysis Plan and Statistical Analyses

To address our research questions, we employed both independent samples t-test and linear regression analyses. The t-tests were used to examine whether there were significant differences between mothers of HR and LR infants in their proportion of labeling and description use during interactions. These tests allowed assessment of group-level differences across different types of parental language input. To further examine whether ASD risk predicted maternal language input, we conducted linear regression analyses with risk status as the predictor variable. In these models, the HR group was dummy coded as the reference category (0), while the LR group was coded as 1. The outcome variables included the frequencies of labels and descriptions used during the interaction.

Labeling Analysis

The current study examined the frequency and proportion of labeling between the HR and LR groups and the differences between these groups. The proportion of labeling was defined as the total number of utterances where labeling occurred divided by the total number of utterances of each mother-child dyad for all their respective sessions. This accounted for how talkative the mother (i.e., total number of utterances) was during the interaction. Lastly, frequencies of labeling were calculated based on the total labels that the mothers stated throughout the sessions for each participant.

Description Use Analysis

The current study examined the frequency and proportion of description use between the HR and LR groups for all types of description use. We analyzed parents' description use for the following categories: causal only, non-causal only, and both together. The proportion of description use for all three analyses were defined as the total number of utterances where description use occurred (non-causal and/or causal) divided by the total number of utterances of each mother-child dyad for all their respective sessions, again accounting for how talkative the mother was throughout the study. Lastly, frequencies of description use were calculated based on the

total descriptions, for each type, the mothers stated throughout the sessions for each participant.

Results

Frequency of Labeling Labeling Analysis

We first asked if there was a difference in the frequency of labeling between mothers of low-risk children and high-risk children. The proportion of labeling was higher for the LR group (M_{LR}=0.30, SD_{LR} = 0.12) compared to the HR group, (M_{HR}=0.22, SD_{HR} = 0.05). This difference was closely significant as indicated by an independent sample t-test, $t(17) = -2.08$, $p = .053$, d = -0.95). These results are shown in Figure 1A.

Frequency of Description Use

We next asked if there was a difference in the frequency of description use between mothers of low-risk children and high-risk children. The proportion of general description use was significantly higher for the LR group (M_{LR} = 0.10, SD_{LR} = 0.04) than the HR group (M_{HR} = 0.05, SD_{HR} = 0.03) as indicated by an independent samples t-test, $t(17) = -3.19$, $p = .005$, d = -1.47. This result suggests a large effect size, indicating a substantial difference in general description use between groups. These results are shown in Figure 1B. For the non-causal description use only, the proportion was also higher in the LR group (M_{LR} = 0.08, , SD_{LR} = 0.03) than in the HR group (M_{HR} = 0.04, SD_{HR} = 0.02), $t(17) = -3.26$, $p = .03$, d = -1.50, which also suggests a large effect size. A similar significant difference and a large effect size were found with the causal description use only category, $t(17) = -2.33$, $p = .03$, d = -1.07, with the LR group (M_{LR} = 0.003, SD_{LR} = 0.003) having a higher mean proportion of causal description than the HR group (M_{HR} = 0.001, SD_{HR} = 0.001). These results are shown in Figure 2A and 2B. Overall, we found that mothers of low-risk children used more labels and more descriptions compared to mothers of high-risk children with all differences associated with large effect sizes.

Effect of Risk Profile on Labeling and Descripton Use

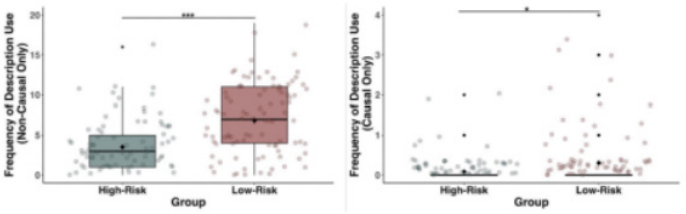
Our second research question asked if group membership (HR vs. LR) predicted the frequency of labeling and description use. To assess the effect of risk profile on the frequency of labeling, a linear regression with risk profile as the predictor variable and frequency of labeling as the outcome variable was run. The regression model was significant, F(1, 200) = 11.23, $p < .001$, explaining approximately 5.32% of the variance in labeling frequency (R^2 = 0.053). Group membership significantly predicted labeling frequency (B = 7.67, SE = 2.29, $t = 3.35$, $p < .001$), with the LR group showing higher frequencies of labeling compared to the HR group. The intercept (B = 19.05, SE = 1.67) reflects the average labeling frequency in the HR group. These results are shown in Table 1.

In addition, a separate linear regression analysis was performed to assess the relationship between group membership and description use, including both causal and non-causal descriptions. As for general description use (causal and non-causal), the model linear regression model was also significant, F(1, 200) = 18.30, $p < .001$, explaining approximately 8.38% of the variance in general description use frequency (R^2 = 0.084). Group membership significantly predicted description use (B = 4.02, SE = 0.94, $t = 4.28$, $p < .001$), with the LR group exhibiting a higher frequency compared to the HR group.

The intercept (B = 4.72, SE = 0.69) reflects the average general description use frequency in the HR group. These results are shown in Table 2. For non-causal description use, the model was significant, F(1, 200) = 17.47, $p < .001$, with the LR group having a higher frequency of non-causal description use only compared to the HR group. The regression model for non-causal description use only also explained approximately 8.03% of the variance in non-causal description use frequency (R^2 = 0.0803). These results are shown in Table 3. For causal description use, the regression model was also significant, F(1, 200) = 6.76, $p < .05$, explaining 3.27% of the variance (R^2 = 0.033). The LR group also had a higher frequency of causal description use only compared to the HR group. These results are also found in Table 4. Group membership significantly predicted non-causal description use only (B = 3.80, SE = 0.91, $t = 4.18$, p < .001) and causal description use only (B = 0.22, SE = 0.08, $t = 2.60$, $p = .01$). The intercept represents the average non-causal description use frequency in the HR group (B = 4.64, SE = 0.66) and the average causal description use frequency in the HR group (B = 0.09, SE = 0.06).

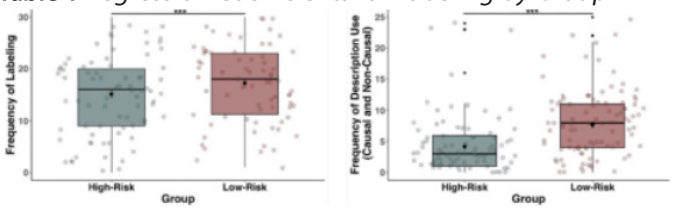
Figure 1 *Comparisons of Frequencies of Labeling and Description Use Between High-Risk (HR) and Low-Risk (LR) Groups*
*Note. *p < .05. **p < .01. ***p < .001.*

Figure 2 *Comparisons of Frequencies of Non-Causal Descrip-*



tions Only and Causal Descriptions Only Between High-Risk (HR) and Low-Risk (LR) Groups
*Note. *p < .05. **p < .01. ***p < .001*

Table 1 *Regression Coefficients for Labeling by Group*



Predictor	*Estimate*	*SE B*	*t-value*	*p*	R^2
Intercept	19.053	1.674	11.385	< .001	0.053
Group	7.669	2.289	3.351	< .001	0.084

Table 2 *Regression Coefficients for General Description Use (Causal and Non-Causal) by Group*

Predictor	*Estimate*	*SE B*	*t-value*	*p*	R^2
Intercept	4.723	0.687	6.878	< .001	0.033
Group	4.017	0.939	4.278	< .001	0.080

Table 3 *Regression Coefficients for Non-Causal Only Description Use by Group*

Predictor	*Estimate*	*SE B*	*t-value*	*p*	R^2
Intercept	4.638	0.664	6.983	< .001	0.033
Group	3.797	0.908	4.180	< .001	0.080

Table 4 *Regression Coefficients for Causal Only Description*

Predictor	*Estimate*	*SE B*	*t-value*	*p*	R^2
Intercept	0.085	0.062	1.373	0.171	0.053
Group	0.220	0.085	2.600	< .05	0.084

Note. Results are based on linear regression models with group (HR vs. LR) as the predictor variable and mothers' language input as the outcome variables. R^2 represents the proportion of variance explained by the model. SE B = Standard Error of B.

Discussion

We used two different methods of analysis to investigate whether there are differences in how often mothers labelled and described referents to their children and whether risk can predict their labeling and description use behavior. Our results showcased close to significant differences in the mothers' labeling and significant differences in their description use for all categories between the HR and LR groups. Furthermore, we found that developmental risk predicted how much mothers labeled and described referents during their interactions. The effect sizes for these group differences were also large (Cohen's d > 0.8), indicating that the observed differences were not only significant but also practically meaningful in real-world settings. This suggests that the frequency in which mothers provided labels and descriptions of referents—more particularly so with their descriptive language—substantially differs depending on the child's ASD risk status, with likely implications for language learning opportunities during early development. These findings, therefore, can drive meaningful and effective interventions that aim to prioritize specific language inputs that are more effective in facilitating early word learning such as increasing descriptive language during interactions for children with a high-risk of developing ASD.

Impact of ASD Risk Status on Mothers' Language Inputs

Our findings show that there are differences in mothers' labeling and description use between the HR and LR group. The regression analysis supported our second hypothesis: infant ASD risk status significantly predicted maternal language input during interaction. However, these results disproved our first hypothesis: labeling and description use differences showed mothers in the HR group labeled and described referents less often compared to those in the LR group, as opposed to an opposite trend.

An explanation for these results can be due to the infants' attentional focus during the interactions. More specifically, the infants' high-risk might have caused the mothers to adjust their communicative behavior based on their child's attentional engagement. As discussed by Adamson et al. (2015), parents of children at higher risk for developmental disorders may modify their language input to better suit their child's ability to engage and attend. This could explain why ASD risk influenced the amount of times mothers were labeling and describing referents during interactions, resulting in mothers in the HR group being more selective or strategic in offering information about referents during their interactions—depending on their child's engagement—compared to mothers in the LR group. Additionally, children with ASD have limited interest and attention to new objects (Adamson et al., 2010). This attention deficit further affects parents' language input when introducing and presenting novel words (Mundy, 2018), such that parents possess limited opportunities to engage the child long enough to present their language inputs during the interaction. Therefore, the limited joint attention and responsiveness during parent-child interactions present in children with ASD provides a clear explanation as to why our findings disproved our first hypothesis; mothers in the HR group could have provided less labeling and descriptions due to their infants' inconsistent attention and engagement as they may have only been attentive to them for shorter periods compared to LR infants. Subsequently, mothers in this group may have refrained themselves from providing detailed descriptions or repeating various or the same labels that could have complicated their point, focusing instead on simpler ways to coherently and concisely form their sentences during the interaction by labeling and describing the referents less often. In conclusion, the ability of HR infants to attend and engage with their mothers could have directly influenced their decision to either expand or repeat labels with additional descriptions or keep the interaction and communication more basic by not doing so.

Overall, our findings implicate the importance of attentional engagement in children's language and communicative development, especially for children with ASD, and the interconnection of attention and language inputs during parent-child interactions found from past studies (Meindl & Cannella-Malone, 2011; McDuffie et al., 2006; Tomasello, 2001).

communicative strategies, further demonstrating a possible bidirectional relationship between both concepts. These complex associations between factors like developmental risk, associated skill deficits and challenges, and language development can inspire practitioners in terms of how to better support children that are not only officially diagnosed with ASD, but also those that are at-risk of developing ASD. Future interventions related to improving the language development of populations that have deficits in their communicative skills such as children with ASD can focus on which factor to enhance on, such as children's attention or their parents' communicative strategies, in hopes to effectively support children's early word learning. For example, practitioners could support parents in using non-verbal strategies (e.g., gesture, eye gaze, and showing) to scaffold attention and enhance word learning for at-risk infants. Thus, our findings not only confirm that maternal input varies by ASD risk group, but also underscore the importance of understanding these early adaptations as part of the broader efforts to optimize language development in high-risk populations

Labeling Trends and the Need for Multimodal Perspectives

However, it is important to note that the differences in labeling between the HR and LR groups were only approaching significance ($p = 0.053$), suggesting slight differences that warrant attention. This close to significant result may be attributed to limitations in statistical power (Cohen, 1992), possibly due to this study's small sample size of 19 participants (10 in the LR group and 9 in the HR group), limiting the ability to detect significant differences for labeling. Additionally, the unequal distribution of boys and girls between groups and the use of five-minute interaction segments may have contributed to variability and reduced the sensitivity of the test (Field, 2018; Bakeman & Gottman, 1997). These factors suggest that the trend towards significance found for labeling could be due to insufficient statistical power rather than a true absence of group differences. Therefore, taking these points into account limits the generalizability of our findings and raises the possibility that some effects—particularly for labeling—may be underpowered compared to the other language inputs examined in this study. This limitation not only affects statistical significance but also the confidence with which we can apply these findings to the broader population of mothers with and without a heightened likelihood of having an autistic child. Future studies should aim to replicate these results in larger and more diverse samples.

Beyond the statistical limits of our sample, the trend toward significance in mothers' labeling suggests that, unlike with descriptions, group differences in labeling may be more subtle or context-dependent. This finding on labeling aligns with prior research by Hani et al. (2013), which found no significant differences in parents' verbal labeling between children with ASD and typically developing children. Although our study showed a trend towards a significant difference rather than a clear absence of difference and used a younger sample of at-risk infants, these results suggest that verbal labeling alone may not fully capture group-level variation in parental language inputs. Therefore, an important implication of this study is that future research should consider not only verbal language input during parent-child interactions, but also multimodal and non-verbal communication strategies used by parents to label referents during parent-child interactions.. For example, non-verbal cues such as non-verbal labeling (e.g., pointing and showing) could have played an important role in introducing a novel word and improving attention within this sample (Brigham et al., 2010) while still representing another form of labeling. This is also supported by Hani et al. (2013)'s study, which showcased that parents of children with ASD significantly produced more shows (e.g., non-verbal cues) in combination with a verbal label compared to parents of typical children. Therefore, given the close to significant differences in our labeling findings, further caution is needed in drawing strong conclusions regarding the relationship between mothers' labeling and children's risk profiles in this sample. An adaptation of a more comprehensive parental labeling beyond just a verbal communicative strategy can expand and create a more nuanced outlook on specific differences between parents' labeling that aims to enhance their children's early word learning. Nonetheless, these findings advocate for a broader view of parental communicative behaviors beyond solely typical children, providing an additional perspective on parents' communicative frame for atypical populations.

Limitations and Future Directions

While this study provides valuable insights into the language inputs of mothers with high-risk infants, there are important limitations that should be considered when interpreting the findings and guiding future research. It is important to note that the participants in this study involved "at-risk" infants for developing autism, as they had an older sibling with an ASD diagnosis. For ASD, reliable diagnoses become available at around three years of age (Vattuone, 2021). However, studies have shown that being a "high risk" does not necessarily lead to a later ASD diagnosis. For instance, Choi et al. (2020) found that out of 55 high-risk infants, only 21 later met the criteria for ASD. Additionally, in our study, one child in the LR group and three children in the HR group later received an ASD diagnosis after age three. This provides important context when interpreting our findings, as it suggests that even within the "at-risk" designation, there may be early behavioral symptoms in children who later receive a diagnosis and those that do not. It would be valuable for future research to explore whether the significant group-level findings in this study were primarily driven by the subset of children who later received a diagnosis. This could provide a more nuanced understanding of how early parental language strategies are shaped by subtle cues associated with later ASD outcomes.

Furthermore, the inclusion of "at-risk" infants limits the generalizability of the findings, given they had an older sibling with an official diagnosis which can, in turn, affect how the mothers interacted with these infants. Future research could explore how parents interact with both their older, autistic child and high-risk infant, examining whether the communicative strategies used with the older child are adapted when interacting with the younger, high-risk infant. It is possible that the language inputs the mothers use may be similar for both children, reflecting a generalization of the mothers' speech rather than a direct influence of the younger child's risk profile

Lastly, the regression models used to test our second hypothesis showed very low R^2 values (ranging from 0.033 to 0.084), suggesting that risk status explained only a small proportion of the variance in parental language input. This indicates that additional variables—potentially including factors such as maternal education, socioeconomic status, or children's knowledge of the words presented during the interaction—likely play important roles in shaping parental communicative behaviors. As our current study did not include these confounding variables in our analysis, future studies should aim to include and control for such factors in their models to offer a more comprehensive understanding of what drives the variation in parents' language input between atypical and typical groups. As such, future research can then make a conclusion on whether parents' adaptation of their communicative strategies, such as how often they label or describe referents, does indeed improve or perhaps worsen their children's vocabulary development.

Despite these limitations, the findings from this study also carry practical implications, particularly for early intervention. Our results suggest that infants' attention and engagement may play a key role in shaping how and when mothers provide language input. Interventions aimed at enhancing children's attentional capacities could therefore help parents make more frequent and effective use of labeling and descriptive language. Supporting mothers—particularly those of high-risk infants—with strategies to maintain engagement may in turn promote language development and mitigate communication delays. Past studies demonstrated such intervention methods that can increase the child's attention during the interaction, such as encouraging eye contact, sitting close to the child, developing play routines, and etc. (Paparella & Freeman, 2015). Implementing these strategies and training parents on the importance of utilizing these methods may help them engage their child long enough to present labels and descriptions which in turn can improve their child's language development.

Conclusion

This study investigated how mothers of high-risk (HR) and low-risk (LR) infants differ in their labeling and description use during parent-child interactions. Our findings highlighted significant differences in the use of descriptions between both groups, supporting the idea that mothers of HR infants adjust their communicative behaviors to engage their children. However, labeling differences were only approaching significance, suggesting potential limitations related to sample size and statistical power. Importantly, we found that developmental risk predicts the frequency of labeling and description use, emphasizing that challenges related to the infants' risk profiles such as attention and engagement could play a crucial role in shaping parents' communicative strategies during parent-child interactions. These results underscore the need for future research to incorporate larger, more diverse samples and to explore additional factors, such as attention and other forms of communicative strategies (e.g., non-verbal labeling), that could influence parent-child interaction dynamics. Practical implications of this study suggest that early intervention strategies focusing on enhancing children's attention and engagement may provide parents with more opportunities to use effective language inputs, ultimately supporting language development in high-risk populations.

Acknowledgements

I would like to express my deepest gratitude to my mentor, Erjing Zhang and my supervisor, Dr. Catherine Sandhofer, for their guidance, support, and encouragement throughout this research project. This work would not have been possible without their mentorship and dedication

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Experiences of Neurodiversity: Belonging, Social Support, and Well-Being

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Acknowledgements

We would like to thank the participants for taking the time to complete the survey.

Funding Details: This research did not receive funding.

Conflict of Interest: All authors declare no conflicts of interest.

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Given the societal barriers that impair overall quality of life for people with disabilities and prevalence of mental health problems among neurodivergent populations, this study sought to explore whether feelings of belonging, perceived social support and well-being differ between neurodivergent and neurotypical individuals. The present study aimed to build on previous work by examining these factors through an intersectionality lens, focusing on those with intersecting marginalized identities of race and ethnicity, immigrant status, and / or sexual and gender identities. Participants (n = 169, 39% neurodivergent) completed an online survey focused on well-being, perceived social support, and feelings of belonging, as well as discrimination and loneliness. Those who identified as neurodivergent reported greater feelings of loneliness but similar perceived well-being, social support, feelings of belonging, and discrimination as neurotypical participants. Future research should aim to examine intersecting identities further, as this was not possible in the present study given the lack of diversity in the sample. These findings contribute to the currently limited literature focused on well-being among neurodivergent populations, and add further weight to a more positive narrative regarding the experiences of neurodivergent adults.

Key words: intersectionality, autistic, ADHD, neurodivergent, discrimination, identity, supports, barriers

Experiences of Neurodiversity: Belonging, Social Support and Well-Being

Neurodiversity is defined as the natural variation and diversity in human minds (Walker, 2014). Those described as neurodivergent typically include those with diagnoses of autism, attention deficit hyperactivity disorder (ADHD), and/or learning disabilities (Morris-Rosendahl & Crocq, 2020). In the US, around 1 in 36 children are estimated to be autistic (Maenner et al., 2023), around 10.5% of children have an ADHD diagnosis (Staley et al., 2023), and around 1.7% report having a learning disability (Cortiella & Horowitz, 2014). The neurodiversity movement seeks to celebrate neurological differences as strengths rather than deficits (Kapp et al., 2013). Proponents of the neurodiversity movement argue the importance of recognizing these differences in order to support neurodivergent populations living in a neurotypical society, and promote motivation to seek support. Recognizing that neurodivergent individuals also embrace other identities, including race, ethnicity, gender identity, and others, is increasingly understood as critical to gaining a full perspective of neurodivergent experiences (Cohen et al., 2022).

Intersectionality, rooted in feminist theory, is the understanding that different aspects of identity are interconnected and can lead to unique struggles, discrimination, and experiences (Bowleg, 2012). These challenges are understood to not be simply additive, but rather compound and exacerbate one another (Crenshaw, 1989). Intersectionality is woven into the neurodiversity paradigm (Strand, 2017); living in a world designed for neurotypical people, challenges faced by neurodivergent people are contextual, based on the situation in which they are living and experiencing (Robertson, 2010).

There is a lack of research and understanding of the interaction between neurodiversity and intersectional identities. Much of the research on autism continues to focus on white,

Western males, leading to Black autistic people being underrepresented within the research literature (Malone et al., 2022). Research focused on neurodivergent children of immigrants is limited as well, focusing more on epidemiology, access to health care, and receiving interventions rather than on lived experiences (Schmengler et al., 2021; Morinaga et al., 2020). Previous research has suggested that the prevalence of autism and ADHD are higher in children of immigrant and refugee parents (Abdullahi et al., 2017; Kawa et al., 2017). Yet, children of immigrant background and of ethnic minorities are underdiagnosed (Begeer et al., 2009), and tend to be diagnosed later than US-born children (Hall-Lande et al., 2021; Valicenti-McDermott et al., 2012).

It is also important to consider the intersection of sexuality and gender identity with neurodiversity. Autistic individuals are more likely to identify as a member of the LGBTQ+ community and one in seven autistic women and one in 20 autistic men report being attracted to someone of the same sex (Dewinter et al., 2017). In addition, 22% of female participants and 8% of male participants assigned these genders at birth reported some gender non-conforming feelings (Dewinter et al., 2017). Miller et al. (2020) argue that neurodivergent people may differ in their conceptualization and internalization of ideas considered normative regarding gender and sexuality. In a population based study of 47,000 people in Sweden, Rudolph et al. (2018) found that a lower proportion of people who scored high on an AQ-10 autism assessment tool identified as heterosexual. Autistic individuals are also more diverse in their gender identities than the wider population (George & Stokes, 2017), and this is without considering those who have not yet been diagnosed with autism, or come out as LGBTQ+, meaning that this could be even higher.

Feelings of Belonging, Social Support and Well-Being

In multicultural societies like America, children often develop tSocial support, feelings of acceptance, and feelings of belonging have been identified as key to well-being, as well as being associated with support seeking behaviors, indirectly acting on mental health and well-being outcomes (Gopalan & Brady, 2020). In a national study of college students in the US, sense of belonging was found to be positively associated with use of campus services and self-reported mental health (Gopalan & Brady, 2020). Those with marginalized identities experienced more difficulty feeling accepted and building a sense of belonging, with subsequent negative impacts on well-being (Gopalan & Brady, 2020).

The associations between feelings of acceptance and belonging and well-being and mental health outcomes have also been identified in neurodivergent populations. Anxiety and depression, which are prevalent among neurodivergent populations (Accardo et al., 2024; Riedelbauch et al., 2024), also correlate with negative well being and autistic and ADHD traits (Garcha & Smith, 2023). Feelings of acceptance and belonging could potentially buffer these interactions. In a study which conducted interviews with autistic people, participants identified the benefits of autistic community connectedness as increased self-esteem and a sense of community not experienced elsewhere, with lack of connectedness being linked to ambivalence with an autistic identity and/or feelings of internalized stigma (Botha et al., 2022). It is therefore important to further understand feelings of acceptance and belonging in neurodivergent populations, in order to enhance the promotion of these feelings.

One way to understand feelings of acceptance and belonging within neurodivergent populations involves developing a greater understanding of the double empathy problem (Milton, 2012). The double empathy problem highlights challenges that may occur when people from different backgrounds interact with one another. Central to this concept is the understanding that communication breakdowns involve all people in the communicative exchange. This concept has recently become popularized within the autistic community (Milton et al., 2022). It becomes especially important when considering autistic people who are members of other minoritized groups.

Loneliness has also been shown to be higher in autistic populations, and perceived social support may be a protective factor of loneliness in autistic adolescent boys (Lasgaard et al., 2010). Social support is also associated with quality of life in autistic adults (Bishop-Fitzpatrick et al., 2018); autistic people report lower perceived social support than individuals with ADHD and neurotypical controls (Alvarez-Fernandez, 2017). More practical, tangible social support has a negative association with depression, potentially acting as an indirect protective factor against suicidality in autistic individuals (Hedley et al., 2017). Interviews with autistic young adults in the UK explored access to support (Davies et al., 2024). Support groups were recognized as helpful in making friends, developing a sense of belonging, and developing coping strategies. In terms of support from professionals and well-being, autistic young people have reported feeling misunderstood by mental health professionals (Davies et al., 2024), and cultural differences can exacerbate this (Kim et al., 2023). The double empathy problem explains miscommunications between autistic and non-autistic people as due to a mismatch in perspectives and communication (Milton, 2012); in healthcare settings a triple empathy problem could arise due to communication differences between healthcare professionals and non-healthcare professionals (Shaw et al., 2024). There are health disparities between autistic and nonautistic populations, and autistic patients should be taken seriously by healthcare professionals (Stanford, n.d.) in order to support their health and well-being. In understanding the support that professionals give, it is important to explore feelings of social support and well-being across different populations.

This study seeks to explore feelings of belonging, social support and well-being and how these experiences differ between neurodivergent and neurotypical individuals, and in particular, those with intersecting identities. While previous work

has looked at belonging (Pesonen et al., 2015), perceived social support (Alvarez-Fernandez, et al., 2017), and well-being (Danker et al., 2019), this study looks at these experiences together and takes a broader perspective of the experiences of neurodivergent individuals through a lens of intersectionality. It is hypothesized that the experiences of neurodivergent individuals are less positive compared to their neurotypical counterparts, particularly amongst those with intersecting identities. This study aims to contribute to the currently limited literature focused on intersectionality and neurodiversity, and specifically to identify particularly vulnerable groups who could benefit from greater support and outreach.

Method

Participants

A sample of 170 participants was obtained. The majority of participants were between the ages of 18 and 21 (78.90%, n = 86). Most participants identified as either a cisgender male or cisgender female (90.53%, n = 153). Around 45% identified as non-white. Over 30% of the sample reported a sexual orientation other than heterosexual (30.95%, n = 53). Over 90% of participants reported having been born in the United States. (91.72%, n =155). With regards to neurodivergence, 66 participants (39.05%) reported being neurodivergent. Being neurodivergent was measured through self-report where participants indicated whether or not their day to day life was affected by neurodivergence, which allowed inclusion of those without a formal diagnosis. Additional information regarding demographic information is reported in Table 1. The average age of the participants utilized was 26.9 years old. In regards to gender, 41.5% were Female, 56.4% were Male, and 2.1% were Non-Binary (Figure 1). In regards to race and ethnicity, participants in this study were composed of the following; 53.1% European American/Caucasian, 24.1% Asian/Pacific Islander, 9.7% Latinx, 6.2% African American/Black, 2.1% Middle Eastern, 4.6% other (Figure 1). Participants' generational status consisted of: 10.7% first generational status, 31.6% second generational status, 12.2% third generational status, 9.2% fourth generational status, 36.3% fifth generational status (Figure 1).

Figure 1
Demographic Information (N=169)

Variable	%	N
Age		
18-21	78.90	86
22-30	8.26	9
30-60	12.84	14
Gender Identity		
Cisgender Man	33.73	57
Cisgender Woman	56.80	96
Transgender Man	1.18	2
Transgender Woman	1.18	2
Non-Binary	1.78	3
Other	2.37	4
Prefer Not to Say	2.96	5
Sexual Orientation		
Heterosexual or Straight	69.05	116
Gay	3.57	6
Lesbian	2.98	5
Bisexual	13.10	22
Queer	.60	1
Asexual	2.98	5
Pansexual	1.79	3
Other	1.79	3
Prefer Not to Say	4.17	7
Race/Ethnicity		
Non-Hispanic White	55.03	93
Black/Afro Caribbean/African-American	11.83	20
Latino/Hispanic-American	13.02	22
Asian-American	10.65	18
Other	5.92	10
Prefer Not to Say	.59	1
Affected by Neurodivergence		
Yes	39.05	66
No	60.95	103
Born in the United States		
Yes	91.72	155
No	8.28	14

Mother Born in the United States		
Yes	63.10	106
No	36.90	62
Father Born in the United States		
Yes	67.48	110
No	32.52	53

Opportunity sampling was used to recruit participants, through the email listserv for the Center for Autism Research and Education at the host university. Potential participants contacted the research team and were screened for eligibility: aged 18 years or older and residing in the U.S. A link to the online Qualtrics questionnaire was emailed to those eligible. Participants were entered into a raffle for a $50 gift card as an incentive to participate. Participants were also recruited through the university research participant pool where they earned course credit for their participation. 59% of the sample were recruited this way. University students accessed the survey through an online participant pool management system, Sona-Systems (sona-systems.com). Following survey completion they received one of ten required research credits for their introductory Psychology course. All aspects of the study were performed in accordance with the Institutional Review Board of the university following ethical approval (IRB approval code: 24-171-HIL).

Measures

Participants completed an online survey via Qualtrics platform, which consisted of seven question areas. The first section covered demographic questions including age, gender identity, race/ethnicity, immigrant status, neurological conditions and diagnoses, etc. The demographics section was always presented first. The remaining six survey sections consisted of self-report measures of sense of belonging, social support, and well-being, as well as everyday discrimination and loneliness. Each of these sections were presented randomly to counteract order effects.

Sense of Belonging Instrument (SOBI)

The SOBI measure consists of two sub scales; the Psychological Sense of Belonging (SOBI-P) which contains eighteen items, and the Antecedents to Sense of Belonging (SOBI-A) which contains nine items. Both sub instruments utilize a 4-point Likert scale. Participants answer each question by choosing a response ranging from 1 (strongly disagree) to 4 (strongly agree) (Hagerty & Patusky, 1995). The purpose of the SOBI-P is to measure an individual's subjective perception of belonging in relation to other groups, environments, and organizations (Hagerty & Patusky, 1995). The purpose of SOBI-A is to measure precursors to a sense of belonging. Content validity was established through a panel review by experts, and construct validity was supported by factor analysis and correlations with related constructs (Hagerty & Patusky, 1995).

Multidimensional Scale of Perceived Social Support (MSPSS)

The MSPSS is a twelve item self-report instrument that measures perceived social support across three areas: family, friends, and significant others. Each group of four items corresponds to each of its subscales. Participants respond to each item using a 7-point Likert scale, where responses range from 1 (Very Strongly Disagree) to 7 (Very Strongly Agree). The MSPSS measures an individual's perception of support from their different social networks (Zimet et al., 1988). Internal validity is supported by high Cronbach alpha values, 0.91 for the scale as a whole, which depict consistent measurement (Zimet et al., 1988). validity (Kessler et al., 2002). Moreover, this measure has been validated with diverse groups, such as Australian, French, and Chinese populations (Furukawa et al., 2003; Arnaud et al., 2010, Chan et al., 2014). Additionally, it is unidimensional and holds high predictive validity (Smout, 2019). Particularly, it has been effectively utilized as a predictive factor for mental disorders and symptoms such as depression (Smout, 2019).

Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS)

The WEMWBS is a self-report survey that measures mental well-being through assessment of emotional and psychological aspects like feeling capable, positive emotions. These aspects can more generally be split into two areas hedonic, the subjective feeling of being happy and life satisfaction, and eudaimonic, or self-efficacy (Tennant et al., 2007). Individuals rate their experiences over the past two weeks on a 5-point Likert scale, from 1 (none of the time) to 5 (all of the time). Higher scores reflect more positive mental well-being. WEMWBS internal consistency is supported by Cronbach's Alpha (0.91). Test-retest reliability is also high (0.83). Validity is further supported by strong correlations with existing measures like the WHO-5 Well-Being Index (Tennant et al., 2007).

Everyday Discrimination Scale

The Everyday Discrimination Scale measures the frequency of routine experiences of unfair treatment in daily life (Sternthal et al., 2011). More specifically, this scale focuses on more subtle, ongoing forms of discrimination rather than major events of discrimination. Individuals use

a 6-point Likert scale, ranging from 1 (Almost every day) to 6 (Never) to rate their experiences (Williams et al., 1997). The scale consists of 9 items that ask individuals how often they experience various forms of mistreatment in their day-to-day lives. For example, being treated with less courtesy or respect, receiving poorer service than others, and being threatened or harassed (Williams et al., 1997). The scale demonstrates excellent psychometric properties across many populations. It has shown high internal consistency, which is supported by Cronbach's alpha ranging from 0.84 to 0.91 (Williams et al., 1997). The scale shows good construct validity, correlating with measures of psychological distress, physical health outcomes, and other discrimination-related constructs.

UCLA Loneliness Scale v3

The UCLA Loneliness Scale measures subjective feelings of loneliness and social isolation. It is a twenty item self-report survey that assesses how often individuals feel lonely, using a 4-point Likert scale ranging from 1 (Never) to 4 (Always). Higher scores indicate greater levels of loneliness (Russell, 1996). Construct validity is supported by excellent correlations with other loneliness scales like the NYU Loneliness Scale, and negative correlations with measures of social support (Russell, 1996).

Throughout the survey four attention check questions were included, yielding around two attention checks for every five minutes of survey response (Muszyński, 2023). Infrequency/frequency items were selected as attention checks where any attentive respondent should select a predicted response (Kay & Saucier, 2023), e.g. "I like to spend my time with people who are nice to me."; "I have never cried." One attentional check question was a repeated question and participants who responded differently the second time were noted. These attention checks were selected to screen out participants who were not paying attention while reducing "spillover" effects of participants responding negatively to attention check questions (Muszyński, 2023). In addition, participants who took less than 50% of the average time to complete the survey were carefully examined and removed if they failed the attention checks or had a significant amount of missing data. These screening procedures resulted in removing thirteen participants. The survey took an average of around 12 minutes to complete.

Results

Linear regression models were created to examine correlations between age, gender, sexual orientation, race/ethnicity, place of birth, and neurodivergence on measures of belonging, social support, and well-being, as well as loneliness and discrimination. Scores on each of the measures were the outcome variables in this study. Age was used as a control variable due to the possible effects it had on each of the measures. Given that most participants were between the ages of 18 and 21, it is reasonable to infer a person's feelings of belonging, social support and well-being could be affected significantly due to the number of changes that often occur during this stage of life, for example moving out of family homes, or to university (Nielsen et al., 2023; Burke et al., 2016). Race/ethnicity was used as a control variable due to the increased rates of discrimination people of color face (Matos et al., 2024). Each of the regression models shown are considered additive models.

Sexuality, place of birth, and being affected by neurodivergence were the predictor variables in this study. Regression models were conducted using one or a combination of the predictor variables to examine their effects on each of the outcome variables. Each of these models was compared using Bayesian Information Criterion (BIC). The full models with the predictor and control variables are displayed due to being the strongest models for explaining scores on each of the outcome variables. Models examining the intersection of being affected by neurodivergence with gender identity, with sexuality, and with race/ethnicity were also generated. However, these models are not displayed due to being significantly weaker and less parsimonious than their counterparts that did not contain the intersections, as evidenced by significantly higher BIC scores in models that examined the intersection along with only one correlation between one interaction and the outcome variable in one model being statistically significant. All models had a significance threshold of $p < .05$.

Sense of Belonging Instrument - Psychological

In Table 2, the beta coefficient (B0) represents the average composite score on the SOBI-P for those who were 18 years old, non-cisgender males, non-heterosexual, and white. According to Table 2, the average score on the SOBI-P for those who fit the above criteria was 26.22. When it comes to age, keeping all other variables constant, as the age of the participant increased by one year, SOBI-P scores increased by .36 (B1). Keeping all other variables constant, those who identified as cisgender males scored 6.83 points higher on the SOBI-P than those who did not identify as cisgender males (B2), indicating a lower sense

Variable	B(SE)	p-value
(Intercept)	26.22(6.28)	**<.001**
Age	.36(.13)	**<.01**
Cisgender male	6.83(2.48)	**<.001**
Straight	-10.01(2.40)	**<.001**
Non-white	-1.98(3.19)	.54
Born in the United States	1.12(4.76)	.81
Mother Born in United States	.14(3.34)	.97
Father Born in United States	4.13(3.90)	.29

Affected by Neurodivergence	4.78(2.47)	.06
Adjusted R-Square		.29

F(8, 84) = 5.60 p <.001

Sense of Belonging Instrument - Antecedent

The average score on the SOBI-A for 18-year old white, cisgender, heterosexual males was 29.14. Unlike on the SOBI-P, age and gender identity did not significantly affect scores on the SOBI-A. However, sexuality (B3) did significantly affect SOBI-A scores, with those identifying as straight scoring 1.82 points higher (indicating lower sense of belonging) than those who did not identify as heterosexual, controlling for all other variables. As with the SOBI-P, place of birth and neurodivergence did not affect scores on the SOBI-P based upon this model. The model predicting SOBI-A scores was not as strong as the model predicting SOBI-P scores, as evidenced by the lower adjusted r-square and non-significant F statistic. Results from Table 3 should be interpreted with this discrepancy in mind.

Table 3

Regression Model Predicting SOBI-A Scores Based on Demographic Information and Diagnosed Neurodivergence (N = 97)

Variable	B(SE)	p-value
(Intercept)	29.14(2.22)	<.001
Age	-.06(.05)	.18
Cisgender male	-.01(.90)	.99
Straight	1.82(.86)	.04
Non-white	-.40(1.21)	.74
Born in the United States	1.00(1.65)	.54
Mother Born in United States	-1.66(1.29)	.20
Father Born in United States	-.00(1.46)	1.00
Affected by Neurodivergence	-.92(.90)	.31
Adjusted R-Square		.06

F(8, 88) = 1.72 p = .11

Multidimensional Scale of Perceived Social Support (MSPSS)

The average score on the MSPSS for 18-year old white, cisgender, heterosexual males was 67.78. Age and gender identity did not significantly affect scores on this measure. However, sexuality (B3) significantly affected scores on this measure. Those who identified as straight scored 10.17 points higher than those who did not identify as straight, controlling for all other variables. As with the previous measures, place of birth and neurodivergence did not affect scores based upon this model. The model for the MSPSS, as seen in Table 4, is considered strong, as evidenced by the adjusted r-square and significant F statistic.

Table 4

Variable	B(SE)	p-value
(Intercept)	29.14(2.22)	<.001
Age	-.06(.05)	.18
Cisgender male	-.01(.90)	.99
Straight	1.82(.86)	.04
Non-white	-.40(1.21)	.74
Born in the United States	1.00(1.65)	.54
Mother Born in United States	-1.66(1.29)	.20
Father Born in United States	-.00(1.46)	1.00
Affected by Neurodivergence	-.92(.90)	.31
Adjusted R-Square		.06

F(8, 88) = 1.72 p = .11

Regression Model Predicting MSPSS Scores Based on Demographic Information and Diagnosed Neurodivergence (N = 97)

Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS)

The average score on the WEMWBS for 18-year old white, cisgender, heterosexual males was 23.77. Age, gender identity, and sexuality did not significantly affect scores on this measure. As with the previous measures, place of birth and neurodivergence did not affect scores based upon this model. However, the low adjusted r-square and non-significant F statistic must be noted when interpreting the results on Table 5. Results from Table 5 should be interpreted with this discrepancy in mind.

Variable	B(SE)	p-value
(Intercept)	23.96(3.21)	<.001
Age	.05(.06)	.47
Cisgender male	-1.28(1.18)	.32
Straight	1.74(1.13)	.13
Non-white	1.36(1.60)	.40
Born in the United States	-1.98(2.46)	.42
Mother Born in United States	-1.62(1.58)	.31
Father Born in United States	1.22(1.85)	.51
Affected by Neurodivergence	-1.90(1.16)	.11

Adjusted R-Square	.01

F(8, 89) = 1.09 p = .38

Table 5

Regression Model Predicting WEMWBS Scores Based on Demographic Information and Diagnosed Neurodivergence (N = 98)

Everyday Discrimination Scale

The average score on the Everyday Discrimination Scale for 18-year old white, cisgender, heterosexual males was 43.82. Age and gender identity did not significantly affect scores on this measure. However, sexuality (B3) did significantly affect scores on this measure, with those identifying as straight scoring 2.91 points lower than those who did not identify as heterosexual, controlling for all other variables. On the Everyday Discrimination Scale, lower scores signify higher levels of discrimination. As with the previous two measures, place of birth and neurodivergence did not affect scores based upon this model. The model for the Everyday Discrimination Scale, as seen in Table 6, is considered strong, as evidenced by the adjusted r-square and significant F statistic.

Variable	B(SE)	p-value
(Intercept)	43.82(4.58)	**<.001**
Age	.03(.10)	.78
Cisgender male	-2.82(1.82)	.13
Straight	6.41(1.71)	**<.001**
Non-white	2.66(2.30)	.25
Born in the United States	-3.38(3.46)	.33
Mother Born in United States	3.18(2.40)	.19
Father Born in United States	-5.14(2.68)	.06
Affected by Neurodivergence	-1.64(1.79)	.36
Adjusted R-Square		.12

F(8, 90) = 2.66 p = .01

Table 6

Regression Model Predicting Everyday Discrimination Scale Scores Based on Demographic Information and Diagnosed Neurodivergence (N = 99)

UCLA Loneliness Scale

The average score on the UCLA Loneliness Scale for 18-year old white, cisgender, heterosexual males was 33.52. Age did not significantly affect scores on this measure. However, gender identity (B2) and sexuality (B3) significantly affected scores on this measure. Those who identified as a cisgender male scored 7.23 higher on this measure than those who did not identify as a cisgender male, controlling for all other variables. Those who identified as straight scored 8.81 points lower than those who did not identify as straight, controlling for all other variables. As with the previous measures, place of birth did not affect scores based upon this model. However, being affected by neurodivergence did affect scores on this measure, with those who reported being affected by neurodivergence scoring 4.92 points higher than those who did not, indicating greater loneliness. The model for the UCLA Loneliness Scale, as seen in Table 7, is considered strong, as evidenced by the adjusted r-square and significant F statistic.

Variable	B(SE)	p-value
(Intercept)	33.52(5.67)	**<.001**
Age	.20(.12)	.10
Cisgender male	7.19(2.28)	**<.01**
Straight	-8.79(2.17)	**<.001**
Non-white	-5.46(3.02)	.07
Born in the United States	7.10(4.14)	.09
Mother Born in United States	-2.98(3.02)	.33
Father Born in United States	5.55(3.53)	.12
Affected by Neurodivergence	4.92(2.25)	**.03**
Adjusted R-Square		.29

F(8, 88) = 5.84 p = <.001

Table 7

Regression Model Predicting UCLA Loneliness Scores Based on Demographic Information and Diagnosed Neurodivergence (N = 97)

Discussion

This study explored feelings of belonging, social support and well-being and how these experiences differed between neurodivergent and neurotypical individuals, particularly those with intersecting identities. As hypothesized the findings showed greater feelings of loneliness among neurodivergent participants, but did not find significant differences on the other measures including sense of belonging, social support, discrimination and well-being. Intersectionality, or identifying with multiple marginalized groups, was not found to be a significant factor. This was an unexpected finding, and could be due to the sample distribution; the majority of the sample identified as white and cisgender, with around 30% identifying as LGBTQ+ and 8.28% reporting as not having been born in the United States.

The finding of greater feelings of loneliness amongst

neurodivergent participants is reflected by previous literature, and these feelings of loneliness have been associated with mental health problems (Lasgaard et al., 2010; Ee et al., 2019; Jong et al., 2024). Previous research has shown higher levels of mental health challenges among those with ADHD (Hargitai et al., 2023; Yoshimasu et al., 2018), autism (Simonoff et al., 2008; Lai et al., 2019), and learning disabilities (Aro et al., 2018). Increased feelings of loneliness could be due to barriers imposed in the environment rather than factors intrinsic to neurodiversity itself. This is in line with efforts from the neurodiversity movement to shift perspectives away from a deficit model and closer to the social model of disability (Oliver, 2013) which argues that disability is caused by environmental obstacles, including attitudes and perspectives of others. Milton's (2012) theory of the double empathy problem argues that misunderstandings between autistic and non-autistic people are due to differences in communication, in that autistic people struggle to communicate with non-autistic people and vice versa, thereby, the 'deficits' associated with autism are a product of the situation. The misconceptions of autism held by neurotypical people have been theorized to contribute to low self esteem and negative mental health outcomes through thwarted belongingness, camouflaging and masking (Cook et al., 2021), and these misconceptions and differences in communication may be what underpins the increased levels of loneliness amongst neurodivergent people. Although research has shown that autistic community connectedness does not moderate the negative relationship between masking and well-being (Cage et al., 2022), there should still be a priority of creating a safe and accepting society whereby autistic people can be authentically themselves without masking. Autistic adults who view their autism as neurodiversity rather than a deficit tend to have higher self-esteem (Ferenc et al., 2023). Listening to the voices of neurodivergent individuals will help increase acceptance and the freedom to be authentic, and focusing on the priorities of neurodivergent individuals themselves in research is also critical for ensuring findings are meaningful to the neurodivergent population. Calls for centering the lived experience of neurodivergent individuals in research about them have grown (Botha & Gillespie-Lynch, 2022; Pellicano & den Houting, 2022), as well as the importance of including neurodivergent researchers in studies focused on their experiences, and the present study includes a neurodivergent co-author.

The lack of difference between the neurodivergent and neurotypical participants on measures of belonging, social support, discrimination and well-being may speak to the current challenges that youth from all demographic groups are experiencing. A link has been established between loneliness and depression and psychological distress in men (Lear & Dorstyn, 2024). For white men specifically, previous research has shown them to be more prone to depression than black men or women of any race (Assari & Lankarani, 2016), and more likely to report daily feelings of anxiety or depression than black or Hispanic men (Blumberg et al., 2015). They are also more likely to die by suicide (Larsen et al., 2024). Relatedly, cisgender males in the sample reported lower sense of belonging and greater loneliness than non-cisgender males.

Those who identified as straight reported a higher sense of belonging and placed greater value and importance on belonging (as indicated on the SOBI-A). They also reported less loneliness and less experiences of discrimination than the non-straight participants. However, they reported lower levels of perceived social support, which relates to the greater loneliness reported by the cisgender males. A potential explanation could be that the non-straight participants were able to connect and identity with the LGBTQ+ community and their "chosen family", known to be a significant source of support (Jackson Levin et al., 2020; Hailey et al., 2020). Further research is necessary to fully explain the lower sense of belonging and greater loneliness reported by cisgender males, and lower levels of social support perceived among straight males.

The lack of difference between the neurodivergent and neurotypical participants on measures of belonging, social support, discrimination and well-being may also reflect the neurodivergent sample, many of whom were college students. To maintain success in a college environment these participants have likely developed numerous coping mechanisms to manage academic and non-academic challenges they may experience. Students with ADHD for example often develop strategies that allow them to maintain academic success such as setting alarms and reminders, scheduling, being accountable, and removing distractions (Meaux et al., 2009). A college environment provides a sense of group identity and community that may foster feelings of belonging and social support (Benson & Whitson, 2022; Samadieh & Rezaei, 2024; McKenney et al., 2024). More recent research has also shown that autistic students maintain high academic achievement, particularly those who are motivated and have a positive self-image (Johnson et al., 2023). It is also worth noting that the measure of being neurodivergent was a self-report measure of whether or not their day-to-day life is affected by being neurodivergent. A more accurate measure would have asked participants to provide evidence of a formal diagnosis of a neurodivergent condition. However, we intended to include individuals who may not have a formal diagnosis. Support in college has been increasing as perspectives among administration shift away from ableism and towards a more inclusive, neurodiversity affirming approach. Autistic college students who receive peer mentoring often improve communication and executive functioning skills (Locke et al., 2024), a potential barrier to college success for many neurodivergent students (Hillier et al., 2021; Anderson & Butt, 2017). They also better understand how to access supports and how to meet people (Hillier

et al., 2019). Some studies have shown similar grade point averages and rates of degree completion between autistic students, students with ADHD/ADD, and learning disabilities, and students without disabilities (Bakker et al., 2023; Myrvold et al., 2021).

Further, the findings that neurodivergent and neurotypical individuals respond similarly to measures of belonging, social support, discrimination and well being help dispel negative, deficit focused, perspectives towards neurodiversity. These findings also relate to previous work examining adult outcomes among neurodivergent populations which has highlighted quality of life, arguably a critical indicator (White et al., 2023), as similar across neurodivergent and neurotypical populations. Increasing understanding and recognition of neurodiversity, and the focus on strengths highlighted by advocates within the neurodiversity movement, has helped shift societal attitudes towards a more positive and optimistic view, and these findings contribute to this movement.

Limitations and Future Directions

While the current findings are unique in the focus on belonging, social support and well-being among neurodivergent and neurotypical populations, there are some limitations that should be taken into account. Firstly, it was not possible to fully explore these experiences within the context of intersectionality due to the sample mostly identifying as cisgender, straight, and white. Future work will need to build on these findings by recruiting a more diverse sample where the significance of various identities can be more clearly elucidated. In addition, intersectionality was examined using broad demographic identifiers (race, immigration status, sexuality, gender identity) whereas in reality people's co-occurring identities are far more complex (Tatum, 2000), and influenced by current situations and previous experiences. Further, our sense of identity might be fluid depending on who we are interacting with and how they perceive us, what we are engaged in doing, social and political contexts, and many other factors (Tatum, 2000). Healthcare, education, government, and social service providers need to consider a much wider range of services, as well as impediments to accessing those supports and services, depending upon how the characteristics of co-occurring identities intersect.

Finally, it may also be beneficial to follow up on these findings using qualitative approaches, such as individual interviews or focus groups, which would allow a more detailed analysis regarding the impact of intersecting identities and well-being, sense of belonging, and perceived social support. Pivotal to this would be ensuring that the research is approached using a constructivist paradigm. Constructivism posits that knowledge generates from individuals themselves, who construct knowledge based upon their lived experiences (Savin-Baden & Major, 2013). As such, research using a constructivist paradigm would ensure the voices of neurodivergent individuals are central to the creation of research questions, approach, analysis and interpretation, as was the case with the present study. Furthermore, the autistic community has been calling for increased community based participatory research (CBPR), which often employs a constructivist paradigm. Using a CBPR framework could help raise the voices of particularly vulnerable groups and hear from their perspective what support would be beneficial for improving quality of life and how to most effectively implement such support (Strang et al., 2019).

Conclusion

This study explored feelings of belonging, social support and well-being and how these experiences differ between neurodivergent and neurotypical individuals, and in particular, those with intersecting identities. These findings build on previous work identifying positive outcomes for neurodivergent adults, and future research should further explore discussions around intersectionality. The sample reported similar feelings of belonging and perceived social support as neurotypical participants, as well as well-being and experiences of discrimination, however neurodivergent participants reported higher levels of loneliness. It is hoped these positive findings contribute to the reframing of neurodiversity and disability more broadly and help shift momentum away from using an ableist lens grounded in medical model philosophy to interpret the neurodivergent experience.

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