Examining the relationship between anxiety and social cognition in an adult population

Tereza Bugeja

University of Malta

A dissertation presented to the Department of Psychology, Faculty for Social Wellbeing in partial fulfilment of the requirements for the degree of Master of Psychology in Neuropsychology at the University of Malta

May 2025

L-Università ta' Malta

FACULTY/INSTITUTE/CENTRE/SCHOOL Faculty for Social Wellbeing

DECLARATIONS BY POSTGRADUATE STUDENTS

Student's Code [redacted]

Student's Name & Surname Tereza Bugeja

Course Master of Psychology in Neuropsychology

Title of Dissertation

Examining the relationship between anxiety and social cognition in an adult population

(a) Authenticity of Dissertation

I hereby declare that I am the legitimate author of this Dissertation and that it is my original work.

No portion of this work has been submitted in support of an application for another degree or qualification of this or any other university or institution of higher education.

I hold the University of Malta harmless against any third party claims with regard to copyright violation, breach of confidentiality, defamation and any other third party right infringement.

(b) Research Code of Practice and Ethics Review Procedures

I declare that I have abided by the University's Research Ethics Review Procedures. Research Ethics & Data Protection form code SWB-2024-00506.

As a Master's student, as per Regulation 58 of the General Regulations for University Postgraduate Awards, I accept that should my dissertation be awarded a Grade A, it will be made publicly available on the University of Malta Institutional Repository.

[redacted]

Signature of Student

TEREZA BUGEJA

Name of Student (in Caps)

26/05/2025

Date

GOVERNMENT OF MALTA

FONDI.eu

The research work disclosed in this publication is partially funded by the Endeavour II Scholarships Scheme. The project is co-funded by the ESF+ 2021-2027

Co-funded by the European Union

ENDEAVOUR SCHOLARSHIPS SCHEME

Abstract

Anxiety is a prevalent emotional response that arises in anticipation of perceived threats. Its impact on cognitive functioning has been widely documented at both clinical and subclinical levels. While less extensively explored, evidence for the association of anxiety with social cognitive functioning, and specifically theory of mind (ToM), is emerging. However, specific limitations in existing studies constrain our understanding of this association, warranting further elucidation. The present study sought to explore the nature of this association further. Using a quantitative methodology, the study assessed whether individual differences in enduring predispositions to anxiety, trait anxiety (TA; low vs. high TA), and varying levels of situation-specific anxiety, state anxiety (SA), impact performance on ToM measures in healthy adults. 73 participants were administered a multidimensional anxiety assessment, measures of cognitive and affective ToM, as well as measures of possible confounds. Statistical analyses using independent samples t-tests revealed significant group differences across TA groups. Specifically, individuals with high TA performed worse than those with low TA on a cognitive ToM task. No group differences were observed on measures assessing affective ToM. Additionally, correlational analyses indicated that SA was not significantly associated with performance on any ToM measure. These findings highlight the importance of considering the impact of anxiety symptoms on social cognitive functioning in clinical practice, as well as the importance of distinguishing between anxiety dimensions and ToM subcomponents in research. Further studies are recommended to clarify the mechanisms underlying this association.

Key words: anxiety, trait, state, social cognition, theory of mind

To my father

Acknowledgements

I would like to express my sincere gratitude to my supervisors, Dr Kristina Bettenzana and Dr Fiona Ambery, for their invaluable encouragement, guidance, and support throughout this journey. I am especially thankful for their generosity in sharing their expertise and for providing me with opportunities to learn and grow.

My sincere appreciation also goes to all the participants who generously volunteered their time to make this research possible.

Special thanks to my fellow colleagues and friends Luana, Ivana, and Aurora, for all their support throughout these two years.

Finally, I am deeply grateful to my partner, Canute, and my family for being constant sources of patience, love, care, understanding, support, and inspiration.

Table of Contents

Introduction....1
Anxiety....1
Anxiety and cognition....1
Social cognition....2
Associations between anxiety and ToM....2
Rationale for the current study....3
Aim of the study....4
Overview of Chapters....4
Literature Review....6
Introduction....6
Anxiety....6
Anxiety and cognition....12
Social cognition....12
Theory of mind....14
Social cognition and mental health conditions....16
Associations between anxiety and ToM....17
Proposed mechanisms underlying the association between anxiety and ToM....21
Considerations about current research....23
Conclusion....24
Methodology....26
Introduction....26
The aims of the study and rationale for the quantitative approach....26
Theoretical framework....27
Participants....27

Ethical considerations 29
Study design and procedure 30
Data collection measures and materials 30
Methods of statistical analyses 40
Conclusion 41
Results 42
Introduction 42
Preliminary analysis 42
Sample demographics 47
Effects of trait anxiety levels on ToM performance 48
Associations between Trait Anxiety, measures of ToM, and possible confounds 49
Exploring possible impact of confounds 50
Association between State Anxiety and measures of ToM 53
Conclusion 54
Discussion 55
Introduction 55
Summary of findings 55
Trait anxiety and theory of mind performance 56
State anxiety and theory of mind performance 64
Conclusion 66
Conclusion 67
Introduction 67
Summary of findings 67
Strengths of the study 68
Limitations 69

Implications of the study....71

Future directions for research....71

Conclusion....72

References....73

Appendix A. Diagnostic Criteria....107

Appendix B. Acknowledgment of receipt of ethics application form....110

Appendix C. Recruitment Forms....111

Appendix D. Debrief Form....115

Appendix E Permission to use the State Trait Inventory for Cognitive and Somatic Anxiety....117

Appendix F. Permission to use the Edinburgh Social Cognition Test....119

Appendix G. ESCoT Scoring Example....121

Appendix H. Full analysis of ANCOVA assumptions....124

List of Tables

Table 1. Example ESCoT questions....35

Table 2. Overview of statistical tests used for data analysis....41

Table 3. Values of skewness, kurtosis, and corresponding absolute z-score for variables 46

Table 4. Means (standard deviations) for participants' demographic information....48

Table 5. Trait Anxiety group comparisons across measures of ToM....49

Table 6. Correlations between Trait Anxiety, measures of ToM, and possible confounds 50

Table 7. Hierarchical regression analysis summary....52

Table 8. Correlations between State Anxiety and measures of ToM 54

List of Figures

Figure 1. Example ESCoT scenario.....34

Figure 2. Example RMET photo.....36

List of Acronyms

aToM	Affective Theory of Mind
ACT	Attentional Control Theory
AQ-10	Autism Quotient-10
cToM	Cognitive Theory of Mind
ESCoT	Edinburgh Social Cognition Test
GAD	Generalised Anxiety Disorder
MASC	Movie for the Assessment of Social Cognition
RMET	Reading the Mind in the Eyes Task
SA	State Anxiety
SAD	Social Anxiety Disorder
STICSA	State Trait Inventory for Cognitive and Somatic Anxiety
TA	TA Trait Anxiety
ToM	Theory of Mind
WAIS-IV	Wechsler Adult Intelligence Scale (Fourth Edition)

Introduction

Anxiety

Anxiety is a future-oriented emotion that arises in response to perceived threats and is characterised by feelings of worry, apprehension, and unpleasantness (American Psychiatric Association [APA], 2022; Baggio et al., 2023). Anxiety is among the most prevalent and disabling psychiatric conditions globally (Vos et al., 2023). An estimated 4-5% of the global population experiences anxiety disorders (Institute for Health Metrics and Evaluation [IHME], 2024; WHO, 2022b), while around 5-6% of individuals experience subthreshold anxiety, where symptoms may be significant but do not meet full diagnostic criteria (England et al., 2022; Zhong et al., 2024).

Conceptually, anxiety can refer to both a stable, enduring predisposition to perceive situations as threatening (trait anxiety), and a transient emotional reaction in response to specific triggers (state anxiety; Baggio et al., 2023; Heeren et al., 2018). Contemporary frameworks have increasingly favoured a dimensional view of anxiety, whereby symptoms are considered to exist along a continuum of severity, as opposed to categorical distinctions between the presence or absence of a disorder (Haslam et al., 2020). This allows the full range of anxiety presentations, from adaptive to impairing, as well as their consequences, to be acknowledged (Wilmer et al., 2021; Zhong et al., 2024).

Anxiety and cognition

An important consequence of anxiety is its impact on cognition, which has been widely documented in the literature, both at clinical and subclinical levels (e.g., Eysenck & Keane, 2020; Nyberg et al., 2021). Traditionally, research has focused on the impact of anxiety on attentional control (e.g., Eysenck et al., 2023), working memory (e.g., Ward et al., 2020), executive functions (e.g., Nyberg et al., 2021), and learning (e.g., Ting et al., 2022).

Recently, however, its association with social cognition has become the focus of a growing body of research.

Social cognition

Social cognition refers to a set of higher-order cognitive functions that enable the processing and interpretation of social information, thereby allowing individuals to respond to and relate to others effectively (Adolphs, 1999; Henry et al., 2021). Several skills and domains are encompassed within this construct, including theory of mind (ToM), affect recognition, and empathy (Henry et al., 2015). Among these, ToM has emerged as a cornerstone of social cognitive research due to its essential role in supporting fundamental social functions (Frith & Frith, 2005; Thibaudeau et al., 2021).

ToM refers to the ability to make inferences about other people's mental states, and research has demonstrated the existence of two fundamental aspects of ToM: cognitive and affective (Apperly, 2010; Shamay-Tsoory & Aharon-Peretz, 2007). Cognitive ToM (cToM) relates to our ability to make attributions about people's thoughts, beliefs, and intentions, while affective ToM refers to the ability to make inferences about people's feelings and emotions (Campanella et al., 2022; Krause et al., 2012).

Associations between anxiety and ToM

ToM and broader social cognitive skills have been widely studied in the context of various mental health conditions, including depression, schizophrenia, and autism. This is because deficits in ToM and social cognition in these conditions are associated with difficulties in social functioning and reduced participation in everyday activities, impacting recovery and quality of life (Gur & Gur, 2016; Javed & Charles, 2018). Recently, research has increasingly focused on the association between ToM and anxiety.

Whilst findings across studies vary, research has highlighted the presence of associations between both trait and state anxiety and ToM. Most studies have explored ToM

in the context of clinical populations, particularly social anxiety disorder (SAD). Here, impairments on ToM tasks are often reported among individuals diagnosed with SAD when compared to healthy controls (e.g., Alvi et al., 2022; Baez et al., 2023), although findings have been noted to depend on task type. Impairments are more often reported on decoding tasks, that is, tasks involving the interpretation of immediately observable cues, such as eye gaze, to interpret others' state of mind (e.g., Alvi et al., 2020; Maleki et al., 2020), and less consistently on reasoning tasks that involve the integration of dynamic and multi-modal contextual information (e.g., Ballespí et al., 2018; Washburn et al., 2016). Research relating to ToM in other anxiety disorders, such as generalised anxiety disorder (GAD), is more limited and inconsistent (e.g., Aydın et al., 2019; Zainal & Newman, 2018).

Despite the known impact of subclinical levels of anxiety on functioning, fewer studies have explored this in the context of ToM. However, evidence in this area has started to emerge. Indeed, studies have shown significant associations between self-reported anxiety symptoms and performance on ToM tasks in people with multiple sclerosis (Genova et al., 2020), and in healthy younger and older adults (Braley et al., 2023). This highlights the importance of investigating the impact of subclinical anxiety on ToM in non-clinical populations.

Rationale for the current study

Overall, existing findings suggest that both trait and state anxiety may impact ToM abilities. However, despite growing evidence for this relationship, specific limitations in existing studies constrain our understanding of this association. Firstly, the impact of distinct anxiety symptom profiles (state and trait) on specific ToM abilities remains underexplored (Chang & Engelmann, 2024). Most studies have not distinguished between cognitive and affective ToM, failing to explicitly explore the differential impact of anxiety on these two ToM subcomponents. However, the few studies that have distinguished between cognitive

and affective ToM (such as Braley et al., 2023) suggest that anxiety might not always affect these two subcomponents equally, highlighting the need for such distinction. Additionally, commonly used tasks of ToM often lack ecological validity, potentially failing to capture the complexity of real-world social interactions (Baez et al., 2023). Moreover, few studies include confounding variables that may be relevant to the relationship under study (Alvi et al., 2022).

The present study sought to address these gaps to more clearly delineate the nature of this association. It employed a multidimensional anxiety assessment tool, the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA; Ree et al., 2008), measuring both state and trait anxiety. Furthermore, in addition to another well-established decoding measure of ToM (Reading the Mind in the Eyes; Baron-Cohen et al., 2001a), the study also employed an ecologically valid measure of social cognition, the Edinburgh Social Cognition Test (ESCoT; Baksh et al., 2018), which assesses cognitive and affective ToM reasoning using the same test, allowing more direct comparisons of these functions. Finally, the study collected data on possible confounds, including vocabulary, perceptual reasoning, and autistic traits, to assess whether these impacted the association under study.

Aim of the study

The aim of this study was to explore whether individual differences in trait anxiety (high vs. low trait anxiety) and varying levels of state anxiety impact ToM performance in a healthy adult population. A nuanced understanding of the nature of these associations was hoped to be achieved by examining the impact of state and trait anxiety dimensions on different aspects of ToM.

Overview of Chapters

The next chapter will provide a detailed review of literature relevant to this study. This chapter will explore the phenomenon of anxiety and its impact on cognitive functioning

before introducing the construct of social cognition, with a focus on ToM. The association between anxiety and ToM will then be explored in more detail. The third chapter will outline the methodology adopted to explore the aims of the study, including details relating to the sample, data collection process, and data management and analysis procedures. The results obtained from the data analyses will be presented in chapter four and then discussed within the context of existing relevant literature in chapter five. Finally, chapter six will provide an overview of findings before discussing the strengths and limitations of the study, the implications of the study's findings, and recommendations for future research.

Literature Review

Introduction

This chapter provides an overview of the literature relevant to the examination of the association between anxiety and social cognition, specifically theory of mind. The chapter first explores the phenomenon of anxiety, providing a definition, epidemiology, and conceptualisation. The second part of the chapter explores the construct of social cognition, as well as its relevance within the field of mental health conditions. Finally, extant literature investigating the association between anxiety and theory of mind is reviewed.

Anxiety

Anxiety is a basic and universal human emotion, characterised by feelings of unpleasantness, worry, tension, and apprehension (Baggio et al., 2023; Saviola et al., 2020; Zeidner, 2008). Widely studied across psychological literature, anxiety is a future-oriented emotional state that involves a heightened state of vigilance (APA, 2022). It arises in anticipation of an uncertain, potential danger or future situations that are perceived as threatening (Gournay et al., 2011; Strongman, 1995).

Epidemiology

Anxiety is a pervasive phenomenon, recognised as one of the most prevalent and disabling forms of psychopathology globally (Javaid et al., 2023), with recent studies identifying it as a leading contributor to disability and disease burden worldwide (Vos et al., 2023). Anxiety-related difficulties begin early in life; however, the mean age of onset tends to differ based on anxiety disorder subtypes, ranging from adolescence to young adulthood (de Lijster et al., 2017; Scholten et al., 2023). The course of anxiety disorders is variable, with some individuals recovering rapidly following a single episode, especially with appropriate treatment, while others experience persistent patterns of difficulties, characterised by chronic symptoms or repeated cycles of remission and relapse (Hovenkamp-Hermelink et al., 2021).

Considerable variability exists in prevalence figures across regions, potentially owing to differential distribution of risk factors, such as low socioeconomic status and exposure to trauma, as well as methodological variations in assessment and diagnosis (Hovenkamp-Hermelink et al., 2021; Javaid et al., 2023). However, recent findings estimate that anxiety disorders affect approximately 4-5% of the global population, amounting to around 300 million people (Javaid et al., 2023; WHO, 2022b). When considering subthreshold anxiety, that is, symptoms that do not meet diagnostic criteria for a disorder, prevalence rates are somewhat higher. In a recent meta-analysis, Zhong and colleagues (2024) compiled data from 45 studies, and estimated an overall prevalence rate of subthreshold anxiety of around 6%. Recent local data indicate similar prevalence rates in the Maltese population. According to the 2019 European Health Interview Survey, around 5% of the population reported experiencing chronic anxiety at some point in their lifetime, with around 4% reporting experiencing symptoms in the preceding 12 months (England et al., 2022). Consistent with the global trend (WHO, 2017, 2022b), local prevalence rates (England et al., 2022) are higher in females (6.1%) than in males (2.9%).

Conceptualising anxiety

Conceptual theories of anxiety can be traced back to Freud who, in his seminal works (e.g., 1924; 1936), was the first to formally describe the anxious response, categorising it into three forms: objective anxiety arising from real external threats, and neurotic and moral anxiety rooted in internal, intrapsychic conflicts (Pretorius & Padmanabhanunni, 2023). Such early theories of anxiety supported a mechanistic view of this phenomenon and defined it as a unified construct (Zeidner, 2008). However, contemporary perspectives acknowledge its multifaceted nature, resulting in multiple symptomatic manifestations (Carlucci et al., 2023). The anxiety response encompasses an ensemble of cognitive/psychological,

physiological/somatic, and behavioural responses (Pretorius & Padmanabhanunni, 2023; Strongman, 1995).

The cognitive dimension of anxiety relates to individuals' thought processes about future events (Beck et al., 2005; Ree et al., 2008). Current theories emphasise the role of aberrant cognitive appraisals in the aetiology and maintenance of anxious emotional responses (Clark & Beck, 2010; Eysenck & Keane, 2020; Kaczkurkin & Foa, 2015), highlighting that maladaptive cognitive processes can contribute to anxiety, particularly when individuals overestimate the danger of a situation and underestimate their ability to cope with it (Sarason, 1984; Zeidner, 2008). On the other hand, the somatic or physiological dimension relates to the activation of the autonomic nervous system and the experience of physical symptoms, such as increased heart rate (Ree et al., 2008; Saviola et al., 2020). These physiological changes are driven by the release of adrenaline and other stress hormones, which prepare the body for a fight-or-flight response (Gournay et al., 2011). Finally, the behavioural dimension refers to the avoidance or escape behaviours people may engage in to avoid situations perceived as threatening, to temporarily alleviate anxiety (Pretorius & Padmanabhanunni, 2023).

Trait and state anxiety

In conceptualising anxiety, a distinction is made in the anxiety literature between state and trait anxiety. State anxiety refers to a temporary and transient emotional response that is triggered by specific stressors, threats, or adverse situations, which, however, dissipates once the provoking circumstances subside or are resolved (Heeren et al., 2018). On the other hand, trait anxiety refers to more stable and enduring differences in people's predisposition to experience anxious responses across different situations (Baggio et al., 2023). Trait anxiety, therefore, refers to differences in people's tendency to perceive situations as threatening and

to experience intense, prolonged state anxiety in response to such situations (Eysenck, 1983; Heeren et al., 2018; Spielberger et al., 1971).

The relationship between trait and state anxiety has been the subject of debate in the literature. From a unidimensional perspective, as proposed by Spielberger's seminal work on the state-trait anxiety theory (1966, 1972), a direct association is assumed between the two, with higher trait anxiety invariably resulting in higher state anxiety in threatening situations (Saviola et al., 2020; Zeidner, 2008). However, other researchers have challenged this view, proposing that both trait and state anxiety are multidimensional in nature (Pretorius & Padmanabhanunni, 2023).

The multidimensional perspective postulates that state anxiety responses vary across cognitive and autonomic/emotional dimensions. Trait anxiety, on the other hand, is posited to comprise four main facets which are associated with specific situational stressors: social evaluation threat, physical danger threat, ambiguous threat, and threat in innocuous situations or daily routines (Endler et al., 1991; Leal et al., 2017). The multidimensional perspective further explains that the extent to which individual differences in trait anxiety lead to corresponding variations in state anxiety depends on how threatening a person perceives a specific situation to be (Endler et al., 1976; Endler et al., 1991). It therefore acknowledges that individuals may have vulnerabilities to specific threats, in response to which they will tend to experience higher state anxiety (Leal et al., 2017; Pretorius & Padmanabhanunni, 2023).

Classifying anxiety

Another debate surrounding the concept of anxiety concerns its classification, which can be approached from either a categorical or dimensional perspective (Kraemer, 2007; Kraemer et al., 2004). Each approach to understanding individual differences in anxiety can have meaningful implications for both practice and research (Haslam et al., 2020). The

categorical perspective organises disorders into discrete categories based on established criteria (Haslam et al., 2020; Kraemer et al., 2004), such as those outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR; APA, 2022) and the International Classification of Diseases (ICD-11; WHO, 2022a; see Appendix A). Here, anxiety disorders are seen as qualitatively distinct from subthreshold and normal levels of anxiety; individuals either meet the criteria and have an anxiety disorder, or they do not (Endler & Kocovski, 2001). This affords clear-cut classifications that have traditionally been favoured for ease of communication and decision-making, both in terms of clinical planning and public health strategies (Bjelland et al., 2009).

However, researchers have also proposed a dimensional approach to categorising anxiety, wherein symptoms are understood to present along a continuum of severity. This ranges from low levels of anxiety, which may be adaptive, to more severe symptom levels that may be impairing, and correspond to a disorder (Endler & Kocovski, 2001; Zhong et al., 2024). Experts have increasingly highlighted that a dimensional approach to anxiety better describes this phenomenon, in terms of both practice and research (Bjelland et al., 2009; Haslam et al., 2020). It has been argued that by dichotomising the experience of anxiety, one fails to acknowledge its full presentation and the variations in symptom intensity across both clinical and community populations (Endler & Kocovski, 2001; Shear et al., 2007).

Adopting a dimensional approach may thus allow a more accurate understanding of anxiety and, consequently, more tailored care based on symptom profile, helping to improve clinical outcomes (Angst & Merikangas, 2001). Additionally, a categorical perspective can overlook the clinically significant impacts of subthreshold symptom levels of anxiety (Bjelland et al., 2009; Zhong et al., 2024), despite studies showing significant impairments in functioning among people with subthreshold anxiety (e.g., Brown et al., 1998; Karsten et al., 2013; Wilmer et al., 2021; Witlox et al., 2021). Hence, a dimensional approach to anxiety will

be adopted in this study as it allows for a more accurate understanding of how variations in anxiety symptom severity may relate to social cognitive functioning.

From adaptive to pathological

Exploring anxiety from a dimensional perspective allows us to view it as a continuum, ranging from an adaptive response to a maladaptive or pathological state (Robinson et al., 2013). From an evolutionary perspective, anxiety serves an important adaptive role, with marked survival utility (Bateson et al., 2011). Anxiety can help induce motivation and, in threatening or uncertain situations, it heightens individuals' awareness, enabling them to orient themselves towards and respond to imminent danger (Endler & Kocovski, 2001; Saviola et al., 2020). This allows quick and effective detection of potential threats, facilitating appropriate coping behaviours (Eysenck, 1992; Rachman, 2013).

However, as highlighted by both the World Health Organisation (WHO, 2022a) and the American Psychiatric Association (2022), when anxiety becomes excessive or disproportionate, it can become dysfunctional and pathological. Anxiety disorders, as outlined in the DSM-5-TR (APA, 2022) and the ICD-11 (WHO, 2022a), include a range of conditions, including generalised anxiety disorder, social anxiety disorder, and phobias. These disorders differ in their triggers and manifestations but share common features of chronic, excessive worry, which result in significant behavioural disturbance, consequent distress, and impairment in daily functioning (APA, 2022; Craske et al., 2017; McKnight et al., 2016; WHO, 2022a).

Research has consistently identified associations between anxiety and various aspects of functioning, including occupational impairment (Gunnarsson et al., 2023), difficulties in family (Olatunji et al., 2007) and intimate relations (Zaider et al., 2010), adverse health effects (Tully et al., 2016), and, ultimately, a reduced quality of life (Hohls et al., 2021; Ribeiro et al., 2020).

Anxiety and cognition

As outlined above, anxiety can impact functioning at both clinical and subclinical levels (Zhong et al., 2024). To better understand this phenomenon and its impacts, extensive research has investigated its relationship with cognition (Eysenck & Keane, 2020; Nyberg et al., 2021; Robinson et al., 2013). It is well documented that anxiety and intense stress trigger a state of arousal that can suppress higher-order cognitive abilities (Fonagy & Bateman, 2019; Luyten et al., 2019). Traditionally, studies have focused on its association with attentional control (Eysenck, 2010; Eysenck et al., 2023; Jaiswal et al., 2018), working memory (Derakshan & Eysenck, 2010; Eysenck et al., 2005; Ward et al., 2020), executive functions (Leshem, 2020; Nyberg et al., 2021; Park & Moghaddam, 2017), and learning (Cavanagh et al., 2019; Ting et al., 2022).

Recent studies, however, have also started to examine its connection with social cognition, particularly the association between anxiety and theory of mind (Braley et al., 2023). This is crucial since anxiety conditions are characterised by significant impairments in social functioning (APA, 2022; Surtees et al., 2024), and social interactions play a key role in both maintaining mental health difficulties and supporting recovery (Bolis et al., 2023). Therefore, understanding the connection between anxiety and social cognition could offer valuable insights into the cognitive, emotional, and relational mechanisms underlying anxiety, and help inform both prevention and intervention strategies (Chevalier et al., 2023).

Social cognition

Social interaction is a vital part of daily life, significantly influencing our functioning and wellbeing (Ferguson, 2021). Among all social animals, humans engage in the most sophisticated social interactions, involving complex social stimuli (Amodio & Frith, 2006; Beaudoin & Beauchamp, 2020; Isernia et al., 2024). Unsurprisingly, therefore, we have developed a set of specialised, higher-order cognitive abilities, collectively known as social

cognition, that orchestrate our ability to perceive, interpret, and respond to nuanced and dynamic stimuli relevant to social behaviour (Adolphs, 1999; Frith, 2008; Happé et al., 2017).

Social cognition underlies our capacity to understand people's actions and motivations, as well as our ability to respond to others in flexible and effective ways (Henry et al., 2021; Schurz et al., 2021). Social cognitive skills are therefore critical for our ability to interact with others effectively and for our daily functioning (Henry et al., 2013). Indeed, across the lifespan, effective social cognitive skills have been associated with favourable outcomes in interpersonal relationships (Alvi et al., 2022; Gleason et al., 2009; Sened et al., 2017). On the other hand, studies have shown that difficulties in processing social information can result in deficits in interpersonal communication (Sasson et al., 2013), decreased social participation (Okruszek et al., 2021; Sirois et al., 2017), increased loneliness (Caputi et al., 2020; Koerber & Osterhaus, 2020), and maladaptive social behaviours (Milders, 2019).

Social cognition is not a unitary construct, but rather a multifaceted phenomenon that encompasses a vast set of abilities (Frith, 2008). These range from specific processes, such as perceiving faces and joint attention, to more general and complex cognitive functions, such as interpreting social information, reasoning, and making social inferences (Adolphs, 1999; Beaudoin & Beauchamp, 2020; Schurz et al., 2021). Different domains of social cognition have been identified, including theory of mind (ToM), emotion recognition, perspective taking, understanding of social norms, and empathy (Beaz & Ibanez, 2014). These abilities are supported by a distributed network of brain regions, known as the social brain network, that work together to enable the processing of social information (Adolphs, 2009). Meta-analytic studies (e.g., Arioli et al., 2021) and integrative reviews (e.g., Schurz et al., 2021), have identified key regions like the amygdala, orbital frontal cortex, superior temporal sulcus

(STS), temporoparietal junction (TPJ), medial prefrontal cortex (mPFC), and insula within this network.

However, despite significant interest in social cognition and its neural and cognitive underpinnings over the past few decades, the field lacks a universally accepted definition. Researchers differ in their conceptualisation of the core components that constitute social cognition and how they interrelate, resulting in the development of various organisational and taxonomical models (Happé et al., 2017; Schurz et al., 2021).

Theory of mind

Despite this lack of consensus about the organisation and structure of social cognition, ToM is recognised as a central ability across models, and it is one of the most extensively studied domains in both clinical and non-clinical populations (Henry et al., 2015; Quesque & Rossetti, 2020). Originally conceptualised by Premack and Woodruff (1978), ToM has been a foundational construct in social cognitive research due to its critical role in enabling key functional abilities (Frith & Frith, 2005; Thibaudeau et al., 2021). ToM refers to the ability to infer the mental state of others, including their intentions, beliefs, feelings, and desires (Apperly, 2010). When utilising this ability, individuals construct an understanding – a theory – about the minds of others based on observed behaviours and contextual cues, which in turn enables them to anticipate and predict others' actions and behaviours effectively (Leslie et al., 2004; Olderbak et al., 2015).

Neuropsychological and neuroanatomical research suggests that ToM is not a unitary construct. Evidence from lesion studies (Campanella et al., 2022; Corradi-Dell'Acqua et al., 2020; Shamay-Tsoory & Aharon-Peretz, 2007), transcranial magnetic stimulation (TMS) studies (Kalbe et al., 2010; Krause et al., 2012), and investigations involving different clinical populations (Maurage et al., 2016; Shamay-Tsoory et al., 2007; Wang & Su, 2013), has demonstrated that two, partly dissociable, components exist: cognitive and affective ToM.

Cognitive ToM (cToM) refers to our ability to infer other people's intentions, such as their beliefs and thoughts, whereas affective ToM (aToM) refers to our ability to infer their emotions (Shamay-Tsoory & Aharon-Peretz, 2007).

Studies have shown that while these two abilities share common neural correlates – possibly due to a common need to infer mental states – they are each associated with their own distinct neural networks (Kalbe et al., 2010; Ruitenberg et al., 2020; Sebastian et al., 2012). Specifically, studies have shown that cToM processes are subtended by a neural network involving the dorsolateral prefrontal cortex (dlPFC), while aToM engages a network involving the ventromedial prefrontal cortex (vmPFC; Abu-Akel & Shamay-Tsoory, 2011; Kalbe et al., 2010; Ruitenberg et al., 2020; Shamay-Tsoory & Aharon-Peretz, 2007). Moreover, specific clinical populations have been found to have selective impairments in either cognitive ToM (e.g., older adults, Wang & Su, 2013) or affective ToM (e.g., individuals with schizophrenia, Shamay-Tsoory et al., 2007), underscoring the importance of exploring both components of ToM in social cognitive research.

A further distinction is made between two different levels of processing within ToM: decoding and reasoning (Tager-Flusberg, 2001). These two aspects of ToM are interdependent and typically function together to support accurate judgments about the mental state of others (Sabbagh, 2004). However, they rely on different types of social information processing and have different cognitive demands. Decoding involves interpreting cues that are immediately observable to understand others' emotions or intentions, for example, facial expression or eye gaze (Samson, 2009). This process is relatively automatic and relies on extracting information directly from the social environment (Zainal & Newman, 2018). Reasoning, on the other hand, involves the integration of dynamic and multi-modal contextual information to predict others' actions. Its effective implementation therefore requires deliberate cognitive effort, memory, and abstract reasoning to understand complex

emotions, intentions, and behaviours (Sabbagh, 2004; Zainal & Newman, 2018). Lesion and electrophysiological data (Cao et al., 2012; Njomboro et al., 2008; Sabbagh et al, 2004) support dissociable neural mechanisms for these two components, which, together, work to enable nuanced social judgments (Sabbagh, 2004).

Social cognition and mental health conditions

Growing evidence highlights the role of social cognitive skills in mental health conditions. While earlier studies focused primarily on other neurocognitive domains, including executive functions and memory, recent research has established an important role for social cognition in this field (Grady & Keightley, 2002; Gur & Gur, 2016). Its relevance to mental health conditions is highlighted by its inclusion as a core neurocognitive domain in DSM-5 (APA, 2013), and as a central construct in the Research Domain Criteria (RDoC), a research framework approaching mental health conditions through basic dimensions of functioning, such as cognition and behaviour, rather than symptoms (Gur & Gur, 2016; Rossetto et al., 2020).

Studies have shown that different mental health conditions are marked by deficits in social cognition (e.g., depression: Weightman et al., 2014; schizophrenia: Penn et al., 2008; borderline personality disorder: Andreou et al., 2015; autism: Frith, 1994; posttraumatic stress disorder: Couette et al., 2020). Additionally, these impairments contribute to symptom maintenance (Washburn et al., 2016) and are an important determinant of functional outcomes and recovery (Javed & Charles, 2018; Sasson et al., 2020). In schizophrenia, studies found that social cognition was more strongly associated with community functioning than other cognitive processes (e.g., processing speed and attention, Fett et al., 2011), and that it mediated the relationship between cognitive and social functioning (Schmidt et al., 2011). This has motivated increased research into the association between social cognition and

mental health conditions, to elucidate psychopathological mechanisms and support intervention (Derntl & Habel, 2011; Roelofs et al., 2017).

While social cognition has been extensively studied in conditions such as depression and schizophrenia, fewer studies have focused on anxiety (Braley et al., 2023). As previously highlighted, most of these studies have explored the social cognitive domain of ToM. Therefore, the following review will specifically examine this domain within the context of anxiety.

Associations between anxiety and ToM

In adults, research has identified associations between both trait anxiety (a dispositional tendency towards anxiety, including symptoms and disorders) and state anxiety (temporary emotional reactions, such as those induced by experimental manipulations; Ree et al., 2008) and social cognition (Braley et al., 2023).

Trait anxiety

The majority of research has explored ToM in the context of clinical populations, with studies predominantly finding that individuals with anxiety-related disorders generally demonstrate poorer performance on measures of ToM compared to controls (Briscoe et al., 2024; Chang & Engelmann, 2024; Surtees et al., 2024). Among these, significant focus has been placed on social anxiety disorder (SAD), reflecting cognitive models that propose that differences in interpreting mental states and social information – such as a tendency to interpret ambiguous social cues as threatening – play a central role in maintaining SAD (Clark, 2001; Ronchi, 2019). Results from recent systematic reviews and meta-analyses highlight that, when compared to healthy controls, individuals with SAD demonstrate impairments in making mental state inferences (Baez et al., 2023). Furthermore, higher symptom severity is associated with greater levels of impairments (Alvi et al., 2022). Findings also suggest that adults with social anxiety tend to ascribe more meaning and

stronger emotions to other people's feelings and thoughts (Hezel & McNally, 2014), and they tend to be less accurate in perceiving positive and neutral stimuli (Alvi et al., 2022).

Most studies investigating ToM in individuals with social anxiety utilised the Reading the Mind in the Eyes Task (RMET; Baron-Cohen et al., 2001a), a measure that assesses the ability to decode mental states of others from static pictures depicting the eye region. Most findings indicated significant impairments in SAD groups compared to healthy controls, with SAD participants demonstrating reduced accuracy in mental state inferences (e.g., Alvi et al., 2020; Hezel & McNally, 2014; Lyvers et al., 2019; Maleki et al., 2020; Tetik et al., 2022; Washburn et al., 2016). However, other studies (e.g., Lenton-Brym et al., 2018; Pepper et al., 2018) found no significant differences between SAD and control groups on the RMET. Fewer studies employed the Movie for the Assessment of Social Cognition (MASC; Dziobek, 2006), a more complex ToM measure in which participants answer multiple-choice questions, interpreting the characters' thoughts, feelings, and intentions after watching dynamic video-based scenarios. Among these, only Buhlmann and colleagues (2015) identified significantly poorer performance in SAD participants compared to controls, whereas other studies reported no significant group differences (Ballespí et al., 2018; Hezel & McNally, 2014; Washburn et al., 2016). Collectively, these findings suggest that individuals with SAD may exhibit greater difficulty in decoding mental states from readily observable cues. However, variability across studies exists, with different factors being posited to account for these discrepancies, including differences in the ToM tasks employed and variations in sample characteristics. Additionally, many studies failed to account for potentially confounding variables such as age, sex, education level, and anxiety severity, limiting the interpretability of findings (Baez et al., 2023).

The relationship between ToM and anxiety disorders beyond SAD remains underexplored (Sloover et al., 2022). For example, research on ToM abilities in adults with

generalised anxiety disorder (GAD) is sparse and yields inconclusive findings. For instance, Aydın et al. (2019) found that individuals with GAD scored significantly lower on the RMET compared to healthy controls. Conversely, Zainal and Newman (2018) reported no overall differences between GAD and control groups on the RMET or the MASC. However, their findings revealed a complex interaction between group (GAD vs. control) and state (worry vs. relaxation). Specifically, worry induction in individuals with GAD enhanced accuracy in overall reasoning and cognitive ToM, particularly for negative stimuli, relative to controls. In contrast, when relaxed, controls outperformed the GAD group in affective ToM attributions and ToM reasoning within positive contexts (Zainal & Newman, 2018).

Beyond categorical anxiety disorders, ToM differences have also been observed in individuals with conditions characterised by elevated anxiety. For instance, adults with obsessive-compulsive disorder and post-traumatic stress disorder have been found to show ToM impairments relative to healthy control (Plana et al., 2014; Sloover et al., 2022; Surtees et al., 2024). Furthermore, in a study investigating the link between social cognition and various symptoms in individuals with multiple sclerosis (MS), researchers found a significant association between higher self-reported anxiety symptoms and poorer performance on tasks measuring ToM (Genova et al., 2020). This pattern emerged for both trait and state anxiety and remained significant after controlling for cognitive ability, specifically processing speed and attention. This suggests that the impact of anxiety on ToM was not simply a byproduct of broader cognitive impairments but rather represented a distinct area of difficulty for individuals experiencing anxiety (Genova et al., 2020).

Although subclinical anxiety has been shown to impact functioning (Bjelland et al., 2009; Zhong et al., 2024), its impact on ToM has received less attention. Nonetheless, studies are starting to address this gap. A recent study by Braley and colleagues (2023) examined the relationship between anxiety symptoms and ToM in non-clinical samples, focusing on

healthy young and older adults. Their findings revealed that anxiety differentially impacts cognitive and affective ToM, and that age plays a moderating role in the connection between anxiety and ToM. Among younger adults, an inverted-U shaped relationship emerged, where moderate anxiety, which was still at subclinical levels, was linked to optimal cognitive ToM performance. On the other hand, cognitive ToM was lowest at low and high anxiety levels. Conversely, older adults showed a linear decline in cognitive ToM as anxiety increased. The findings therefore highlight that the relationship between anxiety and ToM may vary across symptom severity. Furthermore, anxiety did not significantly predict affective ToM, highlighting that anxiety may differentially impact different aspects of ToM (Braley et al., 2023).

State anxiety

Studies have also investigated the association between incidental, or state, anxiety and ToM. For instance, Deuter and colleagues (2018) employed an experimental protocol inducing heightened physiological arousal and found that increased skin conductance responses to emotional stimuli predicted poorer performance on measures of emotional and cognitive empathy, which are closely linked to ToM.

Similarly, Todd and colleagues (2015) explored the impact of incidental anxiety on ToM, focusing on how it influences perspective-taking. In their study, participants were asked to write about emotionally evocative experiences to induce feelings of anxiety, anger, disgust, surprise, or a neutral state. Perspective-taking was assessed through perceptual tasks (e.g., adopting another person's spatial viewpoint) and conceptual tasks (e.g., predicting how a naïve recipient might interpret ambiguous email messages based on the sender's intentions). The study revealed that participants experiencing anxiety were more likely to rely on their own perspective and make inaccurate inferences compared to those experiencing anger, disgust, or neutral emotions. These findings suggest that anxiety-specific effects, rather than

negative emotional valence or heightened arousal alone, contribute to perspective-taking difficulties (Todd et al., 2015).

In a second study, Todd and Simpson (2016) explored how incidental anxiety affects the cognitive mechanisms underlying visual perspective-taking, specifically perspective calculation and perspective selection. Using a task that involved judging the perspective of a human avatar or a non-social object, the researchers found that anxiety impaired the spontaneous calculation of another person's perspective. Intriguingly, the study highlighted the social-specific nature of the effects of anxiety, as the impairment in perspective calculation was only observed when the target was a human avatar, suggesting a specific impact on the implicit processing of others' mental states (Todd & Simpson, 2016).

Proposed mechanisms underlying the association between anxiety and ToM

Different potential mechanisms have been proposed to explain the association between anxiety and ToM. One explanation is that anxiety impacts domain general processes that may underlie efficient ToM attributions (Apperly & Butterfill, 2009). In this account, executive functions, including working memory, inhibition, and cognitive flexibility, are postulated to be recruited in ToM attributions to generate a model of the other individual's mental state to predict behaviour (Briscoe et al., 2024; Meinhardt-Injac et al., 2018; Wade et al., 2018). Anxiety, however, can impair these functions (e.g., Eysenck et al., 2005; Eysenck, 2010; Eysenck et al., 2023; Nyberg et al., 2021; Park & Moghaddam, 2017), impacting ToM performance (Shields et al., 2016; Surtees et al., 2024). Eysenck's Attentional Control Theory (ACT; Eysenck et al., 2007) provides a framework to elucidate this mechanism. The ACT posits that anxiety increases cognitive load, resulting in a reallocation of processing resources toward stimulus-driven processing, particularly stimuli that are perceived as threatening. Consequently, this impairs the efficient functioning of goal-directed abilities, such as executive functions, leaving fewer resources available for tasks that require sustained

attention and mental effort, such as the complex reasoning processes needed for ToM (Briscoe et al., 2024).

However, the findings by Todd and Simpson (2016) outlined above, suggest that the impact of anxiety on ToM cannot be fully explained through deficits in domain-general processes, such as executive functions. Anxiety's egocentric impact on spatial perspective-taking was specific to a human avatar, and did not affect performance on tasks involving non-social avatars. Importantly, this social-specific impact persisted even when controlling for anxiety's potential influence on non-social mental rotation tasks (Surtees et al., 2013; Surtees et al., 2024; Todd et al., 2015). This therefore suggests that anxiety's influence on social perspective attributions is distinct and not merely an extension of its effects on non-social cognitive abilities (Surtees et al., 2024). Furthermore, while evidence is mixed, studies have demonstrated that executive functions do not always predict ToM functions in non-clinical samples (e.g., Di Tella et al., 2020).

Developing on the work by Todd and colleagues (Todd et al., 2015; Todd & Simpson, 2016), an uncertainty account was postulated (Surtees et al., 2024; Todd & Tamir, 2024). Proponents posit that anxiety is inherently characterised by appraisals of uncertainty, which can be aversive. This, in turn, may motivate individuals to reduce the uncertainty (FeldmanHall & Shenhav, 2019; Surtees et al., 2024). In social situations, when inferring others' mental states (which can be a source of uncertainty), one way of reducing the uncertainty could be by engaging in egocentric attributions, that is, projecting one's own (more certain) thoughts and feelings onto others (Todd et al., 2015). This may therefore result in anxious individuals making inaccurate inferences about others' perspectives and mental states due to this egocentric bias, which is adopted to create a more predictable and controllable social context (Surtees et al., 2024). Studies have identified that increased incidental anxiety can result in increased egocentric bias (Todd et al., 2015; Todd & Simpson,

2016). Notably, this effect is not solely due to the high arousal associated with anxiety, as other high-arousal negative emotions, like disgust, do not necessarily lead to the same level of egocentrism (Todd et al, 2015). A key factor, therefore, appears to be the uncertainty component. This is further supported by evidence that surprise, a positive emotion involving uncertainty, can also result in heightened egocentrism (Surtees et al., 2024; Todd et al., 2015).

While the mechanisms outlined above offer valuable insights into the anxiety-ToM relationship, research in this field is still at its inception. The mechanisms discussed likely interact and influence each other in complex ways (Surtees et al., 2024). Overall, however, the reported findings point towards the anxiety-ToM relationship warranting exploration to further elucidate the nature of this association.

Considerations about current research

Overall, the reviewed studies demonstrate that both trait and state anxiety may influence ToM abilities, highlighting that individual differences in anxiety may differentially impact different dimensions of ToM, including cognitive versus affective ToM, as well as decoding versus reasoning abilities. However, specific limitations were identified in extant studies. The impact of distinct anxiety symptom profiles on distinct ToM abilities remains underexplored (Chang & Engelmann, 2024). Understanding these nuances could provide valuable insights into the mechanisms linking anxiety and ToM (Alvi et al., 2022).

Studies have often failed to fully capture the construct of ToM. At present, only a few studies have explicitly examined the differential impact of anxiety on cognitive and affective ToM. Furthermore, in studies where this has been explored, the cognitive and affective components have been measured using different tasks that employ different stimuli, which may differ in task complexity thus complicating direct comparisons (Cuerva et al., 2001; Henry et al., 2013). Additionally, many of the employed tests were developed before ToM was understood as a multidimensional construct, resulting in unclear distinctions between

cognitive and affective ToM. This underscores the need to reliably evaluate both cognitive and affective ToM employing the same measure to enhance the consistency and interpretability of findings. Furthermore, many of the employed assessments lack ecological validity, as they often rely on tasks that fail to replicate the complexity of real-world social interactions. Incorporating more ecologically valid tasks could therefore improve the applicability of research findings to everyday social functioning (Baez et al., 2023; Braley et al., 2023).

The review of available studies also highlighted the lack of inclusion of confounding variables in the analysis which may be relevant to the relationship under study. Indeed, research has shown that factors, such as vocabulary skills, perceptual reasoning abilities, and the presence of autistic traits, can affect performance on social cognition tests (Baker et al., 2014; Bertrams & Schlegel, 2020; Charlton et al., 2009; Poljac et al., 2012). The inclusion of relevant covariates may help better clarify the nature of this relationship (Alvi et al., 2022).

Conclusion

Overall, extant findings have provided some evidence for a negative association between anxiety and ToM. Specific mechanisms have also been proposed to explain this relationship; however, the review highlighted the presence of variability in findings. Specific limitations have been identified in existing studies that may limit our understanding of this association. A clearer delineation of this is therefore warranted. Adopting a more nuanced approach in understanding the impact of anxiety on ToM may provide useful insight into the association. The current study aims to explore the impact of different anxiety symptom profiles across state and trait anxiety across different dimensions of ToM. Furthermore, the use of an ecologically valid measure of ToM that was specifically developed to measure cognitive and affective ToM reasoning using the same stimuli hopes to provide clearer elucidation of this association, with enhanced understanding of how it might translate to real-

world functioning. The inclusion of a decoding task of ToM, as well as measures of known covariates, aims to allow a clearer exploration of this association.

Methodology

Introduction

This chapter outlines the methodology adopted in the current study. It first presents the aims of the study, the rationale for the selected methodology, and the study's theoretical framework. A detailed description of the sample is then provided, including the participants' characteristics and the criteria for inclusion in the study. The sampling method and recruitment process are outlined, followed by a review of the data collection tools. The chapter concludes with an explanation of the procedural steps for data collection and an overview of the statistical analyses employed to analyse data and explore the research questions.

The aims of the study and rationale for the quantitative approach

The aims of the current study were twofold. First, it sought to explore whether participants with high trait anxiety performed differently from those with low trait anxiety on measures of ToM. Second, it sought to evaluate whether varying levels of state anxiety impacted ToM performance. A quantitative approach was adopted to systematically collect, measure, and analyse data to address these aims.

Quantitative research is concerned with the identification and analysis of relationships between variables (Creswell & Creswell, 2023; Leavy, 2022), hence aligning with the aims of the current research. Through the operationalisation, measurement, and quantification of variables, underlying associations can be explored by adopting a hypothetico-deductive approach to data analysis. This allows the testing of formulated hypotheses through the statistical analysis of patterns and relationships within the data (Coolican, 2024; Leavy, 2022). Hence, a quantitative approach allowed the researcher to effectively explore the phenomenon under study.

Theoretical framework

Quantitative research emerged from a positivist philosophy, which assumes that a single, objective reality exists, independent of the research process, and that this reality can be accurately identified, measured, and understood. The positivist worldview holds that through the scientific method, and thus systematic observation and measurement, claims about reality, including the laws underlying the social world, can be made and tested (Leavy, 2022; Park et al., 2020). Central to this worldview is the assumption that separation exists between the researcher and participants, and that the researcher holds a position of objectivity (Park et al., 2020). As such, researchers aim to remain detached and eliminate bias in their observations by maintaining a neutral stance, adopting objective data collection practices, and adhering to strict protocols (Creswell & Creswell, 2023).

Contemporary quantitative research in social science, however, adopts a post-positivist worldview. This paradigm challenges the notion that truth and reality can be completely understood, particularly in the context of human behaviour (Coolican, 2024; Guyon et al., 2018). Hence, claims of probability rather than certainty are made (Creswell & Creswell, 2023). Post-positivism acknowledges that limitations exist in achieving objectivity, and while these limitations may be minimised through rigorous methods, the researcher's values and perspectives may still exert influence (Leavy, 2022). The present study aligns with this post-positivist stance. It recognises the complexities of human behaviour and acknowledges the challenges of achieving absolute objectivity, while valuing rigorous methodologies and probabilistic reasoning as integral for generating reliable insights.

Participants

A total of 73 (20-63 years, $M = 32.93$, $SD = 9.537$) participants were recruited to the study. The recruited sample was deemed to provide sufficient statistical power to address the study's research questions. In the existent literature, the effect sizes for the relationships under

investigation vary across different studies, hence a medium effect size was considered as a guide in determining the required sample size. According to Cohen (1992), to detect a medium effect size, with power = 0.80 and $\alpha = 0.05$, a sample of 67 would be required for correlations and 64 for mean differences.

Participants were recruited using convenience sampling. This is a non-probabilistic sampling method in which all members of the population who fit the inclusion criteria, and who are available and willing to participate in the study, are included in the sample (Jager et al., 2017). Given the time-constrained nature of the study, this method allowed the researcher to recruit a large sample with relatively few logistical constraints (Bornstein et al., 2013). Participants were recruited from the general public through social media advertisements and through referrals from acquaintances. All participants met the following inclusion criteria:

- Participants were required to be between the ages of 18 and 64. A cognitive screen was not administered to exclude cognitive impairments, therefore, the upper age limit was set at 64 due to the increased prevalence of cognitive decline beyond this age (Manly et al., 2022; Overton et al., 2019).
- Participants were required to meet the criteria necessary for effective test completion, including good command of the English language, adequate literacy, corrected-to-normal vision and hearing, and normal colour vision.
- Participants were required to have no known history of alcohol or substance abuse, or head injury that resulted in a loss of consciousness, as such history could alter cognitive functioning and affect (Ramey & Regier, 2018; McDonald & Genova, 2021).
- Participants were also required to have no known diagnosis of a neurodevelopmental condition, and no medical or neurological condition that could impact cognitive functioning or affect. This was important to minimise confounding factors and ensure

that observed effects were associated with individual differences in anxiety (Herrington et al., 2016)

Ethical considerations

A research ethics application form was completed. This helped the researcher consider potential ethical issues and implement safeguards to ensure the ethicality of the study and to protect the rights and well-being of participants (Adu & Miles, 2024; Leavy, 2022). Given that a normative population was employed for the study, no ethical approval was necessary, however, the form was submitted to the Social Wellbeing Faculty Research Ethics Committee (FREC) for records, and acknowledgement of this was received on the 21st of May 2025 (Appendix B).

Each participant in the study received an information sheet prior to their enrolment in the study. This outlined the purpose of the study and the nature of their participation. Participants were also informed that participation was voluntary, that they could stop participation at any time without explanation and without incurring any penalty, and that they had the right to ask for their data to be withdrawn. Participants were encouraged to ask questions and seek clarification about the contents of the information sheet. Individuals who agreed to participate provided their informed consent by signing a consent form prior to the commencement of data collection. The forms (see Appendix C) also highlighted that the information collected would be kept strictly confidential.

Physical data collected (such as paper documents) were stored securely in a locked environment, and all electronic data were stored on a password-protected computer. Only the researcher and supervisors had access to this information. To further ensure confidentiality, participants were assigned unique codes that were used in place of their names on all data records. These codes were linked to consent forms, which were stored securely and

separately from the data. This ensured confidentiality while still allowing the researcher to identify the data if a participant decided to withdraw from the study after data collection.

Finally, while the study was not anticipated to generate any risk for the participants, they were informed of their right to not answer questions and to withdraw from the study without the need for justification. Furthermore, a debrief form was provided to each participant at the end of the session (Appendix D). This outlined free mental health services participants could access, in the unlikely event that participation in the study elicited any distress.

Study design and procedure

The current study adopted a cross-sectional design in which data were collected from participants at a single point in time. The study was non-experimental, in that the researcher aimed to observe relationships between variables, without imposing any experimental manipulations or interventions (Coolican, 2024). This approach provided a snapshot of the variables of interest, allowing for the examination of associations between anxiety and social cognition as they coexist within the defined population.

Following recruitment, the researcher and each participant coordinated a mutually convenient time and place for the study session. Participants were tested individually in a quiet environment, where distractors were kept to a minimum. Each session lasted between 45 and 90 minutes, depending on the time taken by each participant to complete the tasks administered by the researcher. During the session, participants completed a data collection protocol, which is outlined below.

Data collection measures and materials

Demographic information about each participant, including age, sex, years of education, education level, and years of full-time employment, was recorded at the start of each session. Collecting these details was important to evaluate whether these variables might

have potentially confounded the relationship between anxiety and ToM (Baez et al., 2023). Each participant then completed a battery of assessments, measuring the primary variables under study, that is, anxiety and ToM, as well as potential confounds, namely, verbal ability, perceptual reasoning, and autistic traits.

STICSA.

The State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA; Ree et al., 2008) is a 42-item self-report questionnaire that measures anxiety dimensionally. It is composed of two independent 21-item scales; the STICSA-Trait, which measures trait anxiety and explores the respondent's general tendency to experience anxiety, and STICSA-State, which measures state anxiety and asks respondents to rate how they feel at the moment. Each scale is composed of 10 items measuring cognitive symptoms of anxiety, and 11 items measuring somatic symptoms of anxiety. Cognitive items include statements about intrusive thoughts or predicting misfortune, while somatic items focus on physiological symptoms, such as experiencing dizziness and increased heart rate.

Administration of the STICSA requires participants to complete both the state and trait scales. The STICSA-Trait asks participants to specify how often a statement is true of them in general, using a 4-point Likert scale to rate items. The response options for this scale include "Almost never", "Occasionally", "Often" and "Almost always". On the other hand, the STICSA-State asks participants to rate how they feel at the moment of assessment. Again, a 4-point Likert scale is used to rate items, and response options include "Not at all", "A little", "Moderately" and "Very much so". Scores for individual items range from 1 ("Almost never"/"Not at all") to 4 ("Almost always"/"Very much so"). The STICSA is then scored by summing the ratings; higher scores on the STICSA indicate higher levels of anxiety. Each scale can be scored to produce a total scale score (State-Total, Trait-Total), with scores ranging from 21-84.

One of the study's aims was to explore whether participants with high trait anxiety performed differently from those with low trait anxiety on measures of ToM. To address this, participants were divided into two groups based on their Trait-Total score: High Trait Anxiety group and Low Trait Anxiety group. A cut-off of 40 was used, with scores below this indicating Low Trait Anxiety and scores above 40 indicating High Trait Anxiety. This cut-off was chosen in accordance with findings that suggest that a score of 40 is sensitive in screening for the possible presence of anxiety disorders (sensitivity .80, specificity .67; Van Dam et al., 2013). On the other hand, SA was treated as a continuous variable, in recognition of its transient and variable nature, and because not much variability was noted across scores in the sample.

The STICSA was selected owing to its dimensional approach to anxiety. This allowed the researcher to explore whether individual differences in anxiety symptoms are associated with performance on ToM measures. Additionally, its multidimensional approach and distinction between state and trait anxiety, allowed a more comprehensive exploration of the relationship under study (Barros et al., 2022; Tindall et al., 2021). Furthermore, the STICSA was designed to better discriminate between anxiety and depression symptoms through the inclusion of symptoms unique to anxiety (e.g., physiological arousal), and the exclusion of non-specific symptoms or those more closely related to depression (Balsamo et al., 2015; Grös et al., 2007; Ree et al., 2008). This is an advantage over other measures of anxiety, such as the State-Trait Anxiety Inventory (STAI), which has been criticised for its association with measures of depression (Grös et al., 2007). Hence, in an effort to reduce confounds, the STICSA was selected. Authorisation to use the STICSA was obtained from one of the measure's authors (Appendix E).

Psychometric properties. Research has reported good to excellent internal consistency for both scales of the STICSA. Cronbach's alpha coefficients have ranged from

.74 to .95 for the state scale and .75 to .95 for the trait scale across different samples, including students and adults (Barros et al., 2022; Carlucci et al., 2018; Gros et al. 2010). Test-retest reliability for the STICSA-Trait scale has been reported to be adequate, with correlations ranging from .60 to .66 over a 7-week period (Grös et al. 2007). However, test-retest reliability for the STICSA-State scale was reported to be lower, ranging from .49 to .31. However, given the nature of the variable being measured, this is to be expected since state anxiety is susceptible to change over time (Lancaster et al., 2015). This highlights its sensitivity to changes in anxiety levels across situations (Grös et al. 2007; Ree et al., 2008). Finally, the STICSA demonstrates good convergent validity with other measures of anxiety, including the STAI and the DASS, with correlations generally being in the moderate to high range (Barros et al., 2022; Carlucci et al., 2018; Tindall et al., 2021).

The Edinburgh Social Cognition Test

The Edinburgh Social Cognition Test (ESCoT; Baksh et al., 2018) served as the primary measure of cognitive and affective ToM. The ESCoT is an animation-based task that assesses four domains of social cognition within the same test: cognitive and affective ToM, and interpersonal and intrapersonal understanding of social norms. Authorisation to use the ESCoT was obtained from one of the measure's authors (refer to Appendix F).

During this task, participants are shown a series of short animations on a laptop screen depicting social interactions. Participants complete one practice animation, followed by ten additional animations. At the end of each animation, participants are asked a series of scenario-specific questions while a storyboard showing four pictures relating to the animation remains visible on screen (Figure 1).

The questions asked (Table 1) assess participants' comprehension of the story and social cognitive abilities, namely cognitive ToM, affective ToM, interpersonal UNS, and intrapersonal USN. For the purpose of this study, only data from the ToM components were

collected and analysed. Participants' answers are scored on a 0–3-point scale, based on the relevance and quality of the responses (Appendix G). A single prompt is provided per question if the participant's response lacks essential information. Each component has a maximum possible score of 30 points.

This task was selected as a reasoning task of ToM because it allows the assessment of cognitive and affective ToM within the same task, using the same stimuli, which allows for direct comparison of performance across ToM domains in relation to individual differences in anxiety, without concerns relating to possible variations in task difficulty (Poveda et al., 2022). Furthermore, the animations provide rich visual cues that closely mirror real-life scenarios, making the test more ecologically valid by offering a more authentic context for assessing social cognitive abilities, thereby leading to more meaningful assessment (Baksh et al., 2018).

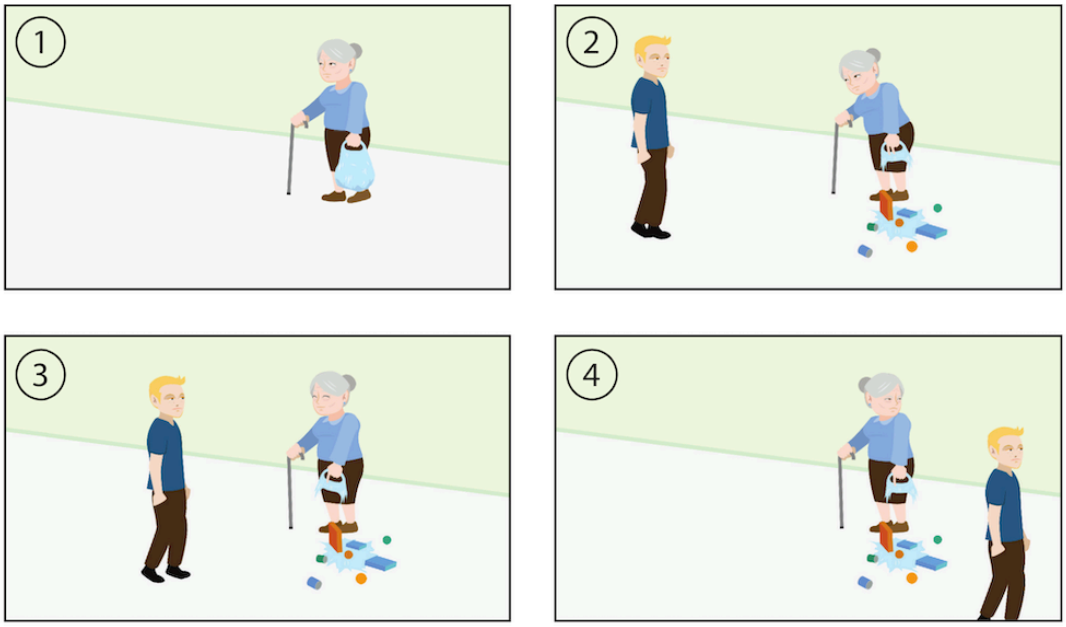

Figure 1. Example ESCoT Scenario reproduced from Baksh et al. (2018)

Table 1.

Example ESCoT questions

ESCoT Measure	Question
Comprehension	Can you tell me what's happening in this story, starting with the first picture and finishing with the last picture?
Cognitive ToM	What is the elderly lady thinking?
Affective ToM	How does the elderly lady feel at the end of the animation?

Note: Questions have been reproduced from Baksh et al. (2018)

Psychometric properties. Research has demonstrated that the ESCoT is a sensitive measure of social cognition, showing convergent validity with traditional tests of social cognition (Baksh et al., 2021; Poveda et al., 2022). Studies have also demonstrated its sensitivity to detect difficulties in social cognition in both healthy (Baksh et al., 2018; Baksh et al., 2020) and clinical adult populations (Baksh et al., 2021; Baksh et al., 2024; Poveda et al., 2022). Its reliability was also established through intraclass correlation, demonstrating a high consistency of .90, indicating strong inter-rater reliability. The internal consistency of the ESCoT was also evaluated by calculating Guttman's Lambda 4 reliability, yielding a coefficient of .70, which is considered acceptable (Baksh et al., 2018).

Reading the Mind in the Tyes Task

The Reading the Mind in the Eyes Task (RMET; Baron-Cohen et al., 2001a) is a well-established test of ToM, which assesses the ability to understand the mental states of others. Participants are presented with 37 photographs (one practice) on a screen, showing only the eye region of various human faces. Participants must then choose which one out of four presented adjectives (one target, three foils) best describes the individual's mental state

(Figure 2). Before testing, participants are provided with a list of definitions of the adjectives, to ensure they understand the meaning of each word. No time limit is imposed on participants, and each correct answer is scored 1, with a total maximum score of 36. Higher scores represent a better performance.

This test was selected as a decoding task of ToM and to allow comparison to previous research, owing to its widespread use across social cognitive research in general, and more specifically as a measure of ToM in studies exploring the association between anxiety and ToM. It was further hoped that examining individual differences in performance across ESCoT and RMET would provide valuable insights into the nature of the association between ToM and anxiety.

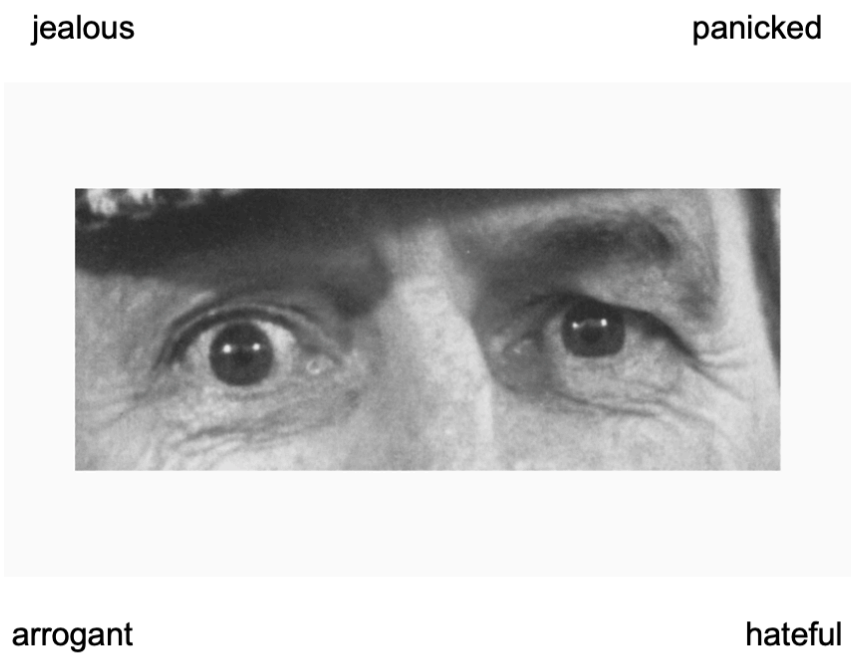

Figure 2. Example RMET photo depicting the ocular region with corresponding choice adjectives

Psychometric properties. Measures of internal consistency and test–retest reliability were not evaluated and published in the original publication (Baron-Cohen et al., 2001a). Subsequent studies, however, have generally reported acceptable test–retest reliability (e.g.,

Fernández-Abascal et al., 2013; Khorashad et al., 2015; Prevost et al., 2014; Vellante et al., 2013; Yildirim, 2011). There is limited evidence for its internal consistency, with considerable variation being reported; some studies reporting high levels, for example, $\alpha = .78$ in Kuczynski et al. (2020), while others report poor levels (e.g., $\alpha = .371$, Khorashad et al., 2015), putting into question the reliability of the test. Different reasons have been proposed for the low internal consistency, including differences in the commonness of responses, and variations in the stimuli presented. Furthermore, while the RMET was posited to measure a single construct, factor studies have failed to support a unidimensional, single-factor solution (Olderbak et al., 2015). Mixed findings have also been reported with regards to convergent validity. Some studies have shown convergent validity with other measures of ToM, such as the Faux Pas and the Strange Stories test (e.g., Torralva et al., 2009), whereas others have found no correlation (e.g., Duval et al., 2011). Despite this, the RMET allows the differentiation between groups assumed to differ in their ToM abilities, such as individuals with or without autism (e.g., Baron-Cohen et al., 1997). Finally, the RMET has been shown to correlate with measures of vocabulary, suggesting that performance on this test may depend on one's vocabulary knowledge (Olderbak et al., 2015).

Matrix Reasoning subtest from the Wechsler Adult Intelligence Scale - fourth edition (Wechsler, 2008a)

The Matrix Reasoning (MR) subtest was administered as a measure of perceptual reasoning ability (Weiss et al., 2010). During this task, participants are shown incomplete 2x2 matrices or series items and are asked to select a response from five options in order to complete the matrix or series (Wechsler, 2008a). Participants provide their response either by pointing to or stating the number of the selected response option. Completion of the task requires the identification of underlying rules or relationships. As the test progresses, item difficulty increases. The task comprises 26 test items, preceded by 2 sample teaching items.

The task is not timed, but a prompt is administered ('Do you have an answer?') after 30 seconds if no response has been generated. Each correct response is allocated a score of 1, whereas a score of 0 is given if the participant gives an incorrect response or if they do not provide a response. The task is discontinued after 3 consecutive incorrect responses. A maximum total raw score of 26 can be obtained, which is then converted to a scaled score based on the participant's age (Wechsler, 2008a).

Psychometric properties. The normative data in the WAIS-IV technical and interpretive manual (Wechsler, 2008b) provides support for the use of its scores in informing clinical judgments about an individual's intellectual abilities (Benson et al., 2010). In the manual, internal reliability is reported to be generally high to excellent for most subtests across different age groups, with average reliability typically exceeding .81. This is substantiated by other research, which also indicates high internal reliability coefficients. For example, Gignac and Watkins (2013) report high to very high coefficients for the majority of scores. The technical manual further notes strong test-retest reliability, most exceeding r = .80, and excellent inter-rater reliability across subtests, with .98 to .99 coefficients being reported across subtests (Wechsler, 2008b).

When considering MR specifically, the developers reported adequate test-retest reliability for the MR subtest, with an average stability coefficient across all ages of .74. Internal consistency across age groups was adequate-to-excellent, ranging from .86 to .92, with an average coefficient of .90 (Wechsler, 2008b).

Vocabulary subtest from the Wechsler Adult Intelligence Scale - fourth edition (Wechsler, 2008a)

The Vocabulary (VC) subtest was administered as a measure of verbal ability (Weiss et al., 2010). During this subtest, participants are asked to define words that are presented to them visually, as well as orally. Responses are recorded verbatim on the record form, and

scored 2, 1 or 0 points according to the sample responses provided in the manual and the general scoring principles. If a participant's response is unclear or too vague, or if it is followed by a (Q) in the sample responses, a non-leading follow-up question is asked, such as "What do you mean?", to seek further clarification. The test is discontinued following 3 consecutive scores of 0. A maximum total raw score of 57 can be obtained, which is then converted to a scaled score based on the participant's age (Wechsler, 2008).

Psychometric properties. The technical manual of the WAIS-IV reports good test-retest reliability for VC, with an average stability coefficient of .89 across all ages. Special interscorer agreement studies were conducted for subtests that require more judgment in scoring, such as VC, in addition to the overall WAIS-IV inter-rater reliability studies. Findings indicate excellent interscorer reliability, at .97, for the VC subtest (Wechsler, 2008b).

AQ10

The 10-item Autism-Spectrum Quotient (AQ10; Allison et al., 2012) was administered as a measure of autism traits. The AQ-10 is a self-report questionnaire, developed as an abbreviated version of the Autism-Spectrum Quotient questionnaire (AQ; Baron-Cohen et al. 2001b). It consists of 10 statements, and participants are asked to indicate how much they agree with the statement using a four-point Likert scale with the following options: 'Definitely Agree', 'Slightly Agree', 'Definitely Disagree', 'Slightly Disagree'. A maximum of 1 point can be scored for each question. Items 1, 7, 8, and 10 are scored 1 point if participants mark 'Definitely Agree' or 'Slightly Agree'. Items 2, 3, 4, 5, 6, and 9 are scored 1 point if participants mark 'Definitely Disagree' or 'Slightly Disagree'. Higher scores represent a higher number of autism traits.

Psychometric properties. The authors of the AQ10 determined that, using a cut-off point of 6, the measure demonstrated a sensitivity of .88, specificity of .91, and a positive

predictive value of .85, making it an adequate screener for ASD (Allison et al., 2012). Using ROC analysis, Booth and colleagues (2013) further confirmed similar performance regarding sensitivity and specificity for the AQ-10 and the AQ in discriminating people with and without an ASD diagnosis.

Methods of statistical analyses

Data were prepared, ensuring that they were accurate and complete. They were then analysed using IBM's Statistical Package for the Social Sciences (SPSS) software version 29.0.0. The data were checked for outliers, and tests were run to determine whether the assumptions for the use of parametric tests were met, specifically, assessing the normality of distribution. For variables demonstrating a normal distribution, parametric tests were employed. On the other hand, for those violating the normality assumption, co-current parametric and non-parametric tests were run. Details and rationales for analyses used are presented in the results section. As outlined, the study sought to assess whether associations exist between measures of ToM and anxiety. Based on the aims of the study and this theoretical position, the following hypotheses were generated and tested:

H1: Participants with high trait anxiety perform differently from those with low trait anxiety on measures of ToM

H2: There is an association between severity of state anxiety and performance on ToM measures

Statistical analyses were guided by the formulation of a null hypothesis, which posits that no relationship exists between the variables under investigation. Significance testing procedures were then employed, and if the p-value exceeded the 0.05 level of significance ($p > .05$), the null hypothesis was retained. Alternatively, a p-value smaller than the 0.05 level of significance ($p < .05$) supported the alternate hypothesis.

Table 2.

Overview of statistical tests used for data analysis

Statistical Test	Purpose
Independent samples t-tests	To assess group differences in ToM performance
Pearson's Correlation, Spearman's Correlation	To examine the association between levels of state anxiety and measures of ToM
Multiple regression analysis	To identify the best predictor(s) of differences in cTOM across trait anxiety levels

Conclusion

This chapter delineated the aims of the study and provided a comprehensive account of the methodology employed to address these objectives. The procedures for data collection were outlined, alongside a description of participant characteristics and the sampling methods utilised. Furthermore, the study's hypotheses were articulated, and the statistical analyses employed to test these hypotheses were discussed. The subsequent chapter will present a detailed account of the results derived from these statistical analyses.

Results

Introduction

The aim of this study was to examine explore whether group differences in trait anxiety and varying levels of state anxiety are associated with performance on ToM measures. This chapter presents the results obtained through the statistical analyses of data, which aimed to elucidate the nature of the association between dimensions of anxiety and ToM. The first part of this chapter describes the preliminary analyses of data, which included checking the data for outliers and missing values, as well as the assessment of the assumptions of normality and homogeneity of variance for the use of parametric testing. Descriptive statistics and an overview of the sample's demographic characteristics are also provided. The chapter continues by presenting the findings obtained from the statistical analyses to test the study's hypotheses. Specifically, it details the results obtained from the independent samples t-tests examining group differences in ToM performance across low and high TA groups, along with multiple regression analyses aimed at identifying predictors of ToM. Correlational analyses exploring the association between state anxiety and ToM are also discussed.

Preliminary analysis

Checking of data for missing values and outliers

Data were visually examined using boxplots to ensure that all variable scores fell within their expected ranges, confirming the absence of any data entry errors. Additionally, careful inspection of the dataset verified that there were no missing values, and that all demographic information and scores for the different variables intended for analysis had been recorded for each participant. Therefore, data from the entire sample were included in subsequent statistical analyses.

The data were also inspected for outliers, or scores that are extreme and that deviate significantly from the majority of data points (André, 2022; Karch et al., 2023; Leys et al., 2019). Detection of outliers is important when making inferences about populations, as many statistical analyses involve the calculation and comparisons of means, which are sensitive to extreme values. Outliers can skew the mean and amplify the standard deviation, affecting statistical analyses and leading to potentially misleading conclusions about the relationships between variables (Leys et al., 2019; Rotello et al., 2025). This can result in false identification of the existence of effects (Type I errors) or the obscuring of real effects (Type II errors; Aguinis et al., 2013; Sullivan et al.., 2021).

Two methods were employed to detect outliers. First, the data were visually assessed through the use of boxplots to identify potential extreme data points (Field, 2024; Rotello et al., 2025). This assessment suggested the presence of possible outliers, which appeared as circles, and possible extreme outliers, which were marked as asterisks beyond the boxplots' 'whiskers'. This visual inspection was followed by a quantitative approach, in which dataset data points from the variables of interest were converted to z-scores; these assess how many standard deviations away from the mean each score is (Field, 2024). Tabachnick and Fidell (2018) define outliers as cases with z-scores in excess of ±3.29, however a more conservative z-score of ±3 was adopted, as the majority of data (99.7%) falls within 3 standard deviations in a distribution (Rotello et al., 2025). In total, six outlying datapoints were identified.

Various methods are described in the literature on how to manage outliers, including exclusion and transformation. However, several authors caution against excluding outlying data points from the dataset, unless there is substantial evidence that they do not reflect the population of interest, as these may enhance the representativeness of the sample (André et al., 2022; Field, 2024; Karch et al., 2023; Sullivan et al, 2021). Hence, following recommendations, the nature of the outlying data points was studied in further detail to

confirm that they were not the result of errors (Aguinis et al., 2013; Leys et al., 2019). Then, to reduce the influence of the outliers while retaining representativeness and avoiding loss of power, the outlying data points were transformed using the Winsorization method. Winsorization involves the transformation of extreme values to a specific percentile of the data (Tabachnick & Fidell, 2018). Specifically, a 5% Winsorization was used, which is a commonly employed percentile value (Leys et al., 2019; Sullivan et al., 2021), whereby any values below the 2.5th percentile were replaced by the 2.5th percentile value for that variable, and any values above the 97.5th percentile were recoded to the value of the 97.5th percentile for that variable. This approach allowed the researcher to minimise the impact of outliers without removing data.

Checking of assumption of normality and homogeneity of variance

Assumption of normality. Many statistical procedures, specifically parametric tests, are based on the assumption that the sampled data, and the population from which they are obtained, follow a normal distribution, and that consequently the residuals of the statistical model will also be normally distributed (Das & Imon, 2016; Field, 2024; Rotello et al., 2025). Hence, before analysing the data, the normality of the variables' distribution was assessed. Different approaches can be adopted in assessing this, including the examination of distribution characteristics and formal tests, such as the Shapiro-Wilk test. In smaller samples, however, formal tests of normality may lack power to detect violations (Das & Imon, 2016; Field, 2024). Hence, the distributions' characteristics were checked graphically, by looking at Q-Q plots and histograms, as well as by determining the distributions' skewness (distribution symmetry) and kurtosis (degree of score clustering at the tails; Rotello et al., 2025).

Graphical examination involved plotting histograms of the scores for each variable, overlaid with a normal bell-shaped curve. Deviations of the distributions from the normal

curve were considered as an indication of non-normality (Abu-Bader, 2021; Rotello et al., 2025). Q-Q plots were also generated for each variable. In normally distributed data, data points align closely with a diagonal line, while deviations from this line indicate a departure from normality (Field, 2024). This visual examination indicated that, for some variables, the distribution was not normal, which is a normal occurrence in social sciences (Bono et al., 2017). To confirm this, a quantitative exploration of the distributions' skewness and kurtosis was undertaken.

When data are normally distributed, skewness and excess kurtosis (as reported in SPSS) are expected to approximate zero (Field, 2024). To test whether deviations from zero on these parameters constitutes a deviation from normality, these values can be converted into z-scores by dividing the sample skewness and excess kurtosis by their respective standard errors (Demir, 2022; Field, 2024). The significance of these z-scores is then evaluated against established thresholds (Abu-Bader, 2021; Tabachnick & Fidell, 2018). Kim (2013) argues that, for medium sample sizes ($50 \leq n \leq 300$), an absolute z-score value larger than 3.29 is considered significant at $p \leq 0.001$, hence indicating non-normality. On the other hand, Mayer (2013) argues for a more conservative approach, such that for sample sizes between $50<n<175$, the z-scores should be in the range of ± 2.58 ($p \leq 0.01$). In this study, Mayer's (2013) more conservative approach was adopted to reduce the risk of falsely accepting normality. Table 3 below presents the skewness and kurtosis values, along with corresponding absolute z-scores, for each variable. As indicated in the table, the distribution from one of the variables (STICSA State Anxiety Total) was significantly skewed, hence indicating that it was not normally distributed.

Table 3.

Values of skewness, kurtosis, and corresponding absolute z-score for variables

	Skewness		Kurtosis	
Measure	Statistic	|z-score|	Statistic	|z-score|
ESCoT cTOM	-0.02	0.06	-0.26	0.46
ESCoT aTOM	-0.61	2.19	-0.10	0.18
RME	-0.51	1.81	-0.16	0.29
STICSA TA Total	0.41	1.47	-0.86	1.55
STICSA SA Total	1.03	**3.65**	0.37	0.66
AQ10	0.51	1.83	0.11	0.19
Matrix Reasoning	0.052	0.19	-0.75	1.35
Vocabulary	-0.443	1.58	-0.06	0.10

Note: absolute z-score highlighted in bold exceed the 2.58 threshold and hence are considered to be in violation of the normality assumption. AQ10 = Autism Quotient-10; aTOM = affective Theory of Mind; cTOM = cognitive Theory of Mind; ESCot = Edinburgh Social Cognition Test; RMET = Reading Mind in the Eyes; SA = State Anxiety; STICSA = State Trait Inventory for Cognitive and Somatic Anxiety; TA = Trait Anxiety

Assumption of homogeneity of variance. Another assumption is that of the homogeneity of variance, that is, the assumption that the spread or variance of the data on the dependent variable is comparable across different groups (Abu-Bader, 2021; Field, 2024). Violations of this assumption can result in inaccurate test statistics and p-values (Rotello et al., 2025). Levene's test was used to assess this for the Low Trait anxiety and High Trait anxiety groups. Non-significant *p*-values (> .05) were obtained across all dependent

variables, suggesting that variances were not significantly different between the anxiety groups on cToM, $F(1,71) = 0.675$, $p = .414$, aToM, $F(1,71) = 2.476$, $p = .120$, and on RME, $F(1,71) = 0.951$, $p = .159$. This suggests that the assumption of homogeneity for these variables across anxiety groups was met.

Parametric vs. nonparametric tests

When data are not normally distributed, nonparametric tests can be used to analyse data, as they are implemented independently of distribution (Demir, 2022; Field, 2024; Orcan, 2020). While parametric tests tend to have more statistical power when underlying assumptions are met, significant violation of these assumptions can reduce the power of these tests, hence nonparametric alternatives may be preferred (Abu-Bader, 2021; Field, 2024). However, some researchers argue that parametric tests, particularly with large sample sizes, can robustly withstand violations, and continue to provide a power advantage (Vrbin, 2022). The choice between parametric and nonparametric tests is not clear-cut and involves a balance between robustness and power of statistical analysis (Field, 2024). Some authors recommend running both parametric and corresponding nonparametric tests to evaluate the consistency in results (Abu-Bader, 2021). Hence, this approach was adopted in performing the statistical analyses involving the highlighted variable.

Sample demographics

The sample consisted of 73 participants with a mean age of 32.93 ($SD = 9.537$), and ages ranging from 20 to 63 years. Out of the total sample, 56 (76.7%) were female, and 17 (23.3%) were male. Mean years of education was of 17.16 years ($SD = 2.478$), and this ranged between 11 and 24 years, from secondary education level to post-graduate (Master's and Doctorate) level.

The 73 participants were divided into two groups based on their Trait-Total score: 40 participants comprised the Low Trait Anxiety (LA) group ($M = 31.36$, $SD = 4.44$), while 33

participants comprised the High Trait Anxiety (HA) group (M = 50.09, SD = 6.74). As reported in the methodology section, a threshold score of 40 was used to differentiate between the Low and High anxiety groups. Table 4 below presents the demographic characteristics of these groups. Chi-square analysis showed that the two groups did not differ in their Male:Female ratio, $\chi^2(1) = .535$, $p = .464$. Independent sample t-tests showed that LA and HA participant groups did not differ significantly in years of fulltime education, with means of 17.26 years (SD = 2.95, range = 13-20) and 17.05 years (SD = 1.78, range = 11-24) respectively, $t(71) = 0.387$, $p = .700$. The analyses indicated that age differed significantly across groups, with means of 36.75 years (SD = 10.07, range = 20-46) for the LA group, and 28.30 years (SD = 6.39, range = 21-63) for the HA group, $t(71) = 4.35$, $p = < .001$.

Table 4.

Means (standard deviations) for participants' demographic information

	Low Anxiety (n = 40)	High Anxiety (n = 33)	*p*-value
Male:Female	8:32	9:24	.464
Age	36.75 (10.07)	28.30 (6.39)	< .001**
Years of fulltime education	17.26 (2.95)	17.05 (1.78)	.700

Note: **significance at the 0.001 level (2-tailed).

Effects of trait anxiety levels on ToM performance

Tests of normality and homogeneity of variance indicated that data from all measures of ToM fulfilled the assumptions for parametric testing. Hence, separate independent samples t-tests were used to assess group differences in ToM performance. Results (Table 5 below) indicated that people with lower trait anxiety performed significantly better on ESCoT cognitive ToM compared to the high anxiety group ($t(71) = 2.656$, $p = .01$). A medium-large

effect size was noted, suggesting that anxiety had a meaningful negative impact on cognitive ToM abilities. On the other hand, performance on ESCoT affective ToM and RMET was equivalent between the two groups. These results indicate that, in this study, trait anxiety specifically impacted the cognitive aspects of theory of mind, with emotional understanding being preserved.

Table 5.

Trait Anxiety group comparisons across measures of ToM

Measure	Low Anxiety (n = 40)	High Anxiety (n = 33)	Comparison			
	Mean (SD)	Mean (SD)	Mean difference	*t*-test (df)	*p*-value	Cohen's d
cToM	23.28 (2.428)	21.85 (2.093)	1.427	$t(71) = 2.656$	.010*	0.625
aTom	27.40 (2.146)	27.48 (1.661)	-.085	$t(71) = -.186$	.853	-.044
RMET	27.08 (3.222)	27.12 (3.731)	-.046	$t(71) = -.057$	.955	-.013

Note: *significance at the 0.05 level (2-tailed).

Associations between Trait Anxiety, measures of ToM, and possible confounds

Pearson correlational analyses were conducted to explore the relationships between TA, ToM measures, age, years of education, and scores on the AQ-10, matrix reasoning, and vocabulary. The findings presented in Table 6 indicate that TA was significantly negatively correlated with age, suggesting that trait anxiety decreased with increasing age in this sample. However, age was not significantly correlated with any ToM measures. Years of education showed a significant positive correlation with both ESCoT affective ToM and the RMET task, indicating improved performance on these measures with higher educational attainment. In contrast, TA and ESCoT cognitive ToM were not significantly related to years of

education. Scores on the AQ-10 did not significantly correlate with any of the other variables. Both ESCoT affective ToM and RMET were significantly positively associated with vocabulary scores, and ESCoT affective ToM was also significantly related to matrix reasoning. These findings suggest that higher performance on the vocabulary tasks was associated with better ESCoT affective ToM and RMET performance. Furthermore, and higher performance on matrix reasoning was also associated with better ESCoT affective ToM performance. Finally, no significant correlations were found between matrix reasoning or vocabulary with either TA or ESCoT cognitive ToM, indicating that these variables were largely independent in this sample.

Table 6.

Correlations between Trait Anxiety, measures of ToM, and possible confounds

	Age	Years of education	AQ-10	Matrix Reasoning	Vocabulary
STICSA TA	-.449**	.035	-.017	-.124	.144
ESCoT cTOM	.230	-.054	-.158	-.008	-.020
ESCoT aTOM	-.078	.232*	.078	.263*	.463**
RMET	-.078	.388**	.022	.229	.537**

Note: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.001 level (2-tailed).

Exploring possible impact of confounds

Analysis of covariance

While initial analyses revealed significant group differences in cognitive ToM, it was important to determine whether these findings were influenced by other variables. To address this, a series of ANCOVAs (Analysis of Covariance) were planned to control for the effect of

age, verbal ability, perceptual reasoning, and autistic traits, which have been found in the literature to affect social cognitive performance (Baker et al., 2014; Baksh et al., 2018; Baksh et al., 2020; Bertrams & Schlegel, 2020; Charlton et al., 2009; Poljac et al., 2012). However, preliminary analyses testing the assumptions of ANCOVA revealed significant violations (see Appendix H for full analysis of assumptions). As the assumptions underlying ANCOVA were not met, alternative statistical approaches were required. The subsequent section details the use of multiple regression analyses to identify the best predictors of cognitive ToM.

Multiple regression analyses

Multiple regression analyses were therefore performed to identify the best predictor(s) of anxiety differences in cognitive ToM performance. When adding predictors to a regression model, a rationale is needed to demonstrate their relevance to the dependent variable (Field, 2024). Hence, while measures of verbal ability, perceptual reasoning, and autistic traits have been found to influence measures of social cognition in the literature (Baker et al., 2014; Bertrams & Schlegel, 2020; Charlton et al., 2009; Poljac et al., 2012), the above correlational analyses (Table 8) indicated that these measures did not correlate with ESCoT cognitive ToM. Adding variables that do not correlate would decrease statistical power by reducing degrees of freedom, which would also increase the standard errors of the associated variables, resulting in less precise parameter estimates (Rotello et al., 2025). These measures were therefore not included in the model. Literature, however, provides evidence for gender differences in ToM (e.g., Adenzato et al., 2017; Baron-Cohen et al., 2001a; Proverbio, 2023), hence gender was also included as a predictor.

A hierarchical regression analysis was therefore conducted to predict cTOM scores based on TA, gender, and age. Based on the correlation between cTOM scores and TA, TA was entered as the first predictor in the model. Gender was then included based on previous findings in the literature (Field, 2024).

In Model 1 (see Table 7 below), TA was entered as the only predictor. Analysis indicated that this model significantly predicted cTOM scores (b = -.0248, $t(72)$ = -2.16, p < .05) and explained 6.2% of the variance (R^2 = .062, p = .034). In Model 2, gender was also added to the model. The inclusion of gender improved the model fit, explaining an additional 5.3% of variance (ΔR^2 = .053). The total variance explained by Model 2 was 11.5% (R^2 = .115, p = .014). In this model, cognitive TOM was found to be predicted by both TA (b = -.0262, $t(72)$ = -2.33, p < .05) and gender (b = -0.232, $t(72)$ = -2.055, p < .05). These results indicate that both higher trait anxiety and being male predicted lower cToM scores.

Table 7.

Hierarchical regression analysis summary

Model	Predictor	B	Std. Error	Beta	*t*	Sig.	R^2	ΔR^2
1	Constant	24.787	1.035		23.950	< .001	.062	
	TA	-0.054	0.025	-0.248	-2.160	.034*		
2	Constant	25.210	1.033		24.407	< .001	.115	.053
	TA	-0.057	0.025	-0.262	-2.329	.023*		
	Gender	-1.293	0.629	-0.232	-2.055	.044*		

Note: *Correlation is significant at the 0.05 level (2-tailed)

Collinearity and heteroscedasticity checks

When conducting multiple regressions, a number of assumptions need to be considered. When multiple predictors are included in a regression model, the model should not demonstrate high multicollinearity, that is, high correlations between the predictor

variables (James et al., 2023). This would indicate that the predictor variables share a significant amount of variance, making it challenging to differentiate the effect of each variable on the dependent variable (Field, 2024; James et al., 2023). Two measures can be generated to diagnose multicollinearity problems; tolerance and its reciprocal value, the variance inflation factor (VIF; Rotello et al., 2025). Literature cites VIF values exceeding 5 or 10 as problematic (James et al., 2023). The VIF value for Model 2 was 1.004, and hence significantly lower than the threshold, suggesting little to no multicollinearity.

Homoscedasticity is another key consideration and assumption in linear regression, and it refers to the assumption that the variability of residuals (errors) of a statistical model is constant across all levels of the predictor variable (Abu-Bader, 2021; Field, 2024; Tabachnick & Fidell, 2018). Deviation from this results in heteroscedasticity, which can affect the reliability of statistical inferences (Field, 2024). In order to inspect for homoscedasticity, the model residuals and the predicted values from the model were generated using SPSS and plotted against each other. Based on both the P-P plot and scatterplot produced, there was no evidence of heteroscedasticity in the regression model. The P-P plot showed that the residuals closely follow the diagonal line, indicating that they were approximately normally distributed. Additionally, the scatterplot of standardised residuals against predicted values showed no clear pattern and appeared randomly distributed, which supported the assumption of homoscedasticity (Abu-Bader, 2021; Field, 2024).

Association between State Anxiety and measures of ToM

There was limited variability in SA scores across participants, hence it was decided to treat this independent variable as continuous. Therefore, correlational analyses were conducted to explore the relationships between SA and ToM measures. As data from SA was not normally distributed, both Pearson’s correlation and Spearman’s rank-order correlation

were conducted. However, using both analyses, no statistically significant associations were found. Pearson's correlation coefficients are detailed in Table 8 below.

Table 8.

Correlations between State Anxiety and measures of ToM

	cTOM	aTOM	RMET
STICSA TA	-.191	.154	.032

Conclusion

In conclusion, group comparisons showed that participants with high trait anxiety performed significantly worse on the ESCoT cognitive ToM measure than those with low trait anxiety. Furthermore, regression analyses indicated that both trait anxiety and gender predicted cognitive ToM performance. No group differences were found on ESCoT affective ToM and RMET. Finally, correlational analyses indicated no association between state anxiety and measures of ToM.

Discussion

Introduction

This study sought to, first, explore whether participants with high trait anxiety performed differently from those with low trait anxiety on measures of theory of mind. Second, it sought to evaluate whether varying levels of state anxiety impacted theory of mind performance. This chapter will discuss the results presented in the previous chapter, critically situating them within the context of existing relevant literature, offering possible explanations for the observed findings, and highlighting their potential implications.

Summary of findings

Significant group differences were found between high and low trait anxiety (TA) groups on the cognitive theory of mind (ToM) subtest of the Edinburgh Social Cognition Test (ESCoT). Specifically, participants in the high TA group performed worse on this task than those in the low TA group. Further analysis identified that both TA and gender predicted cognitive ToM performance; performance decreased with increasing anxiety symptoms, and females performed better than males. However, the inclusion of gender did not nullify the significance of TA as a predictor of cognitive ToM, indicating that gender differences in anxiety do not explain the association between TA and cognitive ToM.

No group differences were observed on the affective ToM subtest of the ESCoT and the Reading the Mind in the Eye Task, indicating that low and high TA groups performed comparably on these measures.

Finally, state anxiety (SA) was not significantly associated with any measure of ToM, suggesting that performance on these measures was not influenced by the transient levels of anxiety experienced by the participants during the assessment.

Trait anxiety and theory of mind performance

The first hypothesis of this study was that participants with high trait anxiety would perform differently from those with low trait anxiety on measures of ToM. Group comparisons between low and high TA groups provided some support for this hypothesis, however, findings suggest that the impact of anxiety was limited to ESCoT cToM performance. Specifically, the low TA group demonstrated a greater mean score on ESCoT cToM when compared to the high TA group. On the other hand, no differences were found in performance on the ESCoT aToM or RMET between the low and high TA groups. The current findings therefore provide conditional support to the first hypothesis, in that the impact of trait anxiety appears to be limited to individuals' ability to make inferences about people's thoughts, beliefs, and intensions but not inferences about people's feelings and emotional states.

The observed negative association between anxiety and ToM replicates the trend which is reported across research exploring this relationship. In accordance with previous studies (e.g., Alvi et al., 2020; Brayley et al., 2023; Bulhmann et al., 2015; Hezel & McNally, 2014; Lyvers et al., 2019; Maleki et al., 2020; Washburn et al., 2016) and meta-analyses (e.g., Alvi et al, 2022; Baez et al., 2023; Briscoe et al., 2024; Surtees et al., 2024), people with higher trait anxiety exhibited a reduced ability to make attributions regarding another person's mental states in given social interactions when compared to those with lower trait anxiety. This association was evident both when trait anxiety was categorised based on a cut-off score (high vs. low TA) and when explored using regression analyses. Indeed, regression analyses confirmed that higher symptom severity was associated with a greater level of difficulties.

However, as previously reported, variability in findings across studies exists, with other researchers reporting no significant differences in performance between high anxiety

and control groups (e.g., Chevalier et al., 2023; Lenton-Brym et al., 2018; Pepper et al., 2018). Different factors have been posited to account for this variability, including the presence of confounding variables that might moderate the relationship (Baez et al., 2023). However, in the present study, no confounds appeared to account for this relationship. Among the potential factors explored in this study, that is, age, verbal skills, perceptual reasoning, and autism traits, none correlated with cToM performance, hence suggesting that these factors did not account for the group differences observed in cToM (Alvi et al., 2022). However, gender was noted to be a significant predictor of cToM performance, with female participants outperforming their male counterparts. Notwithstanding, the inclusion of gender in the regression analysis, while adding predictive power, did not nullify the significance of TA as a predictor of cToM, indicating that gender differences in anxiety do not explain the relationship between TA and cToM.

The observed gender difference concurs with findings in literature, where better social cognitive abilities are noted in females (Adenzato et al., 2017; Baksh et al., 2020; Baron-Cohen et al., 2001a). A prominent theory explaining this difference, Baron-Cohen's (2010) empathising/systematising theory, asserts that females tend to be more empathising and focused on others' mental states, while males are more systematising and oriented towards understanding rule-based systems. It has been hypothesised that this female attunement to affective social stimuli is an evolutionary adaptation, driven by the need to detect and respond to newborns' needs postnatally (Baron-Cohen, 2010).

While the present study confirms the predominant trend that higher anxiety has a negative impact on ToM, a more granular exploration of results is necessary to better understand the processes underlying the current findings. As discussed above, a negative association between anxiety and ToM was only reported for performance on ESCoT cognitive ToM. No association was reported between anxiety and ESCoT affective ToM or anxiety and

RMET. This suggests the presence of a dissociation between the impact of anxiety on cognitive and affective aspects of ToM, which will be discussed further below. The next section, however, will focus on the results obtained on RMET, given the task's widespread use in ToM research within the context of anxiety.

Trait anxiety and RMET

No significant difference in RMET performance was found between the low and high trait anxiety groups. The groups scored comparably in identifying mental states from eye-region photographs suggesting that trait anxiety levels did not influence the ability to decode social cues in this task. Interestingly, this contrasts with most studies that employed this task as a measure of ToM, where significant group differences emerged. In literature, high anxiety participants tend to demonstrate poorer RMET performance, exhibiting reduced accuracy in making mental state inferences from facial cues when compared to their low anxiety/healthy controls counterparts. This pattern has been reported across several studies (e.g., Alvi et al., 2020; Lyvers et al., 2019; Maleki et al., 2020; Tetik et al., 2022). Interestingly, this tends to contrast with less consistent findings reported in studies employing more dynamic, scenario-based tasks which provide richer social contexts. This discrepancy has led to a general conclusion that high-anxiety individuals may exhibit specific difficulties in decoding mental states from readily observable cues, such as facial expressions, as opposed to social cognitive reasoning (Baez et al., 2023). The results of the present study, however, contrast this finding as no group differences were noted between high/low anxiety groups, nor was RMET performance correlated with TA symptom severity.

Importantly, however, as has been discussed in the literature review, most studies exploring ToM in the context of anxiety have focused on clinical samples, and more specifically on individuals with SAD. It is therefore likely that the characteristics of the sample used in the present study contribute to the discrepancy in findings. Indeed, this study

purposefully sought to explore the impact of anxiety in a non-clinical sample. Anxiety was operationalised from a dimensional perspective and measured based on the severity of anxiety symptoms rather than dichotomously, using clinical classification. Furthermore, no specific focus was placed on SAD-specific symptoms.

Hence, one possible explanation for the discrepancy in findings is that RMET performance is more sensitive to clinical levels of anxiety or to specific symptom profiles (e.g., SAD), rather than to subclinical or general anxiety symptoms. This potential explanation is supported by the findings of Braley et al. (2023), the only study identified which examined the relationship between anxiety symptoms and ToM in non-clinical samples. Furthermore, in measuring anxiety, the authors employed the Multidimensional Anxiety Questionnaire (MAQ; Reynolds, 1999) which, similarly to the STICSA, provides a global assessment of anxiety symptomatology. Notably, Braley and colleagues (2023), similarly to the present study, reported no significant findings on measures of affective ToM, which included the use of RMET.

The comparable nature of these findings therefore suggests that it is plausible that RMET performance is sensitive to clinical levels of anxiety and/or that it is more susceptible to disruption in the presence of SAD symptoms. The impact of less severe and/or more generic symptoms of anxiety may therefore be less significant and impactful on RMET performance. Indeed, studies have found that individuals with higher social anxiety symptoms tend to demonstrate poorer externally focused mentalisation skills, which refer to those skills that allow the interpretation of behaviour based on visible cues (Chevalier et al., 2023). This aligns with the nature of RMET, which relies on recognising mental states from eye expressions.

Further evidence for the potential selective impact of social anxiety–related symptomatology on RMET performance emerges from GAD literature. Indeed, in their meta-

analysis, Baez and colleagues (2023), report a lack of robust evidence for RMET performance disruption among GAD populations. As highlighted in the literature review, only one study was identified (Aydın et al., 2019) which reported impaired RMET performance in GAD samples when compared to healthy controls. Overall, therefore, taken together, this evidence could suggest that the null group comparison findings on RMET performance possibly emerge as a function of the non-clinical nature of the current sample and the general, dimensional approach to measuring anxiety symptoms. Specifically, the symptomatology captured in the current sample may not impact the ability to decode affective mental states as measured by the RMET.

Dissociation between cognitive and affective aspects of ToM

As highlighted above, the present findings suggest a dissociation between the impact of anxiety as measured in the present study on cognitive and affective aspects of ToM. Higher trait anxiety levels resulted in poorer cToM performance, but did not impact aToM. Few studies have directly explored the distinct impact anxiety has on aToM and cToM, despite this dissociation being widely documented in literature (e.g., Campanella et al., 2022; Ruitenberg et al., 2020; Shamay-Tsoory et al., 2007). Notwithstanding this, the present findings of a dissociation between these two ToM subcomponents replicate the findings of two other studies which explored the differential impact of anxiety on aToM and cToM.

In their study, Buhlamm and colleagues (2015) found that, high-anxiety individuals exhibited a significantly poorer performance when compared to healthy controls on the MASC when making inferences about the thoughts and intentions of character (cToM). However, no group differences were reported with respect to participants' ability to make inferences about the characters' emotions (aToM). Similarly, Braley and colleagues (2023) found that high levels of anxiety resulted in poorer cToM performance in both older and younger participants, while aToM was unaffected by anxiety in both age groups. In the

younger adult group specifically, they observed a progressive decline in cToM performance once anxiety symptoms exceeded a clinical threshold. This aligns with the current findings, which show a significant group difference in cToM between participants with high and low TA, and regression analyses showing poorer cToM performance with increasing TA symptoms.

A possible explanation for these findings and the apparent selective impact of anxiety on the ability to make inferences about others' thoughts and intentions, but not the ability to make emotional state attributions, may lie in the neural and cognitive substrates that underlie these social cognitive processes. As has been discussed in the literature review, high TA is associated with impairments in domain general processes, particularly in cognitive control and executive functions (e.g., Eysenck et al., 2005; Nyberg et al., 2021; Park & Moghaddam, 2017). These cognitive abilities have been posited to play a role in efficient ToM attributions (Meinhardt-Injac et al., 2018; Wade et al., 2018). Consequently, anxiety-induced impairment in executive functions may result in reduced ToM performance (Apperly & Butterfill, 2009; Shields et al., 2016; Surtees et al., 2024).

However, cToM may be more susceptible to impairments in executive functions than affective aspects of ToM (Braley et al., 2023). Studies have indeed highlighted an association between cToM and executive functions (Fischer et al., 2017; Henry et al., 2013). aToM, on the other hand, tends to be more associated with crystallised cognitive abilities that are less susceptible to the effects of anxiety (Braley et al., 2023; Kermarrec et al., 2020; Troller-Renfree et al., 2015). Indeed, in the present study, aToM but not cToM, was significantly correlated with vocabulary ability.

Cognitive ToM and executive functions share common neural substrates, specifically involving the dlPFC network (Abu-Akel & Shamay-Tsoory, 2011; Kalbe et al., 2010; Ruitenberg et al., 2020; Shamay-Tsoory & Aharon-Peretz, 2007), whose activity is known to

be impacted by trait anxiety (Morgenroth et al., 2019). Hence, anxiety-related disruptions to executive abilities may be particularly pronounced in cToM, which involves more complex and abstract processes than making inferences about emotions (Kalbe et al., 2010). This is supported by the findings of Yeh and colleagues (2016) who found that frontal lobe patients continued to demonstrate significant deficits in aToM compared to controls, even when controlling for executive functions. Conversely, no group differences were noted in cToM performance when executive functions were accounted for, suggesting that executive functions selectively underlie cToM functioning.

On the other hand, aToM may rely on more implicit empathic processes (Shamay-Tsoory et al., 2006). For example, Kalbe et al. (2010) propose that aToM may involve automated affect sharing through a simulation process, whereby the individual imagines their own feelings in similar contexts, which is thought to be less reliant on cognitive control processes. Hence, the differential cognitive and neural demands of cognitive and affective ToM may account for the observed selective impact of anxiety on cToM. Further research is however needed to explore the influence of executive functions and elucidate the specific mechanisms that underlie and mediate the observed dissociation.

Importantly, this dissociation emerged when measuring both ToM components within the same task (the ESCoT). This allowed for the performance on aToM and cToM to be compared in an equivalent manner, minimising the potentially confounding impact that task-specific demands may have on performance when comparing these two subcomponents using different tasks. Hence, despite being shown the same stimuli under the same conditions, people with high TA exhibited poorer performance on cToM when compared to low anxiety counterparts, while performing comparably on aToM. This finding therefore supports the notion that the impact of anxiety on cToM is not simply a byproduct of task demands (Baez et al., 2023). Furthermore, the ESCoT is an ecologically valid measure of ToM, suggesting

that impact of anxiety on ToM emerges even when employing stimuli that mimic real-world social interactions, rather than being limited to highly controlled, laboratory-based tasks. This therefore provides support to the possibility that the poorer performance on cToM among high anxiety individuals potentially reflects an actual vulnerability of cToM to anxiety when compared to aToM. This, in turn, possibly manifests the differing neural and cognitive correlates of these two subcomponents of ToM.

ToM decoding and ToM reasoning

The null findings in RMET, a decoding task of ToM, and the selective impact of anxiety on ESCoT cToM, a reasoning task of ToM, align with emerging evidence of a dissociation between ToM decoding and ToM reasoning (Cao et al., 2012; Njomboro et al., 2008; Sabbagh et al., 2004). They also concur with findings from studies exploring more general forms of anxiety (e.g., Braley et al., 2023). However, they contrast with findings from SAD populations, that report impaired decoding but spared reasoning ToM abilities in people with SAD (e.g., Alvi et al., 2020). Taken together, these findings suggests that differing anxiety subtypes may have different patterns of vulnerability that impact different social cognitive abilities differently.

It is possible, for example, that in socially anxious individuals, negative interpretation biases toward external stimuli impair mechanisms involved in decoding tasks (e.g., interpretation of facial expressions; Chevalier et al., 2023; Huppert et al., 2003). In contrast, general anxiety may more broadly disrupt control mechanisms, by increasing cognitive load and interfering with sustained, goal-directed processing, thereby impairing more complex ToM reasoning tasks (Briscoe et al., 2024; Eysenck et al., 2007). However, the current study, does not test these possible causal mechanisms. Further research is needed to systematically explore the differential impact that different profiles of anxiety symptomatology might have

on various measures – and thus mechanisms – of ToM, to more clearly elucidate the impact of anxiety on this important social cognitive ability.

State anxiety and theory of mind performance

The second hypothesis of the study was that associations exist between levels of SA and ToM performance. However, no support was found for this hypothesis in the current study. Correlational analyses revealed no significant relationships between individuals' state anxiety levels and their performance on any of the ToM measures.

These findings contrast with previous studies, which highlighted an association between incidental or state anxiety and measures of ToM. Indeed, three studies found that increased incidental or state anxiety resulted in poorer performance on measures closely linked to ToM, including emotional and cognitive empathy (Deuter et al., 2018) and perspective-taking (Todd et al., 2015; Todd & Simpson, 2016). On the other hand, Zainal and Newman (2018) found that worry induction in individuals with GAD enhanced their accuracy in ToM. However, important methodological differences exist between the current and prior studies which warrant consideration. First, the previous three studies employed experimental anxiety induction either through a startle response paradigm (Deuter et al., 2018), or through an emotionally evocative recall task (Todd et al., 2015; Todd & Simpson, 2016; Zainal & Newman, 2018). On the other hand, the current study did not manipulate state anxiety, but rather recorded individuals' natural state and responses to the testing situation. It is therefore possible that the data collection session in-and-of-itself was not perceived as anxiety provoking for participants (Leal et al., 2017). This is further compounded by the transient nature of SA (Saviola et al., 2020), such that the intensity of any situational anxiety might have further subsided as participants eased into the session.

Considering that pre-assessment mean SA for the sample was already relatively low (M =33.96, out of a possible total of 84), it is plausible that their level of state arousal during

the execution of ToM tasks might have been too low to influence their social cognitive functioning. Indeed, Zainal and Newman (2018) explicitly found that worry induction versus relaxed states, resulted in different patterns of functioning on ToM tasks in high anxiety and control groups. This highlights the idea that significant alterations in arousal levels may be necessary for observing any changes in individuals' ToM performance. The absence of anxiety-inducing manipulations in the current study may thus have contributed to the non-significant findings.

Another possible source for the divergence in results is that, in the present study, state anxiety was operationalised in terms of dimensional symptom severity on a self-report measure, which captures subjective interpretations of physiological arousal. On the other hand, the other studies utilised more objective approaches to define state anxiety levels, including electrophysiological measures (Deuter et al., 2018) and experimental conditions (Todd et al., 2015; Todd & Simpson, 2016; Zainal & Newman, 2018). Studies have shown that self-report measures do not always correlate with more objective measures, as demonstrated by Gallego and colleagues (2022), who found no correlation between self-reported public speaking anxiety and physiological measures, such as skin conductance and heart rate variability, during speech tasks. This implies that different aspects of the anxiety response might have been recorded across studies, contributing to the contrasting findings.

However, the present null findings on behavioural measures are not isolated in literature. A recent study by Chang and Engelmann (2024), investigated the impact of incidental anxiety, as induced by a threat-of-shock procedure, on behavioural performance on false-belief tasks and on neural activation and connectivity. This study found that the threat-of-shock procedure successfully increased physiological and self-reported arousal levels and resulted in disruptions of the neural networks involved in social cognitive abilities, by weakening the connectivity between social cognitive and attentional control systems.

However, this did not result in result in any significant impacts on false belief task accuracy or efficiency (Chang & Engelmann, 2024). This finding therefore suggests that the impact of incidental anxiety on social cognition, while present, might not be detected through all behavioural measures. It is therefore also possible that the tasks employed in the current study were not sensitive enough to detect these changes, especially given that, as postulated above, the levels of incidental arousal in the present study are anticipated to be much lower than those induced by experimental induction.

Overall, different methodological and task-based properties may help explain the divergence between the current findings on the impact of SA on ToM and those reported in previous research.

Conclusion

In conclusion, this chapter examined the findings obtained through statistical analyses, discussing them in the context of existing literature on anxiety and ToM. Overall, the findings provided some support to existing findings that indicate that TA is negatively associated with ToM. However, findings also revealed that TA differentially impacts cognitive and affective aspects of ToM, pointing to a dissociation between these two constructs. This dissociation was discussed considering possible explanatory mechanisms. In contrast with previous research, the present study found no associations between SA and any ToM measures, possibly reflecting methodological and task-sensitivity differences.

Overall, the present findings contribute to a more nuanced understanding of how different forms and severities of anxiety may interact with distinct components of ToM, and underscore the importance considering of task design, population characteristics, and measurement methods in anxiety-ToM research.

Conclusion

Introduction

This study explored whether group differences in trait anxiety and varying levels of state anxiety are associated with theory of mind performance. Following a review of the existing literature on anxiety and theory of mind, group comparisons and correlational analyses were performed to test the study's hypotheses. The results obtained from these analyses were presented and then discussed with reference to relevant literature, providing, where possible, potential explanations for the reported findings.

The current chapter will first provide a summary of this study's findings, which have been discussed in the preceding chapter. It will then explore the study's strengths and limitations. Possible implications of the findings, as well as future directions for research will also be discussed.

Summary of findings

In this study, two main hypotheses relating to trait anxiety (TA) and state anxiety (SA) were tested through group comparisons and correlational analyses. Anxiety levels were operationalised as the participants' scores on a self-report measure, which captured both the individuals' enduring patterns of experiencing anxiety symptoms, TA, and their transient, in-the-moment, experience of anxiety symptoms, SA.

Overall, the findings highlighted significant group differences in cognitive theory of mind (ToM) across TA levels, such that participants with high TA performed worse than those with low TA on the cognitive ToM subtest of the Edinburgh Social Cognition Test. Further exploration using multiple regression analyses to assess the role of possible confounding variables in this association, revealed that both trait anxiety and gender were significant predictors of cognitive ToM. Higher levels of TA resulted in poorer cognitive ToM

performance, while being female predicted better performance. Notably, the inclusion of gender did not nullify the significant negative association between TA and cognitive ToM.

No significant differences in performance on other measures of ToM were noted across TA groups. Finally, no significant associations were noted between varying levels of SA and performance on any ToM measures. The study, therefore, only provided conditional support for the tested hypotheses.

Strengths of the study

This study offers notable strengths in its investigation of the association between anxiety and ToM. Firstly, in response to recommendations in the literature, and in an attempt to address limitations identified in previous studies, multiple measures of ToM were administered to the same sample under the same conditions, which allowed a direct comparison of the impact of anxiety on different assessments of this social cognitive ability, and by extension, its influence on the distinct underlying processes, such as decoding versus reasoning mechanisms involved in ToM (Alvi et al., 2022).

Additionally, the current study acknowledged the multicomponent nature of ToM, exploring the association of both its cognitive and affective domains with anxiety. This was particularly important, as the observed dissociation between these two domains can help shed light on possible mechanisms underlying the association under study (Braley et al., 2023). Furthermore, the use of a unified task assessing both cognitive ToM and affective ToM, the ESCoT, ensured methodological consistency in measuring these subcomponents, reducing task-related confounding effects that might impact performance, thereby increasing the validity of the study's findings of a dissociation between cognitive ToM and affective ToM (Baksh et al., 2018). Furthermore, the ESCoT's ecological validity, through its use of information-rich visual-dynamic stimuli, better reflected real-world social interactions, improving the generalisability of the study's findings to everyday contexts (Baez et al., 2023).

The approach to measuring anxiety was another strength of this study. The study adopted a multidimensional approach to measuring anxiety, systematically examining both trait and state anxiety. This allowed for a more nuanced exploration of the impact of anxiety on ToM, enabling the researcher to address the differential impact of different forms of anxiety on this social cognitive process. Furthermore, the measure used, the STICSA, was designed to better discriminate between anxiety and depression symptoms, which is particularly relevant as symptoms of depression are related to poorer social cognitive abilities (Genova et al., 2020; Petrovic et al., 2023).

Finally, the research considered the impact of several possible confounding variables, including gender, years of education, vocabulary, perceptual reasoning, and autism traits, but found that none accounted for the reported association between TA and cognitive ToM. This effort to isolate the specific impact of anxiety on ToM allowed for more robust inferences that the observed effects related to anxiety rather than demographic or cognitive factors.

Limitations

The limitations of this study should also be acknowledged. While the sample size was deemed adequate to detect medium effect sizes (Cohen, 1992), it was relatively small when compared to other studies in this field of research. Therefore, the current study might have been underpowered to detect relationships with small effect sizes, thereby limiting the study's findings and conclusions. Furthermore, characteristics of the sample might have impacted findings, while also limiting its generalisability. Firstly, the sample consisted primarily of individuals aged between 20 and 35, who were predominantly female (76.7%). In addition to limiting the generalisability of findings, the gender imbalance might have skewed the results obtained given the known association between social cognition and gender (Adenzato et al., 2017). Secondly, most participants were highly educated, with mean years of education being 17.16 years, and with a large proportion of participants having achieved tertiary education.

However, this contrasts with current figures that indicate that only about a third of the Maltese population has achieved a tertiary level of education (Eurostat, 2020), suggesting that the sample may not be representative of the general Maltese population. This is particularly relevant to the present study given the known negative association between years of education and anxiety (Joannès et al., 2023).

Anxiety was measured using a self-report rating scale. Such measures are vulnerable to bias, including social desirability biases (Durmaz et al., 2020), and inaccurate responding (Latkin et al., 2017), thereby potentially impacting the accuracy of anxiety measurement in the study. While efforts were made to minimise the identified biases by allowing participants to complete self-reports independently, it is still possible that the researcher's presence, as well as the participants' awareness of the study's aims, might have impacted their responding. Another limitation pertaining to the measurement of anxiety specifically relates to the SA subscale. As noted in the discussion, incidental (state) anxiety levels in the study were relatively low, likely due to the absence of any anxiety-inducing experimental manipulations. This likely limited the ability of the present study to meaningfully evaluate the impact of SA on ToM.

Another limitation of the study is its failure to measure other variables that might moderate or mediate the relationship under study. For example, depression is known to often be comorbid with anxiety (Chen, 2022) and to impact social cognitive abilities (Weightman et al., 2014). Executive functions, which, as discussed, could mediate the impact of anxiety on ToM, were also not examined. A more comprehensive understanding of the association between anxiety and ToM would therefore require the exploration of such variables.

Finally, the measures employed in this study were not validated on a Maltese population, however, no alternative assessments could have been used owing to the absence of measures standardised in the local context. Furthermore, the language demands of certain

assessments, particularly the STICSA where questions were administered in English, might have influenced participants' understanding, impacting the accuracy of measurement.

Implications of the study

The overall finding of a negative association between anxiety and ToM highlights that social cognition is an important neurocognitive domain to consider in individuals with anxious presentations, even when working with non-clinical populations (Gur & Gur, 2016). In clinical practice, therefore, the assessment of social cognition more broadly, and ToM more specifically, may be warranted to inform clinical formulation and to understand the full scope of challenges anxious individuals might be experiencing. Assessing core processes, such as the potential impact of anxiety on ToM, rather than focusing solely on diagnostic criteria, might be especially important given its established and significant role in functional outcomes and recovery (Javed & Charles, 2018; Sasson et al., 2020). This broader approach to assessment can in turn inform intervention planning, as treatments that target social cognitive difficulties may help mitigate anxiety symptoms and possible consequent difficulties in social functioning (Chevalier et al., 2023).

The findings also suggest that the association between anxiety and ToM can differ depending on the specific subtype of anxiety and the ToM component being assessed. This suggests that it would be beneficial to assess different aspects of ToM to effectively outline and identify profiles of social cognitive abilities across specific mental health conditions. Beyond its implications for clinical practice, the current findings also highlight that the assessment of different components of ToM across different subtypes of anxiety is warranted in research to more clearly elucidate the nature of this relationship.

Future directions for research

Informed by the current findings and the limitations of this study, a number of recommendations are put forward. Future research could replicate the present study

employing a larger sample, that more accurately represents the target population to ensure that the obtained findings generalise beyond the sample of the study. This would also add statistical power, allowing for the detection of smaller effect sizes and increasing the robustness of the results.

Future studies should also examine the role that possible moderators, such as depression, might play in the association between ToM and anxiety. Additionally, given that executive functions have been proposed as a possible mediating mechanism in the association between anxiety and ToM, future studies should explore potential associations between the ToM and cognitive processes, such as inhibition, cognitive flexibility, and working memory, in the context of anxiety. Such studies could help isolate the specific impact of anxiety on ToM, while offering possible insight into underlying mechanisms in this relationship.

More studies are also needed to better delineate the specific social cognitive profiles associated with different types of anxiety. Future research could therefore systematically explore the impact of different types and levels of anxiety symptomatology across multiple measures of ToM, to provide a comprehensive picture of this relationship. The inclusion of ecologically valid paradigms, such as the ESCoT used in the present study, is recommended, to provide better insight on the impact of anxiety in real-world situations. Additionally, the real-world implications of the observed negative association between anxiety and ToM could be explored by including measures assessing well-being and functional outcomes.

Conclusion

In conclusion, the current study has contributed to the field of neuropsychology by enhancing our understanding of how anxiety, particularly trait anxiety, can impact specific aspects of social cognition. Despite the study's limitations, the findings provide preliminary support for the potential value of including ToM assessment in clinical evaluations and research in the context of anxiety.

References

Abu-Akel, A., & Shamay-Tsoory, S. (2011). Neuroanatomical and neurochemical bases of theory of mind. *Neuropsychologia, 49*(11), 2971–2984. https://doi.org/10.1016/j.neuropsychologia.2011.07.012

Abu-Bader, S. H. (2021). *Using statistical methods in social science research: With a complete SPSS guide* (3rd ed.). Oxford University Press.

Adenzato, M., Brambilla, M., Manenti, R., De Lucia, L., Trojano, L., Garofalo, S., ... & Cotelli, M. (2017). Gender differences in cognitive Theory of Mind revealed by transcranial direct current stimulation on medial prefrontal cortex. *Scientific Reports, 7*(1), 41219. https://doi.org/10.1038/srep41219

Adolphs, R. (1999). Social cognition and the human brain. *Trends in Cognitive Sciences*, *3*(12), 469-479. https://doi.org/10.1016/S1364-6613(99)01399-6

Adolphs, R. (2009). The social brain: neural basis of social knowledge. *Annual Review of Psychology*, *60*(1), 693-716. https://doi.org/10.1146/annurev.psych.60.110707.163514

Adu, P., & Miles, D. A. (2024). *Dissertation research methods: A step-by-step guide to writing up your research in the social sciences.* Taylor & Francis.

Aguinis, H., Gottfredson, R. K., & Joo, H. (2013). Best-practice recommendations for defining, identifying, and handling outliers. *Organizational Research Methods, 16*(2), 270-301. https://doi.org/10.1177/1094428112470848

Allison, C., Auyeung, B., & Baron-Cohen, S. (2012). Toward brief “red flags” for autism screening: the short autism spectrum quotient and the short quantitative checklist in 1,000 cases and 3,000 controls. *Journal of the American Academy of Child & Adolescent Psychiatry, 51*(2), 202-212. https://doi.org/10.1016/j.jaac.2011.11.003

Alvi, T., Kouros, C. D., Lee, J., Fulford, D., & Tabak, B. A. (2020). Social anxiety is negatively associated with theory of mind and empathic accuracy. *Journal of Abnormal Psychology, 129*(1), 108-113. https://doi.org/10.1037/abn0000493

Alvi, T., Kumar, D., & Tabak, B. A. (2022). Social anxiety and behavioral assessments of social cognition: A systematic review. *Journal of Affective Disorders, 311*, 17-30. https://doi.org/10.1016/j.jad.2022.04.130

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). American Psychiatric Publishing. https://doi.org/10.1176/appi.books.9780890425787

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Publishing. https://doi.org/10.1176/appi.books.9780890425596

Amodio, D. M., & Frith, C. D. (2006). Meeting of minds: The medial frontal cortex and social cognition. *Nature Reviews Neuroscience, 7*, 268–277. http://dx.doi.org/10.1038/nrn1884

André, Q. (2022). Outlier exclusion procedures must be blind to the researcher's hypothesis. *Journal of Experimental Psychology: General, 151*(1), 213–223. https://doi.org/10.1037/xge0001069

Andreou, C., Kelm, L., Bierbrodt, J., Braun, V., Lipp, M., Yassari, A. H., & Moritz, S. (2015). Factors contributing to social cognition impairment in borderline personality disorder and schizophrenia. *Psychiatry Research, 229*(3), 872-879. http://dx.doi.org/10.1016/j.psychres.2015.07.057

Angst, J., & Merikangas, K. R. (2001). Multi-dimensional criteria for the diagnosis of depression. *Journal of Affective Disorders, 62*(1-2), 7-15. https://doi.org/10.1016/S0165-0327(00)00346-3

Apperly, I. (2010). *Mindreaders: The cognitive basis of "theory of mind".* Psychology Press.

Apperly, I. A., & Butterfill, S. A. (2009). Do humans have two systems to track beliefs and belief-like states? *Psychological Review, 116*(4), 953-970. https://doi.org/10.1037/a0016923

Arioli, M., Cattaneo, Z., Ricciardi, E., & Canessa, N. (2021). Overlapping and specific neural correlates for empathizing, affective mentalizing, and cognitive mentalizing: A coordinate-based meta-analytic study. *Human Brain Mapping, 42*(14), 4777-4804. https://doi.org/10.1002/hbm.25570

Aydın, O., Balıkçı, K., Çökmüş, F. P., & Ünal Aydın, P. (2019). The evaluation of metacognitive beliefs and emotion recognition in panic disorder and generalized anxiety disorder: effects on symptoms and comparison with healthy control. *Nordic Journal of Psychiatry, 73*(4-5), 293-301. https://doi.org/10.1080/08039488.2019.1623317

Baez, S., Tangarife, M. A., Davila-Mejia, G., Trujillo-Güiza, M., & Forero, D. A. (2023). Performance in emotion recognition and theory of mind tasks in social anxiety and generalized anxiety disorders: A systematic review and meta-analysis. *Frontiers in Psychiatry, 14*, 1192683. https://doi.org/10.3389/fpsyt.2023.1192683

Baggio, T., Grecucci, A., Meconi, F., & Messina, I. (2023). Anxious brains: A combined data fusion machine learning approach to predict trait anxiety from morphometric features. *Sensors, 23*(2), 610. https://doi.org/10.3390/s23020610

Baker, C. A., Peterson, E., Pulos, S., & Kirkland, R. A. (2014). Eyes and IQ: A meta-analysis of the relationship between intelligence and “Reading the Mind in the Eyes”. *Intelligence, 44*, 78-92. https://doi.org/10.1016/j.intell.2014.03.001

Baksh, R. A., Abrahams, S., Auyeung, B., & MacPherson, S. E. (2018). The Edinburgh Social Cognition Test (ESCoT): Examining the effects of age on a new measure of theory of

mind and social norm understanding. *PloS one, 13*(4), e0195818. https://doi.org/10.1371/journal.pone.0195818

Baksh, R. A., Abrahams, S., Bertlich, M., Cameron, R., Jany, S., Dorrian, T., ... & Auyeung, B. (2021). Social cognition in adults with autism spectrum disorders: Validation of the Edinburgh Social Cognition Test (ESCoT). *The Clinical Neuropsychologist*, *35*(7), 1275-1293.

Baksh, R. A., Bugeja, T., & MacPherson, S. E. (2020). Executive functions do not underlie performance on the Edinburgh Social Cognition Test (ESCoT) in healthy younger and older adults. *Journal of the International Neuropsychological Society, 26*(5), 527-538. https://doi.org/10.1017/S1355617719001450

Baksh, R. A., MacPherson, S. E., Auyeung, B., Pal, S., & Abrahams, S. (2024). The relationship between social cognitive processes and behavior changes in people with amnestic mild cognitive impairment or dementia using the Edinburgh Social Cognition Test (ESCoT). *Neuropsychology, 38*(3), 223–238. https://doi.org/10.1037/neu0000929.

Ballespí, S., Pérez-Domingo, A., Vives, J., Sharp, C., & Barrantes-Vidal, N. (2018). Childhood behavioral inhibition is associated with impaired mentalizing in adolescence. *PLoS One, 13*(3), e0195303. https://doi.org/10.1371/journal.pone.0195303.

Balsamo, M., Innamorati, M., Van Dam, N. T., Carlucci, L., & Saggino, A. (2015). Measuring anxiety in the elderly: psychometric properties of the state trait inventory of cognitive and somatic anxiety (STICSA) in an elderly Italian sample. *International Psychogeriatrics, 27*(6), 999-1008. https://doi.org/10.1017/S1041610214002634

Baron-Cohen, S. (2010). Empathizing, systemizing, and the extreme male brain theory of autism. *Progress in Brain Research, 186*, 167–175. https://doi.org/10.1016/B978-0-444-53630-3.00011-7

Baron-Cohen, S., Jolliffe, T., Mortimore, C., & Robertson, M. (1997). Another advanced test of theory of mind: Evidence from very high functioning adults with autism or Asperger Syndrome. *Child Psychology & Psychiatry & Allied Disciplines, 38*(7), 813–822. https://doi.org/10.1111/j.1469-7610.1997.tb01599.x

Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., & Plumb, I. (2001a). The "Reading the Mind in the Eyes" test revised version: A study with normal adults, and adults with Asperger syndrome or high-functioning autism. *Journal of Child Psychology and Psychiatry, 42*, 241–251. https://doi.org/10.1111/1469-7610.00715

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001b). The autism-spectrum quotient (AQ): Evidence from asperger syndrome/high-functioning autism, malesand females, scientists and mathematicians. *Journal of Autism and Developmental Disorders, 31*, 5-17. https://doi.org/10.1023/A:1005653411471

Barros, F., Figueiredo, C., Brás, S., Carvalho, J. M., & Soares, S. C. (2022). Multidimensional assessment of anxiety through the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA): From dimensionality to response prediction across emotional contexts. *PLoS One, 17*(1), e0262960. https://doi.org/10.1371/journal.pone.0262960

Bateson, M., Brilot, B., & Nettle, D. (2011). Anxiety: An evolutionary approach. *The Canadian Journal of Psychiatry, 56*(12), 707-715. https://doi.org/10.1177/070674371105601202

Beaudoin, C., & Beauchamp, M. H. (2020). Social cognition. In A. Gallagher, C. Bulteau, D. Cohen & J.L. Michaud (Eds.) *Handbook of clinical neurology* (*Vol. 173*, pp. 255-264). Elsevier.

Beck, A. T., Emery, G., & Greenberg, R. L. (2005). *Anxiety disorders and phobias: A cognitive perspective.* Basic Books/Hachette Book Group.

Benson, N., Hulac, D. M., & Kranzler, J. H. (2010). Independent examination of the Wechsler Adult Intelligence Scale-Fourth Edition (WAIS-IV): What does the WAIS-IV measure? *Psychological Assessment, 22*(1), 121–130. https://doi.org/10.1037/a0017767

Bertrams, A., & Schlegel, K. (2020). Speeded reasoning moderates the inverse relationship between autistic traits and emotion recognition. *Autism, 24*(8), 2304-2309. https://doi.org/10.1177/1362361320937090

Bjelland, I., Lie, S. A., Dahl, A. A., Mykletun, A., Stordal, E., & Kraemer, H. C. (2009). A dimensional versus a categorical approach to diagnosis: Anxiety and depression in the HUNT 2 study. *International Journal of Methods in Psychiatric Research, 18*(2), 128-137. https://doi.org/10.1002/mpr.284

Bolis, D., Dumas, G., & Schilbach, L. (2023). Interpersonal attunement in social interactions: from collective psychophysiology to inter-personalized psychiatry and beyond. *Philosophical Transactions of the Royal Society B, 378*(1870), 20210365. https://doi.org/10.1098/rstb.2021.0365

Bono, R., Blanca, M. J., Arnau, J., & Gómez-Benito, J. (2017). Non-normal distributions commonly used in health, education, and social sciences: A systematic review. *Frontiers in Psychology, 8*, 1602. https://doi.org/10.3389/fpsyg.2017.01602

Booth, T., Murray, A.L., McKenzie, K. et al. Brief Report: An Evaluation of the AQ-10 as a Brief Screening Instrument for ASD in Adults. *Journal of Autism and Developmental Disorders, 43*, 2997–3000 (2013). https://doi.org/10.1007/s10803-013-1844-5

Bornstein, M. H., Jager, J., & Putnick, D. L. (2013). Sampling in developmental science: Situations, shortcomings, solutions, and standards. *Developmental Review, 33*(4), 357-370. https://doi.org/10.1016/j.dr.2013.08.003

Braley, M. S., Thornton, A. E., & Loken Thornton, W. (2023). Anxiety symptoms and theory of mind in older and younger adults: Curvilinearity moderated by age group. *Aging & Mental Health, 27*(4), 829-837. https://doi.org/10.1080/13607863.2022.2060183

Briscoe, H., Vickers-Graver, B., Cherukat, M., Jones, C., & Surtees, A. (2024). The link between anxiety and theory of mind in children: A meta-analysis. *Journal of Affective Disorders, 367,* 530-544. https://doi.org/10.1016/j.jad.2024.08.171

Brown, T. A., Chorpita, B. F., & Barlow, D. H. (1998). Structural relationships among dimensions of the DSM-IV anxiety and mood disorders and dimensions of negative affect, positive affect, and autonomic arousal. *Journal of Abnormal Psychology, 107*(2), 179-192. https://doi.org/10.1037/0021-843X.107.2.179

Buhlmann, U., Wacker, R., & Dziobek, I. (2015). Inferring other people's states of mind: Comparison across social anxiety, body dysmorphic, and obsessive–compulsive disorders. *Journal of Anxiety Disorders, 34*, 107-113. https://doi.org/10.1016/j.janxdis.2015.06.003

Campanella, F., West, T., Corradi-Dell'Acqua, C., & Skrap, M. (2022). Cognitive and affective theory of mind double dissociation after parietal and temporal lobe tumours. *Brain, 145*(5), 1818-1829. https://doi.org/10.1093/brain/awab441

Cao, B., Li, Y., Li, F., & Li, H. (2012). Electrophysiological difference between mental state decoding and mental state reasoning. *Brain Research, 1464*, 53-60. https://doi.org/10.1016/j.brainres.2012.05.009

Caputi, M., Cugnata, F., & Brombin, C. (2021). Theory of mind and loneliness: Effects of a conversation-based training at school. *International Journal of Psychology, 56*(2), 257-265. https://doi.org/10.1002/ijop.12707

Carlucci, L., Innamorati, M., Ree, M., D'Ignazio, G., & Balsamo, M. (2023). Measuring state and trait anxiety: An application of multidimensional item response theory. *Behavioral Sciences, 13*(8), 628. https://doi.org/10.3390/bs13080628

Carlucci, L., Watkins, M. W., Sergi, M. R., Cataldi, F., Saggino, A., & Balsamo, M. (2018). Dimensions of anxiety, age, and gender: Assessing dimensionality and measurement invariance of the State-Trait for Cognitive and Somatic Anxiety (STICSA) in an Italian sample. *Frontiers in Psychology, 9*, 2345. https://doi.org/10.3389/fpsyg.2018.02345

Cavanagh, J. F., Bismark, A. W., Frank, M. J., & Allen, J. J. B. (2019). Multiple dissociations between comorbid depression and anxiety on reward and punishment processing: Evidence from computationally informed EEG. *Computational Psychiatry, 3*, 1–17. https://doi.org/10.1162/CPSY_A_00024

Chang, L. A., & Engelmann, J. B. (2024). The impact of incidental anxiety on the neural signature of mentalizing. *Imaging Neuroscience, 2*, 1-23. https://doi.org/10.1162/imag_a_00096

Charlton, R. A., Barrick, T. R., Markus, H. S., & Morris, R. G. (2009). Theory of mind associations with other cognitive functions and brain imaging in normal aging. *Psychology and Aging, 24*(2), 338-348. https://10.1037/a0015225

Chevalier, V., Simard, V., & Achim, J. (2023). Meta-analyses of the associations of mentalization and proxy variables with anxiety and internalizing problems. *Journal of Anxiety Disorders, 95*, 102694. https://doi.org/10.1016/j.janxdis.2023.102694

Clark, D. A., & Beck, A. T. (2010). Cognitive theory and therapy of anxiety and depression: Convergence with neurobiological findings. *Trends in Cognitive Sciences, 14*(9), 418-424. https://doi.org/1010.1016/j.tics.2010.06.007

Clark, D. M. (2001). A cognitive perspective on social phobia. In W. R. Crozier & L. E. Alden (Eds.) *International handbook of social anxiety: Concepts, research and interventions relating to the self and shyness* (pp. 405-430). Wiley

Coolican, H. (2024). *Research methods and statistics in psychology* (8th ed.). Psychology Press.

Corradi-Dell'Acqua, C., Ronchi, R., Thomasson, M., Bernati, T., Saj, A., & Vuilleumier, P. (2020). Deficits in cognitive and affective theory of mind relate to dissociated lesion patterns in prefrontal and insular cortex. *Cortex, 128*, 218-233. https://doi.org/10.1016/j.cortex.2020.03.019

Couette, M., Mouchabac, S., Bourla, A., Nuss, P., & Ferreri, F. (2020). Social cognition in post-traumatic stress disorder: A systematic review. *British Journal of Clinical Psychology, 59*(2), 117-138. https://doi.org/10.1111/bjc.12238

Craske, M., Stein, M., Eley, T., Milad, M. R., Holmes, A., Rapee, R. M. & Wittchen, H-U. (2017) Anxiety disorders. *Nature Reviews Disease Primers, 3*, 17024. https://doi.org/10.1038/nrdp.2017.24

Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE Publications.

Cuerva, A. G., Sabe, L., Kuzis, G., Tiberti, C., Dorrego, F., & Starkstein, S. E. (2001). Theory of mind and pragmatic abilities in dementia. *Cognitive and Behavioral Neurology, 14*(3), 153-158.

Das, K. R., & Imon, A. H. M. R. (2016). A brief review of tests for normality. *American Journal of Theoretical and Applied Statistics, 5*(1), 5-12. https://doi.org/10.11648/j.ajtas.20160501.12

de Lijster, J. M., Dierckx, B., Utens, E. M. W. J., Verhulst, F. C., Zieldorff, C., Dieleman, G. C., & Legerstee, J. S. (2017). The age of onset of anxiety disorders: A meta-analysis. *The Canadian Journal of Psychiatry, 62*(4), 237–246. https://doi.org/10.1177/0706743716640757

Demir, S. (2022). Comparison of normality tests in terms of sample sizes under different skewness and Kurtosis coefficients. *International Journal of Assessment Tools in Education, 9*(2), 397-409. https://doi.org/10.21449/ijate.1101295

Derakshan, N., & Eysenck, M. W. (2010). Introduction to the special issue: Emotional states, attention, and working memory. *Cognition and Emotion*, *24*(2), 189–199. https://doi.org/10.1080/02699930903412120

Derntl, B., & Habel, U. (2011). Deficits in social cognition: a marker for psychiatric disorders? *European Archives of Psychiatry and Clinical Neuroscience, 261*(Suppl 2), 145-149. https://doi.org/ 10.1007/s00406-011-0244-0

Deuter, C. E., Nowacki, J., Wingenfeld, K., Kuehl, L. K., Finke, J. B., Dziobek, I., & Otte, C. (2018). The role of physiological arousal for self-reported emotional empathy. *Autonomic Neuroscience, 214*, 9-14. https://doi.org/10.1016/j.autneu.2018.07.002

Di Tella, M., Ardito, R. B., Dutto, F., & Adenzato, M. (2020). On the (lack of) association between theory of mind and executive functions: A study in a non-clinical adult sample. *Scientific Reports, 10*(1), 17283. https://doi.org/10.1038/s41598-020-74476-0

Durmaz, A., Dursun, İ., & Kabadayi, E. T. (2020). Mitigating the effects of social desirability bias in self-report surveys: Classical and new techniques. In M. L. Baran & J. E. Jones (Eds.), *Applied social science approaches to mixed methods research* (pp. 146–185). IGI Global.

Duval, C., Piolino, P., Bejanin, A., Eustache, F., and Desgranges, B. (2011). Age effects on different components of theory of mind. *Consciousness and Cognition, 20*, 627–642. https://doi.org/10.1016/j.concog.2010.10.025

Dziobek, K., Fleck, S., Kalbe, E., Rogers, K., Hassenstab, J., Brand, M., ... & Convit, A. (2006). Introducing MASC: A movie for the assessment of social cognition. Journal of *Autism and Developmental Disorders, 36*(5), 623–636. https://doi.org/10.1007/s10803-006-0107-0

Endler, N. S., & Kocovski, N. L. (2001). State and trait anxiety revisited. *Journal of Anxiety Disorders*, *15*(3), 231-245. https://doi.org/10.1016/S0887-6185(01)00060-3

Endler, N. S., Magnusson, D., Ekehammar, B., & Okada, M. (1976). The multidimensionality of state and trait anxiety. *Scandinavian Journal of Psychology, 17*(1), 81-96. https://doi.org/10.1111/j.1467-9450.1976.tb00215.x

Endler, N. S., Parker, J. D., Bagby, R. M., & Cox, B. J. (1991). Multidimensionality of state and trait anxiety: Factor structure of the Endler Multidimensional Anxiety Scales. *Journal of Personality and Social Psychology, 60*(6), 919–926. https://doi.org/10.1037/0022-3514.60.6.919

England K, Buttigieg D, Calleja N. (2022). *European Health Interview Survey (EHIS) 2019/2020, Health Status Report*. Directorate for Health Information and Research, Ministry for Health, Malta. https://dhir.gov.mt/wp-content/uploads/2024/04/European_Health_Interview_Survey_2019_2020-Health-Status-Report.pdf

Eurostat. (2020). *Europe 2020 indicators – education: Statistics explained.* European Union. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Europe_2020_indicators_-_education&oldid=301033#Continuous_decrease_in_early_school_leaving

Eysenck, H. J. (1983). Personality as a fundamental concept in scientific psychology. *Australian Journal of Psychology, 35*(3), 289–304. https://doi.org/10.1080/00049538308258745

Eysenck, M. W. (1992). *Anxiety: The cognitive perspective*. Psychology Press.

Eysenck, M. W. (2010). Attentional control theory of anxiety: Recent developments. In A. Gruska, G. Matthews & B. Szymura (Eds.), *Handbook of individual differences in cognition: Attention, memory, and executive control* (pp. 195–204). Springer.

Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion, 7*, 336–353. https://doi.org/10.1037/1528-3542.7.2.336

Eysenck, M. W., & Keane, M. T. (2020). *Cognitive psychology: A student's handbook* (8th ed.). Psychology Press.

Eysenck, M. W., Moser, J. S., Derakshan, N., Hepsomali, P., & Allen, P. (2023). A neurocognitive account of attentional control theory: How does trait anxiety affect the brain's attentional networks? *Cognition and Emotion*, *37*(2), 220-237. https://doi.org/10.1080/02699931.2022.2159936

Eysenck, M., Payne, S., & Derakshan, N. (2005). Trait anxiety, visuospatial processing, and working memory. *Cognition and Emotion*, *19*(8), 1214–1228. https://doi.org/10.1080/02699930500260245

FeldmanHall, O., & Shenhav, A. (2019). Resolving uncertainty in a social world. *Nature Human Behaviour, 3*(5), 426-435. https://doi.org/10.1038/s41562-019-0590-x

Ferguson, H. J. (2021). The cognitive basis of social interaction across the lifespan. In H. J. Ferguson & E. E. F. Bradford (Eds.), *The cognitive basis of social interaction across the lifespan* (pp. 1-26). Oxford University Press.

Fernández-Abascal, E. G., Cabello, R., Fernández-Berrocal, P., & Baron-Cohen, S. (2013). Test-retest reliability of the 'Reading the Mind in the Eyes' test: a one-year follow-up study. *Molecular Autism,* 4, 1-6. https://doi.org/10.1186/2040-2392-4-33

Fett, A. K., Viechtbauer, W., Dominguez, M. D., Penn, D. L., van Os, J., & Krabbendam, L. (2011). The relationship between neurocognition and social cognition with functional outcomes in schizophrenia: A meta-analysis. *Neuroscience & Biobehavioral Reviews, 35*(3), 573–588. https://doi.org/10.1016/j.neubiorev.2010.07.001

Field, A. (2024). *Discovering statistics using IBM SPSS Statistics* (6th ed.). SAGE Publications.

Fischer, A. L., O'Rourke, N., & Loken Thornton, W. (2017). Age differences in cognitive and affective theory of mind: Concurrent contributions of neurocognitive performance, sex, and pulse pressure. *The Journals of Gerontology: Series B, Psychological Sciences and Social Sciences, 72*(1), 71–81. https://doi.org/10.1093/geronb/gbw088

Fonagy, P., & Bateman, A. W. (2019). Introduction. In A. W. Bateman, & P. Fonagy (Eds.), *Handbook of mentalizing in mental health practice* (2nd ed, pp. 3–20). American Psychiatric Association Publishing.

Freud, S. (1924). The passing of the Oedipus complex. *International Journal of Psychoanalysis, 5*(4), 419-424.

Freud, S. (1936). *The problem of anxiety.* W. W. Norton & Co.

Frith, C. D. (2008). Social cognition. *Philosophical Transactions of the Royal Society B: Biological Sciences, 363*(1499), 2033-2039. https://doi.org/10.1098/rstb.2008.0005

Frith, C., & Frith, U. (2005). Theory of mind. *Current Biology, 15*(17), R644-R645. https://doi.org/1010.1016/j.cub.2005.08.041

Frith, U. (1994). Autism and theory of mind in everyday life. *Social Development, 3*(2), 108-124. https://doi.org/10.1111/j.1467-9507.1994.tb00031.x

Gallego, A., McHugh, L., Penttonen, M., & Lappalainen, R. (2022). Measuring public speaking anxiety: self-report, behavioral, and physiological. *Behavior Modification, 46*(4), 782-798. https://doi.org/10.1177/0145445521994308

Genova, H. M., Lancaster, K., Lengenfelder, J., Bober, C. P., DeLuca, J., & Chiaravalloti, N. D. (2020). Relationship between social cognition and fatigue, depressive symptoms, and anxiety in multiple sclerosis. *Journal of Neuropsychology, 14*(2), 213-225. https://doi.org/10.1111/jnp.12185

Gignac, G. E., & Watkins, M. W. (2013). Bifactor modeling and the estimation of model-based reliability in the WAIS-IV. *Multivariate Behavioral Research, 48*(5), 639-662. https://doi.org/10.1080/00273171.2013.804398

Gleason, K. A., Jensen-Campbell, L. A., & Ickes, W. (2009). The role of empathic accuracy in adolescents' peer relations and adjustment. *Personality and Social Psychology Bulletin, 35*(8), 997-1011. https://doi.org/10.1177/01461672093366

Gournay, K., Rogers, Curran, J. & Darling, J. (2011). Anxiety disorders: An introduction. *British Journal of Wellbeing, 2*(6), 39-45. https://doi.org/10.12968/bjow.2011.2.6.39

Grady, C. L., & Keightley, M. L. (2002). Studies of altered social cognition in neuropsychiatric disorders using functional neuroimaging. *The Canadian Journal of Psychiatry, 47*(4), 327-336. https://doi.org/10.1177/070674370204700403

Grös, D. F., Antony, M. M., Simms, L. J., & McCabe, R. E. (2007). Psychometric properties of the state-trait inventory for cognitive and somatic anxiety (STICSA): comparison

to the state-trait anxiety inventory (STAI). *Psychological Assessment, 19*(4), 369–381. https://doi.org/10.1037/1040-3590.19.4.369

Gros, D. F., Simms, L. J., & Antony, M. M. (2010). Psychometric properties of the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA) in friendship dyads. *Behavior Therapy, 41*(3), 277-284.

Gunnarsson, A. B., Hedberg, A. K., Håkansson, C., Hedin, K., & Wagman, P. (2023). Occupational performance problems in people with depression and anxiety. *Scandinavian Journal of Occupational Therapy, 30*(2), 148-158. https://doi.org/10.1080/11038128.2021.1882562

Gur, R. C., & Gur, R. E. (2016). Social cognition as an RDoC domain. *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics, 171*(1), 132-141. https://doi.org/10.1002/ajmg.b.32394

Guyon, H., Kop, J. L., Juhel, J., & Falissard, B. (2018). Measurement, ontology, and epistemology: Psychology needs pragmatism-realism. *Theory & Psychology, 28*(2), 149-171. https://doi.org/10.1177/0959354318761606

Happé, F., Cook, J. L., & Bird, G. (2017). The structure of social cognition: In(ter) dependence of sociocognitive processes. *Annual Review of Psychology, 68*(1), 243-267. https://doi.org/10.1146/annurev-psych-010416-044046

Haslam, N., McGrath, M. J., Viechtbauer, W. & Kuppens, P. (2020). Dimensions over categories: A meta-analysis of taxometric research. *Psychological Medicine 50*, 1418-1432. https://doi.org/10.1017/ S003329172000183X

Heeren, A., Bernstein, E. E., & McNally, R. J. (2018). Deconstructing trait anxiety: A network perspective. *Anxiety, Stress, & Coping, 31*(3), 262-276. https://doi.org/10.1080/10615806.2018.1439263

Henry, A., Raucher-Chéné, D., Obert, A., Gobin, P., Vucurovic, K., Barrière, S., ... & Kaladjian, A. (2021). Investigation of the neural correlates of mentalizing through the Dynamic Inference Task, a new naturalistic task of social cognition. *NeuroImage*, 243, 118499. https://doi.org/10.1016/j.neuroimage.2021.118499

Henry, J. D., Cowan, D. G., Lee, T., & Sachdev, P. S. (2015). Recent trends in testing social cognition. *Current Opinion in Psychiatry*, *28*(2), 133-140.

Henry, J. D., Phillips, L. H., Ruffman, T., & Bailey, P. E. (2013). A meta-analytic review of age differences in theory of mind. *Psychology and Aging, 28*(3), 826-839. https://doi.org/10.1037/a0030677

Herrington, J. D., Miller, J. S., Pandey, J., & Schultz, R. T. (2016). Anxiety and social deficits have distinct relationships with amygdala function in autism spectrum disorder. *Social Cognitive and Affective Neuroscience, 11*(6), 907-914. https://doi.org/10.1093/scan/nsw015

Hezel, D. M., & McNally, R. J. (2014). Theory of mind impairments in social anxiety disorder. *Behavior Therapy, 45*(4), 530-540. https://doi.org/10.1016/j.beth.2014.02.010

Hohls, J. K., König, H. H., Quirke, E., & Hajek, A. (2021). Anxiety, depression and quality of life—a systematic review of evidence from longitudinal observational studies. *International Journal of Environmental Research and Public Health, 18*(22), 12022. https://doi.org/10.3390/ ijerph182212022

Hovenkamp-Hermelink, J. H. M., Jeronimus, B. F., Myroniuk, S., Riese, H., & Schoevers, R. A. (2021). Predictors of persistence of anxiety disorders across the lifespan: A systematic review. *The Lancet Psychiatry, 8*(5), 428–443. https://doi.org/10.1016/S2215-0366(20)30433-8

Huppert, J. D., Foa, E. B., Furr, J. M., Filip, J. C., & Mathews, A. (2003). Interpretation bias in social anxiety: A dimensional perspective. *Cognitive Therapy and Research, 27*(5), 569–577. https://doi.org/10.1023/A:1026359105456

Institute for Health Metrics and Evaluation (2024). *GBD Results.* https://vizhub.healthdata.org/gbd-results/

Isernia, S., Pirastru, A., Rossetto, F., Cacciatore, D. M., Cazzoli, M., Blasi, V., ... & Baglio, F. (2024). Human reasoning on social interactions in ecological contexts: Insights from the theory of mind brain circuits. *Frontiers in Neuroscience, 18*, 1420122. https://doi.org/10.3389/fnins.2024.1420122

Jager, J., Putnick, D. L., & Bornstein, M. H. (2017). II. More than just convenient: The scientific merits of homogeneous convenience samples. *Monographs of the Society for Research in Child Development, 82*(2), 13-30. https://doi.org/10.1111/mono.12296

Jaiswal, S., Tsai, S. Y., Juan, C. H., Liang, W. K., & Muggleton, N. G. (2018). Better cognitive performance is associated with the combination of high trait mindfulness and low trait anxiety. *Frontiers in Psychology, 9*, 627. https://doi.org/10.3389/fpsyg.2018.00627

James, G., Witten, D., Hastie, T., Tibshirani, R., & Taylor, J. (2023). *An introduction to statistical learning.* Springer.

Javaid, S. F., Hashim, I. J., Hashim, M. J., Stip, E., Samad, M. A., & Ahbabi, A. A. (2023). Epidemiology of anxiety disorders: Global burden and sociodemographic associations. *Middle East Current Psychiatry, 30*(1), 44. https://doi.org/10.1186/s43045-023-00315-3

Javed, A., & Charles, A. (2018). The Importance of Social Cognition in Improving Functional Outcomes in Schizophrenia. *Frontiers in Psychiatry*, *9*, 157. https://doi.org/10.3389/fpsyt.2018.00157

Joannès, T., Havet, N., Jusot, F., & Fantin, R. (2023). The level of education is associated with an anxiety-depressive state among men and women – Findings from France during the first quarter of the COVID-19 pandemic. *BMC Public Health, 23,* 1405. https://doi.org/10.1186/s12889-023-16280-9

Kaczkurkin, A. N., & Foa, E. B. (2015). Cognitive-behavioral therapy for anxiety disorders: An update on the empirical evidence. *Dialogues in Clinical Neuroscience, 17*(3), 337-346. https://doi.org/10.31887/DCNS.2015.17.3/akaczkurkin

Kalbe, E., Schlegel, M., Sack, A. T., Nowak, D. A., Dafotakis, M., Bangard, C., ... & Kessler, J. (2010). Dissociating cognitive from affective theory of mind: a TMS study. *Cortex, 46*(6), 769-780. https://doi.org/10.1016/j.cortex.2009.07.010

Karch, J. D. (2024). Outliers may not be automatically removed. *Journal of Experimental Psychology: General, 152*(6), 1735–1753. https://doi.org/10.1037/xge0001357

Karsten, J., Penninx, B. W., Verboom, C. E., Nolen, W. A., & Hartman, C. A. (2013). Course and risk factors of functional impairment in subthreshold depression and anxiety. *Depression and Anxiety, 30*(4), 386-394. https://doi.org/10.1002/da.22021

Kermarrec, S., Attinger, L., Guignard, J. H., & Tordjman, S. (2020). Anxiety disorders in children with high intellectual potential. *BJPsych Open, 6*(4), 1–6. https://doi.org/10.1192/bjo.2019.104

Khorashad, B. S., Baron-Cohen, S., Roshan, G. M., Kazemian, M., Khazai, L., Aghili, Z., ... & Afkhamizadeh, M. (2015). The “Reading the Mind in the Eyes” test: investigation of psychometric properties and test–retest reliability of the Persian version. *Journal of Autism and Developmental Disorders, 45*, 2651-2666. https://doi.org/10.1007/s10803-015-2427-4

Kim, H.Y. (2013). Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis. *Restorative Dentistry & Endodontics, 38*(1), 52-54. https://doi.org/10.5395/rde.2013.38.1.52

Koerber, S., & Osterhaus, C. (2020). Some but not all aspects of (advanced) theory of mind predict loneliness. *British Journal of Developmental Psychology, 38*(1), 144-148. https://doi.org/10.1111/bjdp.12302

Kraemer, H. C. (2007). DSM categories and dimensions in clinical and research contexts. *International Journal of Methods in Psychiatric Research, 16*(S1), S8-S15. https://doi.org/10.1002/mpr.211

Kraemer, H. C., Noda, A., & O'Hara, R. (2004). Categorical versus dimensional approaches to diagnosis: Methodological challenges. *Journal of Psychiatric Research, 38*(1), 17-25. https://doi.org/10.1016/S0022-3956(03)00097-9

Krause, L., Enticott, P. G., Zangen, A., & Fitzgerald, P. B. (2012). The role of medial prefrontal cortex in theory of mind: a deep rTMS study. *Behavioural Brain Research, 228*(1), 87-90. https://doi.org/10.1016/j.bbr.2011.11.037

Kuczynski, A. M., Kanter, J. W., & Robinaugh, D. J. (2020). Differential associations between interpersonal variables and quality-of-life in a sample of college students. *Quality of Life Research, 29*(1), 127–139. https://doi.org/10.1007/s11136-019-02298-3

Lancaster, S. L., Melka, S. E., Klein, K. P., & Rodriguez, B. F. (2015). Ethnicity and anxiety: A psychometric evaluation of the STICSA. *Measurement and Evaluation in Counseling and Development, 48*(3), 163-176. https://doi.org/10.1177/0748175615578757

Latkin, C. A., Edwards, C., Davey-Rothwell, M. A., & Tobin, K. E. (2017). The relationship between social desirability bias and self-reports of health, substance use, and social

network factors among urban substance users in Baltimore, Maryland. *Addictive Behaviors, 73*, 133–136. https://doi.org/10.1016/j.addbeh.2017.05.005

Leal, P. C., Goes, T. C., da Silva, L. C. F., & Teixeira-Silva, F. (2017). Trait vs. state anxiety in different threatening situations. *Trends in Psychiatry and Psychotherapy, 39*(3), 147-157. https://doi.org/10.1590/2237-6089-2016-0044

Leavy, P. (2022). *Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches* (2nd ed.). Guilford Press.

Lenton-Brym, A. P., Moscovitch, D. A., Vidovic, V., Nilsen, E., & Friedman, O. (2018). Theory of mind ability in high socially anxious individuals. *Anxiety, Stress, & Coping, 31*(5), 487-499. https://doi.org/10.1080/10615806.2018.1483021

Leshem, R. (2020). Trait anxiety and attention: Cognitive functioning as a function of attentional demands. *Current Psychology, 39*(5), 1830-1842. https://doi.org/10.1007/s12144-018-9884-9

Leslie, A. M., Friedman, O., & German, T. P. (2004). Core mechanisms in 'theory of mind'. *Trends in Cognitive Sciences, 8*(12), 528-533. https://doi.org/10.1016/j.tics.2004.10.001

Leys, C., Delacre, M., Mora, Y. L., Lakens, D., & Ley, C. (2019). How to classify, detect, and manage univariate and multivariate outliers, with emphasis on pre-registration. *International Review of Social Psychology, 32*(1), 1–10. https://doi.org/10.5334/irsp.289

Luyten, P., Malcorps, S., Fonagy, P., & Ensink, K. (2019). Assessment of mentalizing. In A. W. Bateman, & P. Fonagy (Eds.), *Handbook of mentalizing in mental health practice* (2nd ed, pp. 37–62). American Psychiatric Association Publishing.

Lyvers, M., Scott, K., & Thorberg, F. A. (2019). Social anxiety and alexithymia in relation to problematic drinking and theory of mind. *The American Journal of Psychology, 132*(3), 325-342. https://doi.org/10.5406/amerjpsyc.132.3.0325

Maleki, G., Zabihzadeh, A., Richman, M. J., Demetrovics, Z., & Mohammadnejad, F. (2020). Decoding and reasoning mental states in major depression and social anxiety disorder. *BMC Psychiatry, 20*, 1-8. https://doi.org/10.1186/s12888-020-02873-w

Manly, J. J., Jones, R. N., Langa, K. M., Ryan, L. H., Levine, D. A., McCammon, R., Heeringa, S. G., ... Weir, D. (2022). Estimating the prevalence of dementia and mild cognitive impairment in the US: The 2016 Health and Retirement Study Harmonized Cognitive Assessment Protocol Project. *JAMA Neurology, 79*(12), 1242–1249. https://doi.org/10.1001/jamaneurol.2022.3543

Maurage, P., D'Hondt, F., de Timary, P., Mary, C., Franck, N., & Peyroux, E. (2016). Dissociating affective and cognitive theory of mind in recently detoxified alcohol-dependent individuals. *Alcoholism: Clinical and Experimental Research, 40*(9), 1926-1934. https://doi.org/10.1111/acer.13155

Mayers, A. (2013). *Introduction to statistics and SPSS in psychology.* Pearson Education Limited.

McDonald, S., & Genova, H. (2021). The effect of severe traumatic brain injury on social cognition, emotion regulation, and mood. In K. M. Heilman & S. E. Nadeau (Eds.), *Handbook of Clinical Neurology* (Vol. 183, pp. 235–260). Elsevier.

McKnight, P. E., Monfort, S. S., Kashdan, T. B., Blalock, D. V., & Calton, J. M. (2016). Anxiety symptoms and functional impairment: A systematic review of the correlation between the two measures. *Clinical Psychology Review, 45*, 115-130. http://dx.doi.org/10.1016/j.cpr.2015.10.005

Meinhardt-Injac, B., Daum, M. M., Meinhardt, G., & Persike, M. (2018). The two-systems account of theory of mind: Testing the links to social-perceptual and cognitive abilities. *Frontiers in Human Neuroscience, 12*, 25. https://doi.org/10.3389/fnhum.2018.00025.

Milders, M. (2019). Relationship between social cognition and social behaviour following traumatic brain injury. *Brain Injury, 33*(1), 62-68. https://doi.org/10.1080/02699052.2018.1531301

Morgenroth, E., Orlov, N., Lythgoe, D. J., Stone, J. M., Barker, H., Munro, J., Eysenck, M., & Allen, P. (2019). Altered relationship between prefrontal glutamate and activation during cognitive control in people with high trait anxiety. *Cortex, 117,* 53–63. https://doi.org/10.1016/j.cortex.2019.02.010

Njomboro, P., Deb, S., & Humphreys, G. W. (2008). Dissociation between decoding and reasoning about mental states in patients with theory of mind reasoning impairments. *Journal of Cognitive Neuroscience, 20*(9), 1557-1564. https://doi.org/1010.1162/jocn.2008.20118

Nyberg, J., Henriksson, M., Wall, A., Vestberg, T., Westerlund, M., Walser, M., ... & Åberg, M. (2021). Anxiety severity and cognitive function in primary care patients with anxiety disorder: a cross-sectional study. *BMC Psychiatry*, *21*, 1-13. https://doi.org/10.1186/s12888-021-03618-z

Okruszek, Ł, Piejka, A., Krawczyk, M., Schudy, A., Wiśniewska, M., Żurek, K., & Pinkham, A. (2021). Owner of a lonely mind? Social cognitive capacity is associated with objective, but not perceived social isolation in healthy individuals. *Journal of Research in Personality, 93*, 104103. https://doi.org/10.1016/j.jrp.2021.104103

Olderbak, S., Wilhelm, O., Olaru, G., Geiger, M., Brenneman, M. W., & Roberts, R. D. (2015). A psychometric analysis of the reading the mind in the eyes test: Toward a

brief form for research and applied settings. *Frontiers in Psychology, 6,* 1503. https://doi.org/10.3389/fpsyg.2015.01503

Olatunji, B. O., Cisler, J. M., & Tolin, D. F. (2007). Quality of life in the anxiety disorders: A meta-analytic review. *Clinical Psychology Review, 27*(5)*,* 572–581. https://doi-org.ru.idm.oclc.org/10.1016/j.cpr.2007.01.015

Orcan, F. (2020). Parametric or non-parametric: Skewness to test normality for mean comparison. *International Journal of Assessment Tools in Education, 7*(2), 255-265. https://doi.org/10.21449/ijate.656077

Overton, M., Pihlsgård, M., & Elmståhl, S. (2019). Prevalence and incidence of mild cognitive impairment across subtypes, age, and sex. *Dementia And Geriatric Cognitive Disorders, 47*(4-6), 219-232. https://doi.org/10.1159/000499763

Park, Y. S., Konge, L., & Artino Jr, A. R. (2020). The positivism paradigm of research. *Academic Medicine, 95*(5), 690-694. https://doi.org/10.1097/ACM.0000000000003093

Park, J., & Moghaddam, B. (2017). Impact of anxiety on prefrontal cortex encoding of cognitive flexibility. *Neuroscience, 345*, 193-202. http://dx.doi.org/10.1016/j.neuroscience.2016.06.013

Penn, D. L., Corrigan, P. W., Bentall, R. P., Racenstein, J., & Newman, L. (1997). Social cognition in schizophrenia. *Psychological Bulletin*, *121*(1), 114. https://doi.org/10.1037/0033-2909.121.1.114

Pepper, K. L., Demetriou, E. A., Park, S. H., Song, Y. C., Hickie, I. B., Cacciotti-Saija, C., ... & Guastella, A. J. (2018). Autism, early psychosis, and social anxiety disorder: understanding the role of social cognition and its relationship to disability in young adults with disorders characterized by social impairments. *Translational Psychiatry, 8*(1), 233. https://doi.org/10.1038/s41398-018-0282-8

Plana, I., Lavoie, M. A., Battaglia, M., & Achim, A. M. (2014). A meta-analysis and scoping review of social cognition performance in social phobia, posttraumatic stress disorder and other anxiety disorders. *Journal of Anxiety Disorders, 28*(2), 169-177. https://doi.org/10.1016/j.janxdis.2013.09.005

Poljac, E., Poljac, E., & Wagemans, J. (2012). Reduced accuracy and sensitivity in the perception of emotional facial expressions in individuals with high autism spectrum traits. *Autism, 17*, 668–680. https://doi. org/10.1177/1362361312455703

Poveda, B., Abrahams, S., Baksh, R. A., MacPherson, S. E., & Evans, J. J. (2022). An investigation of the validity of the Edinburgh social cognition test (ESCoT) in acquired brain injury (ABI). *Journal of the International Neuropsychological Society, 28*(10), 1016-1028. https://doi.org/10.1017/S1355617721001223

Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences, 1*(4), 515–526. https://doi.org/10.1017/S0140525X00076512

Pretorius, T. B., & Padmanabhanunni, A. (2023). Anxiety in brief: Assessment of the five-item trait scale of the state-trait anxiety inventory in South Africa. International *Journal of Environmental Research and Public Health, 20*(9), 5697. https://doi.org/10.3390/ijerph20095697

Prevost, M., Carrier, M.-E., Chowne, G., Zelkowitz, P., Joseph, L., & Gold, I. (2014). The Reading the Mind in the Eyes test: Validation of a French version and exploration of cultural variations in a multi-ethnic city. *Cognitive Neuropsychiatry, 19*(3), 189–204. https://doi.org/10.1080/13546805.2013.823859

Proverbio, A. M. (2023). Sex differences in the social brain and in social cognition. Journal of Neuroscience Research, 101(5), 730-738. https://doi.org/10.1002/jnr.24787

Quesque, F., & Rossetti, Y. (2020). What do theory-of-mind tasks actually measure? Theory and Practice. *Perspectives on Psychological Science*, *15*(2), 384-396. https://doi.org/10.1177/1745691619896607

Rachman, S. (2013). *Anxiety* (3rd ed.). Oxford: Blackwell.

Ramey, T., & Regier, P. S. (2018). Cognitive impairment in substance use disorders. *CNS Spectrums, 24*(1), 102–113. https://doi.org/10.1017/S1092852918001426

Ree, M. J., French, D., MacLeod, C., & Locke, V. (2008). Distinguishing cognitive and somatic dimensions of state and trait anxiety: Development and validation of the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA). *Behavioural and Cognitive Psychotherapy, 36*(3), 313-332. https://doi.org/10.1017/S1352465808004232

Reynolds, W. (1999). *Multidimensional Anxiety Questionnaire: Professional manual.* Psychological Assessment Resources.

Ribeiro, O., Teixeira, L., Araújo, L., Rodríguez-Blázquez, C., Calderón-Larrañaga, A., & Forjaz, M. J. (2020). Anxiety, depression and quality of life in older adults: trajectories of influence across age. *International Journal of Environmental Research and Public Health, 17*(23), 9039. https://doi.org/10.3390/ijerph17239039

Robinson, O. J., Vytal, K., Cornwell, B. R., & Grillon, C. (2013). The impact of anxiety upon cognition: Perspectives from human threat of shock studies. *Frontiers in Human Neuroscience*, *7*. https://doi.org/10.3389/fnhum.2013.00203

Roelofs, R. L., Wingbermühle, E., Egger, J. I., & Kessels, R. P. (2017). Social cognitive interventions in neuropsychiatric patients: A meta-analysis. *Brain Impairment, 18*(1), 138-173. https://doi.org/10.1017/BrImp.2016.31

Ronchi, L., Banerjee, R., & Lecce, S. (2020). Theory of mind and peer relationships: The role of social anxiety. *Social Development, 29*(2), 478–493. https://doi.org/10.1111/sode.12417

Rossetto, F., Baglio, F., Massaro, D., Alberoni, M., Nemni, R., Marchetti, A., & Castelli, I. (2020). Social cognition in rehabilitation context: Different evolution of affective and cognitive theory of mind in mild cognitive impairment. *Behavioural Neurology, 2020*(1), 5204927. https://doi.org/10.1155/2020/5204927

Rotello, C. M., Myers, J. L., Well, A. D., & Lorch, R. F., Jr. (2025). *Research design and statistical analysis* (4th ed.). Routledge.

Ruitenberg, M. F., Santens, P., & Notebaert, W. (2020). Cognitive and affective theory of mind in healthy aging. *Experimental Aging Research, 46*(5), 382-395. https://doi.org/10.1080/0361073X.2020.1802980

Sabbagh, M. A. (2004). Understanding orbitofrontal contributions to theory-of-mind reasoning: Implications for autism. *Brain and Cognition, 55*(1), 209-219. https://doi.org/10.1016/j.bandc.2003.04.002

Sabbagh, M. A., Moulson, M. C., & Harkness, K. L. (2004). Neural correlates of mental state decoding in human adults: An event-related potential study. *Journal of Cognitive Neuroscience, 16*(3), 415-426. https://doi.org/10.1162/089892904322926755

Samson, D. (2009). Reading other people's mind: Insights from neuropsychology. *Journal of Neuropsychology,* 3(1), 3-16. https://doi.org/10.1348/174866408X377883

Sarason, I. G. (1984). Stress, anxiety, and cognitive interference: Reactions to tests. *Journal of Personality and Social Psychology, 46*(4), 929-938. https://doi.org/10.1037/0022-3514.46.4.929

Sasson, N. J., Nowlin, R. B., & Pinkham, A. E. (2013). Social cognition, social skill, and the broad autism phenotype. *Autism, 17*(6), 655-667. https://10.1177/1362361312455704

Sasson, N. J., Morrison, K. E., Kelsven, S., & Pinkham, A. E. (2020). Social cognition as a predictor of functional and social skills in autistic adults without intellectual disability. *Autism Research, 13*(2), 259-270. https://doi.org/10.1002/aur.2195

Saviola, F., Pappaianni, E., Monti, A., Grecucci, A., Jovicich, J., & De Pisapia, N. (2020). Trait and state anxiety are mapped differently in the human brain. *Scientific Reports, 10*(1), 11112. https://doi.org/10.1038/s41598-020-68008-z

Schmidt, S. J., Mueller, D. R., & Roder, V. (2011). Social cognition as a mediator variable between neurocognition and functional outcome in schizophrenia: Empirical review and new results by structural equation modeling. *Schizophrenia Bulletin, 37*(Suppl 2), S41–S54. https://doi.org/10.1093/schbul/sbr079

Scholten, W., ten Have, M., van Geel, C., van Balkom, A., de Graaf, R. & Batelaan, N. (2023). Recurrence of anxiety disorders and its predictors in the general population. *Psychological Medicine 53*, 1334–1342. https://doi.org/10.1017/S0033291721002877

Schurz, M., Radua, J., Tholen, M. G., Maliske, L., Margulies, D. S., Mars, R. B., ... & Kanske, P. (2021). Toward a hierarchical model of social cognition: A neuroimaging meta-analysis and integrative review of empathy and theory of mind. *Psychological Bulletin,* 147(3), 293-327. http://dx.doi.org/10.1037/bul0000303

Sebastian, C. L., Fontaine, N. M., Bird, G., Blakemore, S. J., De Brito, S. A., McCrory, E. J., & Viding, E. (2012). Neural processing associated with cognitive and affective Theory of Mind in adolescents and adults. *Social Cognitive and Affective Neuroscience, 7*(1), 53-63. https://doi.org/10.1093/scan/nsr023

Sened, H., Lavidor, M., Lazarus, G., Bar-Kalifa, E., Rafaeli, E., & Ickes, W. (2017). Empathic accuracy and relationship satisfaction: A meta-analytic review. *Journal of Family Psychology, 31*(6), 742-752. https://doi.org/10.1037/FAM0000320

Shamay-Tsoory, S. G., & Aharon-Peretz, J. (2007). Dissociable prefrontal networks for cognitive and affective theory of mind: A lesion study. *Neuropsychologia, 45*(13), 3054-3067. https://doi.org/10.1016/j.neuropsychologia.2007.05.021

Shamay-Tsoory, S. G., Shur, S., Barcai-Goodman, L., Medlovich, S., Harari, H., & Levkovitz, Y. (2007). Dissociation of cognitive from affective components of theory of mind in schizophrenia. *Psychiatry Research, 149*(1-3), 11-23. https://doi.org/10.1016/j.psychres.2005.10.018

Shamay-Tsoory, S. G., Tibi-Elhanany, Y., & Aharon-Peretz, J. (2006). The ventromedial prefrontal cortex is involved in understanding affective but not cognitive theory of mind stories. *Social Neuroscience, 1*(3-4), 149-166. https://doi.org/10.1080/17470910600985589

Shear, M. K., Bjelland, I., Beesdo, K., Gloster, A. T., & Wittchen, H. U. (2007). Supplementary dimensional assessment in anxiety disorders. *International Journal of Methods on Psychiatric Research, 16*(S1), S52-S64.

Shields, G. S., Moons, W. G., Tewell, C. A., & Yonelinas, A. P. (2016). The effect of negative affect on cognition: Anxiety, not anger, impairs executive function. *Emotion, 16*(6), 792-797. https://doi.org/10.1037/emo0000151.

Sirois, K., Tousignant, B., Boucher, N., Achim, A. M., Beauchamp, M. H., Bedell, G., ... & Jackson, P. L. (2017). The contribution of social cognition in predicting social participation following moderate and severe TBI in youth. *Neuropsychological Rehabilitation, 29*(9), 1383–1398. https://doi.org/10.1080/09602011.2017.1413987

Sloover, M., van Est, L. A., Janssen, P. G., Hilbink, M., & van Ee, E. (2022). A meta-analysis of mentalizing in anxiety disorders, obsessive-compulsive and related disorders, and trauma and stressor related disorders. *Journal of Anxiety Disorders, 92,* 102641. https://doi.org/10.1016/j.janxdis.2022.102641

Spielberger, C. D., Gonzalez-Reigosa, F., Martinez-Urrutia, A., Natalicio, L. F., & Natalicio, D. S. (1971). The state-trait anxiety inventory. *Revista Interamericana de Psicologia/Interamerican Journal of Psychology, 5*(3 & 4). https://doi.org/10.30849/rip/ijp.v5i3%20&%204.620

Spielberger, C. D. (1966). The effects of anxiety on complex learning and academic achievement. In C. D. Spielberger (Ed.), *Anxiety and behavior.* Academic Press.

Spielberger, C. D. (1972). Anxiety as an emotional state. In C. D. Spielberger (Ed.), *Anxiety: Current trends in theory and research* (Vol 1, pp. 23-49). Academic Press

Strongman, K. T. (1995). Theories of anxiety. *New Zealand Journal of Psychology*, *24*(2), 4-10.

Sullivan, J. H., Warkentin, M., & Wallace, L. (2021). So many ways for assessing outliers: What really works and does it matter? *Journal of Business Research, 132*, 530–543. https://doi.org/10.1016/j.jbusres.2021.03.066

Surtees, A., Apperly, I., & Samson, D. (2016). I've got your number: Spontaneous perspective-taking in an interactive task. *Cognition, 150*, 43-52. https://doi.org/10.1016/j.cognition.2016.01.014

Surtees, A. D., Briscoe, H., & Todd, A. R. (2024). Anxiety and Mentalizing: Uncertainty as a driver of egocentrism. *Current Directions in Psychological Science, 33*(2), 100-107. http://dx.doi.org/10.1177/09637214231217314

Tabachnick, B. G., & Fidell, L. S. (2018). *Using multivariate statistics* (7th ed.). Pearson.

Tager-Flusberg, H. (2001). A reexamination of the theory of mind hypothesis of autism. In J. A. Burack, T. Charman, N. Yimiya, & P. R. Zelazo (Eds.), *The development of autism: Perspectives from development and theory* (pp. 173–193). Lawrence Erlbaum Associates Publishers.

Tetik, D., Gica, S., Bestepe, E. E., Buyukavsar, A., & Gulec, H. (2022). Emotional information processing and assessment of cognitive functions in social anxiety disorder: An event-related potential study. *Clinical EEG and Neuroscience, 53*(2), 104-113. https://doi.org/10.1177/1550059420981

Thibaudeau, É., Cellard, C., Turcotte, M., & Achim, A. M. (2021). Functional impairments and theory of mind deficits in schizophrenia: A meta-analysis of the associations. *Schizophrenia Bulletin, 47*(3), 695-711. https://doi.org/10.1093/schbul/sbaa182

Tindall, I. K., Curtis, G. J., & Locke, V. (2021). Dimensionality and measurement invariance of the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA) and validity comparison with measures of negative emotionality. *Frontiers in Psychology, 12,* 644889. https://doi.org/10.3389/fpsyg.2021.644889

Ting, C. C., Palminteri, S., Lebreton, M., & Engelmann, J. B. (2022). The elusive effects of incidental anxiety on reinforcement-learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 48*(5), 619. https://doi.org/10.1037/xlm0001033

Todd, A. R., Forstmann, M., Burgmer, P., Brooks, A. W., & Galinsky, A. D. (2015). Anxious and egocentric: How specific emotions influence perspective taking. *Journal of Experimental Psychology: General, 144*(2), 374. https://doi.org/10.1037/xge0000048

Todd, A. R., & Simpson, A. J. (2016). Anxiety impairs spontaneous perspective calculation: Evidence from a level-1 visual perspective-taking task. *Cognition, 156*, 88-94. http://dx.doi.org/10.1016/j.cognition.2016.08.004

Todd, A. R., & Tamir, D. I. (2024). Factors that amplify and attenuate egocentric mentalizing. *Nature Reviews Psychology, 3*(3), 164-180. https://doi.org/10.1038/s44159-024-00277-1

Torralva, T., Roca, M., Gleichgerrcht, E., Bekinschtein, T., and Manes, F. (2009). A neuropsychological battery to detect specific executive and social cognitive

impairments in early frontotemporal dementia. *Brain 132*, 1299–1309. https://doi.org/10.1093/brain/awp041

Troller-Renfree, S. V., Barker, T. V., Pine, D. S., & Fox, N. A. (2015). Cognitive functioning in socially anxious adults: Insights from the NIH Toolbox Cognition Battery. *Frontiers in Psychology, 6*, 764. https://doi.org/10.3389/fpsyg.2015.00764

Tully, P. J., Harrison, N. J., Cheung, P., & Cosh, S. (2016). Anxiety and cardiovascular disease risk: a review. *Current Cardiology Reports, 18*, 1-8. http://dx.doi.org/10.1007/s11886-016-0800-3

Van Dam, N. T., Gros, D. F., Earleywine, M., & Antony, M. M. (2013). Establishing a trait anxiety threshold that signals likelihood of anxiety disorders. *Anxiety, Stress, & Coping, 26*(1), 70–86. https://doi.org/10.1080/10615806.2011.631525

Vellante, M., Baron-Cohen, S., Melis, M., Marrone, M., Petretto, D. R., Masala, C., & Preti, A. (2013). The "Reading the Mind in the Eyes" test: Systematic review of psychometric properties and a validation study in Italy. *Cognitive Neuropsychiatry, 18*(4), 326–354. https://doi.org/10.1080/13546805.2012.721728

Vos, T., Lim, S. S., Abbafati, C., Abbas, K. M., Abbasi, M., Abbasifard, M., ... & Bhutta, Z. A. (2020). Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: A systematic analysis for the Global Burden of Disease Study 2019. *The Lancet, 396*(10258), 1204-1222. http://dx.doi.org/10.1016/S0140-6736(20)30925-9

Vrbin, C. M. (2022). Parametric or nonparametric statistical tests: Considerations when choosing the most appropriate option for your data. *Cytopathology, 33*(6), 663-667. https://doi.org/10.1111/cyt.13174

Wade, M., Prime, H., Jenkins, J. M., Yeates, K. O., Williams, T., & Lee, K. (2018). On the relation between theory of mind and executive functioning: A developmental

cognitive neuroscience perspective. *Psychonomic Bulletin & Review, 25*(6), 2119-2140. https://doi.org/10.3758/s13423-018-1459-0.

Wang, Z., & Su, Y. (2013). Age-related differences in the performance of theory of mind in older adults: A dissociation of cognitive and affective components. *Psychology and Aging, 28*(1), 284-291. http://dx.doi.org/10.1037/a0030876

Ward, R. T., Lotfi, S., Sallmann, H., Lee, H. J., & Larson, C. L. (2020). State anxiety reduces working memory capacity but does not impact filtering cost for neutral distracters. *Psychophysiology*, *57*(10), e13625. https://doi.org/10.1111/psyp.13625

Washburn, D., Wilson, G., Roes, M., Rnic, K., & Harkness, K. L. (2016). Theory of mind in social anxiety disorder, depression, and comorbid conditions. *Journal of Anxiety Disorders*, *37*, 71-77. https://doi.org/10.1016/j.janxdis.2015.11.004

Wechsler, D. (2008a). *WAIS-IV administration and scoring manual.* Psychological Corporation.

Wechsler, D. (2008b). *WAIS-IV Technical and Interpretive Manual.* Psychological Corporation.

Weightman, M. J., Air, T. M., & Baune, B. T. (2014). A review of the role of social cognition in major depressive disorder. *Frontiers in Psychiatry, 5*, 179. https://doi.org/10.3389/fpsyt.2014.00179

Weiss, L. G., Saklofske, D. H., Coalson, D., & Raiford, S. E. (Eds.). (2010). *WAIS-IV clinical use and interpretation: Scientist-practitioner perspectives.* Academic Press.

Wilmer, M. T., Anderson, K., & Reynolds, M. (2021). Correlates of quality of life in anxiety disorders: Review of recent research. *Current Psychiatry Reports, 23*, 77. https://doi.org/10.1007/s11920-021-01290-4

Witlox, M., Garnefski, N., Kraaij, V., Simou, M., Dusseldorp, E., Bohlmeijer, E., & Spinhoven, P. (2021). Prevalence of anxiety disorders and subthreshold anxiety

throughout later life: Systematic review and meta-analysis. *Psychology and Aging, 36*(2), 268. https://doi.org/10.1037/pag0000529

World Health Organization. (2017). *Depression and other common mental disorders: Global health estimates.* https://www.who.int/publications/i/item/depression-global-health-estimates

World Health Organization. (2022a). *ICD-11: International classification of diseases* (11th revision). World Health Organization. https://icd.who.int/

World Health Organization. (2022b). *World mental health report: Transforming mental health for all.* https://www.who.int/publications/i/item/9789240049338

Yeh, Z.-T., Tsai, M.-C., Tsai, M.-D., Lo, C.-Y., & Wang, K.-C. (2016). The relationship between theory of mind and the executive functions: Evidence from patients with frontal lobe damage. *Applied Neuropsychology: Adult, 23*(3), 200–209. https://doi.org/10.1080/23279095.2016.1185425

Yıldırım, E. A., Kaşar, M., Güdük, M., Ateş, E., Küçükparlak, İ., & Özalmete, E. O. (2011). Investigation of the reliability of the "reading the mind in the eyes test" in a Turkish population. *Turkish Journal of Psychiatry, 22*(3), 177–186.

Zaider, T. I., Heimberg, R. G., & Iida, M. (2010). Anxiety disorders and intimate relationships: A study of daily processes in couples. *Journal of Abnormal Psychology, 119*(1), 163-173. https://doi.org/10.1037/a0018473.

Zainal, N. H., & Newman, M. G. (2018). Worry amplifies theory-of-mind reasoning for negatively valenced social stimuli in generalized anxiety disorder. *Journal of Affective Disorders*, *227*, 824-833. https://doi.org/10.1016/j.jad.2017.11.084

Zeidner, M. (2008). Anxiety revisited: Theory, research, applications. In G. Boyle, D. Saklofske, & G., Matthews (Eds.), *The SAGE Handbook of Personality Theory and*

Assessment: Volume 1 Personality Theories and Models (pp. 423-446). SAGE Publications Ltd.

Zhong, Q., Niu, L., Chen, K., Lee, T. M., & Zhang, R. (2024). Prevalence and risk of subthreshold anxiety developing into threshold anxiety disorder in the general population. *Journal of Affective Disorders, 367*, 815-822. https://doi.org/10.1016/j.jad.2024.09.031

Appendix A

Diagnostic Criteria

DSM-5-TR (APA, 2022) Diagnostic Criteria for Generalized Anxiety Disorder (F41.1)

A. Excessive anxiety and worry (apprehensive expectation), occurring more days than not for at least 6 months, about a number of events or activities (such as work or school performance).

B. The individual finds it difficult to control the worry.

C. The anxiety and worry are associated with three (or more) of the following six symptoms (with at least some symptoms having been present for more days than not for the past 6 months):

   Note: Only one item is required in children.

   1. Restlessness or feeling keyed up or on edge.
   2. Being easily fatigued.
   3. Difficulty concentrating or mind going blank.
   4. Irritability.
   5. Muscle tension.
   6. Sleep disturbance (difficulty falling or staying asleep, or restless, unsatisfying sleep).

D. The anxiety, worry, or physical symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

E. The disturbance is not attributable to the physiological effects of a substance (e.g., a drug of abuse, a medication) or another medical condition (e.g., hyperthyroidism).

F. The disturbance is not better explained by another mental disorder (e.g., anxiety or worry about having panic attacks in panic disorder, negative evaluation in social anxiety disorder, contamination or other obsessions in obsessive-compulsive disorder, separation from attachment figures in separation anxiety disorder, reminders of traumatic events in posttraumatic stress disorder, gaining weight in anorexia nervosa, physical complaints in somatic symptom disorder, perceived appearance flaws in body dysmorphic disorder, having a serious illness in illness anxiety disorder, or the content of delusional beliefs in schizophrenia or delusional disorder).

ICD-11 (WHO, 2022a) Diagnostic Criteria for Generalized Anxiety Disorder (6B00)

Essential (Required) Features:

- Marked symptoms of anxiety manifested by either:
    - General apprehensiveness that is not restricted to any particular environmental circumstance (i.e., 'free-floating anxiety'); or
    - Excessive worry (apprehensive expectation) about negative events occurring in several different aspects of everyday life (e.g., work, finances, health, family).
- Anxiety and general apprehensiveness or worry are accompanied by additional characteristic symptoms, such as:
    - Muscle tension or motor restlessness.
    - Sympathetic autonomic overactivity as evidenced by frequent gastrointestinal symptoms such as nausea and/or abdominal distress, heart palpitations, sweating, trembling, shaking, and/or dry mouth.
    - Subjective experience of nervousness, restlessness, or being 'on edge'.
    - Difficulty concentrating.
    - Irritability.
    - Sleep disturbances (difficulty falling or staying asleep, or restless, unsatisfying sleep).
- The symptoms are not transient and persist for at least several months, for more days than not.
- The symptoms are not better accounted for by another mental disorder (e.g., a Depressive Disorder).
- The symptoms are not a manifestation of another medical condition (e.g., hyperthyroidism) and are not due to the effects of a substance or medication on the central nervous system (e.g., caffeine, cocaine), including withdrawal effects (e.g., alcohol, benzodiazepines).
- The symptoms result in significant distress about experiencing persistent anxiety symptoms or significant impairment in personal, family, social, educational, occupational, or other important areas of functioning. If functioning is maintained, it is only through significant additional effort.

Additional Clinical Features:

- Some individuals with Generalized Anxiety Disorder may only report general apprehensiveness accompanied by chronic somatic symptoms without being able to articulate specific worry content.
- Behavioural changes such as avoidance, frequent need for reassurance (especially in children), and procrastination may be seen. These behaviours typically represent an effort to reduce apprehension or prevent untoward events from occurring.

Appendix B

Acknowledgment of receipt of ethics application form

L-Università ta' Malta

Tereza Bugeja <tereza.bugeja.10@um.edu.mt>

The status of your REDP form (SWB-2024-00506) has been updated to Acknowledged

1 message

form.urec@um.edu.mt <form.urec@um.edu.mt> 21 May 2024 at 07:11
To: tereza.bugeja.10@um.edu.mt

Dear Tereza Bugeja,

Please note that the status of your REDP form (SWB-2024-00506) has been set to *Acknowledged*.

This status change was accompanied by the following explanation/justification: *Dear Tereza Bugeja, Your research ethics application has been received. As indicated in the Research Ethics Review Procedures, REDP forms which have no self-assessment issues are kept for record and audit purposes only. Hence, research may commence. Kindly note that FREC will not issue any form of approval as the responsibility for the self-assessment part lies exclusively with the researcher. Regards, SWB FREC*

You can keep track of your applications by visiting: https://www.um.edu.mt/research/ethics/redp-form/frontEnd/.

This email has been automatically generated by URECA. Please do not reply. If you wish to communicate with your F/REC please use the respective email address.

Appendix C

Recruitment Forms

Information and Recruitment Form

Study title
Examining the relationship between different profiles of anxiety and social cognition

Introduction
I would like to invite you to take part in a research study examining the role that individual differences in anxiety have on performance on measures of social cognition (that is, how we process social information and how we use this information to interact effectively with others) in adults.

Why am I doing the project?
The project is part of my Master of Psychology in Neuropsychology at the University of Malta and is being supervised by Dr Kristina Bettenzana. It is hoped that this study will help us further comprehend if and how our ability to understand other people's behaviours and engage appropriately with others changes as a function of individual difference in anxiety.

What will happen?
In this study, you will be asked to participate in an individual session during which you will complete short paper and pencil and computer tasks that assess social cognition and look into profiles of anxiety.

How much time will participation involve?
The study typically involves a single session of between 60-90 minutes. Short breaks will be offered throughout, and you may ask for a break at any time during the session.

Your rights as a participant
Your participation in this project is voluntary. You may decide to stop being a part of the research study at any time without explanation. You have the right to ask that any data you have supplied to that point be withdrawn/destroyed.

You have the right to have your questions about the procedures answered (unless answering these questions would interfere with the study's outcome). If you have any questions as a result of reading this information sheet, you should ask the researcher before the study begins.

Eligibility criteria

To be eligible for this study, you must meet the following criteria:

- Be between the ages of 18 and 64
- Have a good command of the English language
- Have corrected to normal vision and hearing
- Have no known history of alcohol or substance abuse.
- Have no medical or neurological conditions that could influence cognition or affect. o No history of head injury that resulted in a loss of consciousness.
- Have no known diagnosis of neurodevelopmental condition.

Risks

Participation in this study involves completion of a test (AQ10) which is used in clinical and research settings as a diagnostic screening tool for autism symptoms, which you may not be aware of.

Scores from these tests would not be a sufficient basis for clinical decisions or diagnosis, contain substantial margins of error, and are not used for diagnostic purposes in this study. It will not possible to provide feedback of individual scores to participants.

Confidentiality/Anonymity

All information collected about you during this study will be kept strictly confidential.

When your role with this project is complete, your data will be anonymised. From that time, there will be no record that links the data collected from you with any personal data from which you could be identified (e.g., your name, address, email, etc.). Up until the point at which your data have been anonymised, you can decide not to consent to having your data included in further analyses. Once anonymised, these data may be made available to researchers via accessible data repositories and possibly used for novel purposes.

For further information

Researcher:
Tereza Bugeja
tereza.bugeja.10@um.edu.mt

Supervisor:
Dr Kristina Bettenzana
kristina.vella@um.edu.mt

Psychology – Faculty for Social Wellbeing,
University of Malta

Thank you for taking the time to read this information sheet. Your contribution to this study would be highly appreciated. Should you accept to participate in the study, kindly fill in the consent form and return it to tereza.bugeja.10@um.edu.mt.

If you want to find out about the final results of this study, you should contact Tereza Bugeja on tereza.bugeja.10@um.edu.mt. Please note that you will be provided with a summary of the results of the study, however, it will not be possible to share with you your personal results following participation in the study.

Informed Consent Form

Study title

Examining the relationship between anxiety and social cognition in an adult population

Consent

By signing below, you are agreeing that:

- You have read and understood the Information and Recruitment Form,
- Questions about your participation in this study have been answered satisfactorily,
- You are aware of the potential risks (if any),
- You are taking part in this research study voluntarily (without coercion)
- Anonymised data only may be shared in public research repositories.
- You are aware that participation in this study involves completion of some standardised tests which are routinely used as preliminary screens for clinical conditions/impairments of which you might not be aware. You understand that these assessments are not sufficient for diagnostic purposes, nor will they be used in this manner in this study. You also acknowledge that the researchers cannot inform participants of individual test scores.

_____

Participant's Name (Printed)

_____ _____

Participant's Signature Date

_____ _____

Name of Researcher (Printed) Signature of Researcher

Appendix D

Debrief Form

Study title
Examining the relationship between different profiles of anxiety and social cognition

Researcher:
Tereza Bugeja
tereza.bugeja.10@um.edu.mt

Supervisor:
Dr Kristina Bettenzana
kristina.vella@um.edu.mt

Dear Participant,

Thank you very much for contributing to this study.

The aim of this study is to examine the role that individual differences in anxiety have on performance on measures of social cognition in adults. Social cognition refers to the abilities we use in order to process social information and how we use this information to interact effectively with others.

Your participation in this study is very valuable and will help increase our understanding of how differences in the anxiety people experience in the moment (state anxiety), as well as more stable differences in anxiety (trait anxiety) impact the skills we use in order to understand and interact with others.

While participating in this study, you may have encountered questions that elicited discomfort or distress. Any negative emotions elicited are anticipated to be temporary. However, if you feel the need for further support due to any lingering negative feelings, below are some local psychological services you could access for support.

Should you require any additional information or you have any further feedback you can contact me via email on tereza.bugeja.10@um.edu.mt

Thank you once more for your participation,

Yours sincerely

Tereza Bugeja

Service and Description	Contact Information
Community Mental Health Clinics The Community Mental Health clinics teams (CMHTs) offer support to individuals experiencing mental illness or mental health challenges within the community at different health centres and clinics. General practitioners, family doctors, or physicians from primary care health centres can provide referrals to the service. Centres are located at: Cospicua, Paola, Qormi, Floriana, Mtarfa, Mosta and Qawra.	Further information can be accessed on: https://healthservices.gov.mt/en/mch/Pages/community-mental-health-services/community-mental-health-teams.aspx Contact Details of Mental Health Clinics covering the South of Malta: Cospicua: 2166 2088 / 2397 2330 Paola: 2182 1566 / 2182 1562 Contact Details of Mental Health Clinics covering the Center of Malta: Floriana: 2122 0521 / 2122 0454 Qormi: 2144 1317 / 2144 0170 Contact Details of Mental Health Clinics covering the North of Malta: Mtarfa: 2145 6750 / 2145 4917 / 2145 6758 Mosta/Qawra: 2142 4969
Richmond Foundation **Helpline 1770 -** free support to individuals experiencing mental health challenges **OLLIChat** – online chat free to anyone experiencing mental health challenges	**Helpline**:1770 **Chat**: https://www.olli.chat These services are available **Monday through Saturday from 8 am to 8 pm**. Outside of these hours, you can reach out to 1579, the mental health services helpline.
Aġenzija Appoġġ - Supportline 179 Supportline 179 is the National Helpline in Malta that offers 24/7 support to individuals who may require help for diverse issues, as well as information about or referral to other services and agencies.	**Supportline: 179**
kellimni.com Online support service run by trained and volunteer staff.	**https://kellimni.com** The **Kellimni.com** team can be contacted through online Chat, Email, Whatsapp, Messenger, Instagram and Telegram

The latest register of warranted psychologists can be accessed through:

https://family.gov.mt/wp-content/uploads/2023/11/Register-of-Warranted-Psychologists-November-2023.pdf

Appendix E

Permission to use the State Trait Inventory for Cognitive and Somatic Anxiety

L-Università ta' Malta

Tereza Bugeja <tereza.bugeja.10@um.edu.mt>

RE: Permission to use the STICSA

1 message

Melissa Ree <melissa.ree@uwa.edu.au> 7 March 2024 at 04:17
To: Tereza Bugeja <tereza.bugeja.10@um.edu.mt>

Dear Tereza,

Please go ahead and use the STICSA – it's a free to use instrument.

All the best with your research,

Melissa

Dr Melissa Ree

Senior Lecturer (Clinical Psychology)

Psychological Science

G19, Center for Sleep Science • M309, 10-12 Parkway, Nedlands, Perth WA 6009 Australia

T +61 8 6488 8693 • **E** melissa.ree@uwa.edu.au

Please note that I work at UWA on Mondays & Tuesdays

THE UNIVERSITY OF WESTERN AUSTRALIA

From: Tereza Bugeja <tereza.bugeja.10@um.edu.mt>
Sent: Wednesday, March 6, 2024 8:52 PM
To: Melissa Ree <melissa.ree@uwa.edu.au>
Subject: Permission to use the STICSA

Dear Dr Ree,

I am a student at the University of Malta reading for a Master's degree of Psychology in Neuropsychology. As part of my studies, I am completing a research project titled "Examining the relationship between different profiles of anxiety and social cognition". The purpose of this study is to explore the associations between profiles of anxiety and theory of mind, and also how state and trait anxiety might relate to this construct in the general population.

In view of this, I would like to ask for your permission to use the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA) as a measure of anxiety. Should such permission be granted, I will ensure to use the STICSA without any modification.

I look forward for your reply and kind guidance regarding access to the measure.

Thank you for taking the time to consider my request,

Kind regards,

Tereza Bugeja

3 attachments

Microsoft Word - STICSA-state.pdf
53K

Microsoft Word - STICSA-trait.pdf
53K

Ree et al. 08 STICSA.pdf
119K

Appendix F

Permission to use the Edinburgh Social Cognition Test

L-Università ta' Malta

Tereza Bugeja <tereza.bugeja.10@um.edu.mt>

Re: Permission for EsCOT use

Asaad Baksh <asaad.baksh@kcl.ac.uk> To: Tereza Bugeja <tereza.bugeja.10@um.edu.mt> 20 March 2024 at 10:34

Hi Tereza

Thanks a lot for filling out the form.

I'm not sure if you still have the link, so here you go:

https://tinyurl.com/ESCoTMaterials

Asaad

From: Tereza Bugeja <tereza.bugeja.10@um.edu.mt>
Date: Wednesday, 20 March 2024 at 09:01
To: Asaad Baksh <asaad.baksh@kcl.ac.uk>
Subject: Fwd: Permission for EsCOT use

You don't often get email from tereza.bugeja.10@um.edu.mt. Learn why this is important

Hi Asaad,

I hope this email finds you well.

Kindly find attached the completed request form.

Kind regards

Tereza

---------- Forwarded message ---------
From: **Asaad Baksh** <asaad.baksh@kcl.ac.uk>
Date: Thu, Feb 22, 2024 at 11:42 AM
Subject: Re: Permission for EsCOT use
[redacted]>

Hi Tereza

Good to hear from you! I'm good thanks. How are you doing?

Sure, just fill in the attached request form and send it back to me.

Asaad

Begin forwarded message:

[redacted]

Subject: Permission for EsCOT use

Date: 22 February 2024 at 09:14:55 GMT

[redacted]

Hi Asaad,

How have you been? I hope all is well.

I am currently completing a practice-based master in Malta in neuropsychology. As part of my dissertation I was hoping to look into associations between social cognition and symptoms of anxiety and depression, and I would be interested in using the EsCOT as a measure of social cognition. Do you think that this would be possible please?

Thank you and kind regards

Tereza

Appendix G

ESCoT Scoring Example

Scenario 1: Helping the elderly (social norm violation)

General Comprehension: *Can you tell me what's happening in this story, starting with the first picture and finishing with the last picture?*

Prompt ONCE if needed: *Anything else?*

		Notes/Partial Responses/Misconstruction/Omissions
1. Old lady with bag		
2. Shopping bag bursts and all of her shopping is on the ground		
3. Points to spilled shopping as man is present		
4. Man walks on		
Other		

Question 1

Cognitive Theory of Mind: *What is the elderly lady thinking?*

Prompt ONCE if needed: *Can you tell me more about what you mean by that? / Can you explain that in a little bit more detail?*

			Additional notes
A social answer that recognises that the elderly lady required assistance and provides a contextual reason of why she needed assistance. For example, *she wants his help because her shopping is all over the pavement and it doesn't look like she has another bag.* Mention of affective state limits mark to 2 points	3		
A social answer that recognises that the elderly lady required assistance. No more than 2 points can be gained if a contextual reason is not given. No more than 2 points can be gained if a contextual reason is not given. For example, *she'd like the young man to help her pick up the shopping* (prompt)	2		
A non-social answer that recognises that the elderly lady required assistance. No more than 1 point can be gained if there is no mention of the other person from the interaction in the response, even with a contextual reason. For example, *she wants the shopping picked up*	1		
Don't know/irrelevant answer	0		

Question 2

Affective Theory of Mind: *How does the elderly lady feel at the end of the animation?*

Prompt ONCE if needed: *Can you tell me more about what you mean by that? / Can you explain that in a little bit more detail?*

			Additional notes
An answer that demonstrates a higher order emotional understanding, with a contextual reason. For example, *she feels abandoned because she is going to have to pick up her shopping on her own, which will be difficult as she has mobility issues*	3		
An answer that demonstrates a lower order emotional understanding, with a contextual reason. For example, *she is not happy she is going to have to pick up her shopping on her own, which will be difficult as she has mobility issues* (prompt)	2		
An answer that demonstrates a higher or lower order emotional understanding with no contextual reason. For example, *she is disappointed, or she feels disgusted* (prompt)	1		
Don't know/irrelevant answer	0		

Appendix H

Full analysis of ANCOVA assumptions

Analysis of covariance

Initial analyses revealed significant group differences in cognitive ToM, it was subsequently important to determine whether these findings were influenced by other variables. To address this, a series of ANCOVAs (Analysis of Covariance) were planned to control for the effect of age, verbal ability, perceptual reasoning, and autistic traits, which have been found in literature to affect social cognitive performance (Baker et al., 2014; Baksh et al., 2018; Baksh et al., 2020; Bertrams & Schlegel, 2020; Charlton et al., 2009; Poljac et al., 2012). However, preliminary analyses testing the assumptions of ANCOVA revealed significant violations.

The assumption of linearity, that is that a linear relationship exists between the covariate and the dependent variable (Rotello et al., 2025), was tested for all covariates using scatterplots and comparisons to the regression line. This demonstrated that none of the covariates maintained a significant linear relationship with cToM across TA groups (all $R^2 <$ .04). The violation of this assumption persisted despite attempts to transform the covariates to linearise the relationship (Rotello et al., 2025).

Table 9.

Test of assumption of linearity

Covariates	R^2 for LA	R^2 for HA	Assumption
Age	.011	.019	violated
Matrix reasoning	.010	.001	violated
Autism traits (AQ10)	.031	.009	violated
Vocabulary	.031	.025	violated

Furthermore, ANCOVA analyses also assume homogeneity of regression slopes, that is that the relationship between the covariates and the dependent variable is the same across both groups in the study (Field, 2024; Rotello et al., 2025). To assess for this, an interaction term (TA group × covariate) was included in the model, and this revealed additional assumption violations. The interaction between TA and matrix reasoning ($F(2, 70) = 3.199$, $p = .047$), as well as TA and age ($F(2, 70) = 3.677$, $p = .03$), were statistically significant indicating that the relationship between matrix reasoning and cToM, and age and cToM differed significantly between anxiety groups. The interaction between TA and autism traits approached significance ($F(2, 70) = 3.080$, $p = .052$), suggesting potential differences in regression slopes, while the interaction between TA and vocabulary scores was non-significant ($F(2, 70) = 2.649$, p = .078). Levene's test for equality of error variances was non-significant for all models (age: $F(1, 71) = .645$, $p = .425$; matrix reasoning: $F(1, 71) = .596$, $p = .443$; vocabulary: $F(1, 71) = .646$, $p = .424$; autism traits: $F(1, 71) = .270$, $p = .605$), indicating that while homogeneity of variances was maintained, the assumption of homogeneous regression slopes was violated for multiple covariates.

Hence, as the assumptions underlying ANCOVA were not met, alternative statistical approaches were required. The subsequent section details the use of multiple regression analyses to identify the best predictors of cognitive ToM

Table 9.

Tests of homogeneity of regression slopes

Covariates interaction term	f-statistic	p-value	Assumption
TA × Age	F(2, 70) = 3.677	**.030***	violated
TA × Matrix reasoning	F(2, 70) = 3.199	**.047***	violated
TA × Autism traits (AQ10)	F(2, 70) = 3.080	.052	maintained
TA × Vocabulary	F(2, 70) = 2.649	.078	maintained

Note: *significance at the 0.05 level