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Student's name:

Arianna Paricos

Student's candidate number:

730270

Supervisor's name:

Charlotte Hartwright

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Social Anxiety and Theory of Mind: A Comparison of Self-Report and Objective Measures

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Social Anxiety and Theory of Mind: A Comparison of Self-Report and Objective Measures

Arianna Paricos

Aston University

Abstract

This study aims to explore the relationship between social anxiety and Theory of Mind (ToM) ability. Findings are evaluated in the context of theoretical models (Clark & Wells, 1995; Heimberg et al., 2010), to aid improvement of the understanding of social anxiety disorder (SAD). Two hypotheses are proposed: (1) social anxiety will negatively associate with self-report and objective measures of ToM ability; (2) objective and self-report measures of ToM will be positively associated. Literature assessing the relationship between social anxiety and ToM has not produced consistent results and has exclusively focused on ToM decoding and reasoning ability. This study is the first to explore the relationship between social anxiety, cognitive and affective ToM ability, and self-reported ToM ability. A correlational study was conducted (36 participants), comparing Social Interaction Anxiety Scale scores (SIAS; Mattick & Clarke, 1998) for social anxiety levels; Interpersonal Reactivity Index (IRI) perspective-taking subscale scores for self-reported ToM ability (Davis, 1980); error rate (in millimeters) on the Paper and Pencil Sandbox Task (Coburn, Bernstein, & Begeer, 2015) for cognitive ToM ability; and reaction times on the Yoni Task (Shamay-Tsoory & Aharon-Peretz, 2007) for cognitive and affective ToM ability. Contrary to expectations, no significant relationships were found between any of the measures. The results prompt re-thinking regarding the mechanisms of SAD and offer insight into the complexity of the relationship between social anxiety and ToM ability. However, the implications can only be inferred within the context of the study limitations, these are discussed alongside recommendations for future research.

Social Anxiety and Theory of Mind: A Comparison of Self-Report and Objective Measures

Social Anxiety Disorder (SAD) is defined in DSM-5 as excessive perception of threat, and thus fear, in social situations, especially regarding circumstances with potential for external scrutiny (Heimberg et al., 2014). The world lifetime prevalence rate of SAD is estimated at 4%, with a heightened lifetime prevalence rate for high income countries (such as the UK) at 5.5% (Stein et al., 2017). The onset of SAD is during early-mid adolescence; whilst some cases end naturally within adolescence, many see symptomology persisting into adulthood, at which point the likelihood of recovery without treatment is marginal (Grant et al., 2005). Despite this, it is estimated that approximately 50% of individuals with SAD in the UK do not seek treatment, and those that do, have endured symptoms for 15-20 years before doing so (NICE, 2013).

The persistent and prevalent nature of SAD led to a surge of research in the early 2000s into the extent of its impact. Relative to those without the disorder, those with SAD demonstrate reduced functionality in friendships (Davila & Beck, 2002) and romantic relationships (Sparrevohn & Rapee, 2009). Furthermore, individuals with SAD are at higher risk of not completing high school education (Stein & Kean, 2000) as well as having lower employment and reduced occupational functioning (Wittchen, Fuetsch, Sonntag, Muller, & Liebowitz, 2000). Quality of life is lower in individuals with SAD than those without (Eng, Coles, Heimberg, & Safren, 2005). However, despite a heightened awareness of the severity of the impact SAD can have on individuals' functioning and quality of life, SAD is under-detected by clinicians and treatment is insufficient (Chapdelaine, Carrier, Fournier, Duhoux, & Roberge, 2018). Quality of life for individuals after receiving treatment for SAD increases relative to before treatment, however, this is still reported to be lower than that of healthy controls (Eng, Coles, Heimberg, & Safren, 2001).

The extent of the difficulties experienced by individuals with SAD highlights the importance of understanding the underpinnings of the social dysfunction associated with the disorder. Theory of Mind (ToM) is the ability to infer the mental states of others such as their beliefs, desires and emotions and to use this information to recognise and predict their behaviour and responses, making it critical for successful social interactions (Stone, Baron-Cohen, & Knight, 1998). The term ToM was first coined by Premack and Woodruff (1978) when investigating the social awareness of chimpanzees, but has subsequently become a defining feature of investigations into human social cognitive function (Brune & Brune-Cohrs, 2006). Initial ToM research was primarily developmental, leading to a well-established developmental trajectory of ToM ability in children (Wellman, Cross, & Watson, 2001).

Explorations of ToM in atypical development began to emerge, such as in Autism Spectrum Disorder (ASD; Baron-Cohen, 1995) – and psychopathologies such as depression (Lee, Harkness, Sabbagh, & Jacobson, 2005; Wolkenstein, Schonenberg, Schirm, & Hautzinger, 2011), borderline personality disorder (Fertuck et al., 2009) and schizophrenia (Brune, 2005). Moreover, neurocognitive research identified differential modes of activation for ToM tasks in ASD (Oberman & Ramachandran, 2007) and schizophrenia (Fett et al., 2011), providing potential neurological explanations of the ToM deficits associated with these disorders. This has led to the creation of successful ToM interventions that have aided the social functioning of individuals with ASD through direct teaching of social skills (Peters & Thompson, 2018) and schizophrenia through Cognitive Remediation Therapy (Bechi et al., 2015).

SAD, up until recent years, was largely neglected in the body of research investigating potential ToM dysfunction in psychopathologies, with the first publication being by Dustin Washburn in 2012. With this research area being somewhat in its infancy, the current

understanding of the social functioning impairments in SAD is primarily based on several influential theories that do not specifically regard the potential involvement of ToM deficits (Clark & Wells, 1995; Heimberg, Brozovich, & Rapee, 2010; Rapee & Heimberg, 1997).

Evaluating theoretical models of SAD is consequently imperative to this discussion as this will provide insight into the extent of the potential implications of findings regarding SAD and ToM.

Theoretical Framework of SAD

The notion that SAD is distinct from specific phobias, such as fear of spiders or heights, was first proposed by Marks and Gelder (1965). Since then, over fifty years of research has postulated various underlying processes and causes of SAD. From this, several models of SAD have been formulated from different theoretical standpoints, such as the metacognitive model of SAD (Hartman, 1983), the cognitive model of SAD (Clark & Wells, 1995), cognitive-behavioural models of SAD (Heimberg et al., 2010; Rapee & Heimberg, 1997), and the developmental psychopathology model of SAD (Ollendick & Hirshfeld-Becker, 2002). The most influential of these models has arguably been the Clark and Wells (1995) model and the Heimberg et al. (2010) model, given the direct impact they have had on the production and recommended utilisation of treatment for SAD, as outlined in guidance proposed by NICE (2013).

Clark and Wells (1995) suggest that SAD is maintained through a combination of four key processes that prevent the overruling of automatic negative beliefs. The first is self-focused attention – individuals hold unsubstantiated views that people are watching and judging their social performance; this view is suggested to be based on the individual's self-perception. The second is safety behaviours, such as avoiding eye contact – this removes the opportunity for the testing and rejection of biased negative thoughts. The third is anxiety induced performance

deficits. These result from excessive self-monitoring – the self-focus and safety behaviours mean the individual will come across as less friendly and this behavioural deficit may lead to further negative social experiences and interactions – aiding the maintenance of a negative schema. Finally, anticipatory and post-event processing – specific social events are either avoided through excessive anxiety experienced beforehand, or are markedly dissected after the event, fueling future employment of safety and avoidance behaviours.

Similarly to the Clark and Wells (1995) model, the Heimberg et al. (2010) model of SAD acknowledges the significance of self-focused attention in the maintenance of social dysfunction in SAD. However, Heimberg et al. (2010) present an alternative explanation for this – attentional biases. Individuals with SAD are suggested to interpret social situations as negative due a bias in attention towards threat. For example, individuals with SAD may experience elevated heart rate during social interactions – information only available to them – however, this negatively impacts their self-perception from the perspective of their audience, as their attention is biased towards potential negative feedback.

At face value, the two models seem similar, however, the central features demonstrate key differences in approach. The Clark and Wells (1995) model emphasises self-monitoring and holding oneself to unrealistic standards. This implies that those with SAD are highly self-critical and that the social dysfunction experienced is a result of negative self-imagery. Contrastingly, the Heimberg et al. (2010) model suggests that individuals with SAD over-attribute meaning to subtle cues given by their audience during interactions and have an attentional bias to perceived negative feedback. In the context of social functioning, the Clark and Wells (1995) model could therefore be argued to suggest that individuals with SAD hold a belief that their ability to function socially is poor, but that there may not be true social cognitive deficits. The Heimberg et

al. (2010) model may suggest the opposite, with over-mentalization being the root of the social dysfunction typically observed in SAD. This implies that whilst ToM ability was not explicitly discussed, the theoretical underpinnings may still be indicative of a ToM deficit in SAD.

The stark differences are demonstrated in the recommended cognitive-behavioural-therapy (CBT) from each model. NICE (2013) recommends CBT as first line treatment for SAD and specifies to follow the principles of Clark and Wells (1995) or Heimberg et al. (2010) in the delivery of this. The CBT based on Clark and Wells (1995) model focuses on amending patients' negative self-image through techniques such as video feedback and in-session role-play of scenarios in order to confront core beliefs held. Alternatively, the CBT based on the Heimberg et al. (2010) model focuses on cognitive restructuring and gradual exposure to anxiety provoking situations. Simply put, the Clark and Wells (1995) based CBT aims to modify individuals self-perception, whereas the Heimberg et al. (2010) based CBT aims to modify attentional biases towards threat in social situations. There have been no direct comparisons of the different CBT models, however, overall efficacy of CBT in the treatment of SAD is considered to be moderate and there is large consensus that more effective treatments are required (Carpenter et al., 2018).

The potential role of a ToM deficit in SAD is unclear based on current models and treatments. This is surprising given the negative impact SAD has been shown to have on social functioning (Keller, 2005). Nevertheless, research in this field has begun to emerge and a review of the key publications is outlined below.

ToM and SAD

There is limited research investigating ToM in SAD. Studies have primarily focused on assessing ToM decoding ability using the Reading the Mind in the Eyes Task (MIE; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001) and ToM reasoning ability using the Movie

Assessment of Social Cognition (MASC; Dziobek et al., 2006). It was originally hypothesised by Washburn (2012) that SAD participants would demonstrate greater ToM decoding and reasoning ability than participants with depression. This prediction was based on evidence showing SAD participants accurately deduced emotions during a facial emotion recognition task (Hunter, Buckner, & Schmidt, 2009; Philippot & Douilliez, 2005) and it was postulated that this ability extends to accurate mental inferences of others (Washburn, 2012).

If Washburn's (2012) hypothesis proved to be true it would suggest fundamental inaccuracies in the current understanding of the cognitive mechanisms of SAD. This is because the SAD models discussed (Clark & Wells, 1995; Heimberg et al., 2010) argue that individuals with SAD are not able to accurately infer the mental states of others due to self-focused attention and attentional biases; however, Washburn's (2012) hypothesis implies heightened – not diminished – ToM ability in SAD. However, when comparing MIE results (indicative of the participants ToM decoding ability), of different participant groups, Washburn (2012) found no support for this hypothesis. The results demonstrated that those with pure SAD (without being comorbid with depression) performed significantly worse on the MIE than participants with comorbid SAD and depression, participants with pure depression, and healthy controls (Washburn, 2012). Therefore, contrary to the hypothesis, this suggests individuals with SAD have profound impairments in ToM decoding.

In addition, it may be possible to explain these findings using the current SAD models. A key characteristic of SAD is widely regarded to be self-focused attention (Clark & Wells, 1995; Rapee & Heimberg, 1997; Heimberg et al., 2010). It may be that this inward-attention interferes with individuals' ability to process external information, such as emotion expressed in the eyes as is expected in the MIE (Baren-Cohen et al., 2001). This may explain the discrepancy between the

accuracy of individuals on the MIE (Washburn, 2012) and previous findings with emotional facial expressions (e.g. Hunter et al., 2009): identification of emotional facial expressions may require less cognitive processing than inferring mental states of others based on subtle social cues. However, interpretation of Washburn's (2012) findings can only be speculative given the exploratory nature of the study. Nevertheless, the results have been replicated in a larger sample (Washburn, Wilson, Roes, Rnic, & Harkness, 2016).

Additionally, self-focused attention in SAD has been shown to have the greatest impact in situations involving evaluation of the individual (Neils-Christensen, Stein, & Means-Christensen, 2003). Since Washburn (2012) used the MIE task to assess ToM decoding ability, which involved the participants sat in front a computer screen, unobserved, with the knowledge that their data was anonymised, it is unlikely that this would be perceived as evaluative by participants. This demonstrates issues with the implications of Washburn's (2012) findings as it is unclear what this apparent ToM decoding deficit suggests about the nature of SAD.

Whilst Washburn's (2012) study may not demonstrate clear theoretical implications, it did pave the way for further exploration of the speculations made. Hezel and McNally (2014) replicated aspects of Washburn's (2012) study in that the ToM ability of individuals with SAD and healthy controls were compared using the MIE and MASC. Hezel and McNally (2014) replicated Washburn's (2012) findings regarding ToM decoding ability – the SAD participants were significantly less accurate on the MIE than healthy controls. Building on the potential interpretation of Washburn's (2012) findings, Hezel and McNally (2014) also introduced a condition with a cognitive load task. This involved participants memorising a series of eight symbols prior to completing the MIE and reciting these symbols throughout the completion of the MIE. They found that participants in the cognitive load condition performed significantly

worse on the MIE, indicating the addition of a cognitive task negatively impacts ToM decoding ability. This suggests that the cognitive load, through self-focused attention in SAD, may reduce efficient cognitive processing of external stimuli. However, Hezel and McNally (2014) found no group-condition interactions – individuals with SAD performed worse than control participants irrespective of experimental condition. This therefore suggests that cognitive load, as a result of self-focused attention, may not be a correct interpretation of the reduced ToM decoding ability seen in SAD.

Regarding ToM reasoning ability, Hezel and McNally (2014) found SAD participants made more ‘excessive ToM’ errors in the MASC than controls, i.e. they over-estimated the emotions and feelings of characters in the film. This suggests a deficit in ToM reasoning ability in individuals with SAD, however, it was highlighted that ‘excessive ToM’ was consistently observed regardless of the emotion being portrayed (Hezel & McNally, 2014). Therefore, this implies that the assumption that those with SAD are biased towards negative interpretations of social interactions (Rapee & Heimberg, 1997; Heimberg et al., 2010) may not be correct. This supports the argument that SAD may be best described through social cognitive dysfunction as participants displayed ToM decoding and reasoning deficits (Hezel & McNally, 2014), distinct from cognitive-behavioural arguments of a negative interpretation bias (Rapee & Heimberg, 1997; Heimberg et al., 2010). However, the scoring outlined for the MASC (Dziobek et al., 2006) denotes that ‘excessive ToM’ does encompass negative suppositions regarding the protagonist’s thoughts in the video. This therefore means that it cannot be fully ascertained that Hezel and McNally’s (2014) results indicate social cognitive dysfunction independent of negative interpretation biases.

Likewise, Hezel and McNally's (2014) finding of a ToM reasoning deficit has not been consistently reported. Lenton-Brym, Moscovitch, Vidovic, Nilsen, and Friedman (2018), when administering the MASC to a sub-clinical sample of participants identified as having a high level of social anxiety (HSA) or a low level of social anxiety (LSA), found no difference between the two groups in terms of 'excessive ToM'. This therefore means that there cannot be full confidence in interpretations as there is a lack of consistency in results. However, this discrepancy could demonstrate a difference in ToM ability in clinical SAD and non-clinical experiences of social anxiety – those scoring as HSA on self-report measures may be more similar in their ToM ability to LSA individuals than clinical SAD. Thus, the notion that SAD is maintained through social cognitive dysfunction, as opposed to self-focused attention impacting social performance, cannot be dismissed. This is also supported by the similarity in findings between Hezel and McNally (2014) and Washburn et al. (2016) with 'excessive ToM' in SAD participants during the MASC task, further indicating a discrepancy between clinical and non-clinical samples. Moreover, Lenton-Brym et al.'s (2018) study was conducted online without a researcher present. Given the number of tasks participants were required to complete, the full attention and efforts of participants cannot be counted on, and this may have contributed to the similarities in findings between the HSA and LSA groups.

Lenton-Brym et al. (2018) have conducted the only study investigating the relationship between ToM deficits and social anxiety in a non-clinical sample. This forms part of the rationale behind this study as additional literature with a non-clinical sample may provide answers regarding potential differences between clinical and non-clinical populations. In addition, this field of research has focused exclusively on decoding and reasoning ToM ability, with no publications exploring the potential affective and cognitive ToM deficits. Cognitive ToM is one's

ability to infer what others are thinking (Kalbe et al., 2007), whereas affective ToM is one's ability to infer what others are feeling and the emotions they are experiencing (Peron et al., 2009). Since current SAD models indicate an inward focus when making interpretations of the thoughts and beliefs of others (Clark and Wells, 1995; Heimberg et al., 2010) it is surprising that affective and cognitive ToM have not previously been explored.

Equally, it cannot be ascertained from current findings if individuals with SAD demonstrate social cognitive dysfunction in the form of ToM deficits (Hezel & McNally, 2014), or if negative schema regarding one's ability to successfully navigate social situations and interactions inhibits full functionality (Clark & Wells, 1995; Heimberg et al., 2010). Comparisons of actual social cognitive function and self-reported social cognitive function may contribute to finding an answer to this.

Aims

(1) Considering the lack of previous investigation, this study aims to explore the relationship between cognitive and affective ToM and social anxiety levels in a non-clinical sample.

(2) To resolve the debate surrounding whether social anxiety is better characterised by true poor social function, or a belief of poor social function, this study will also compare self-report and objective measures of ToM ability.

Hypotheses

(1) On the basis of Washburn (2012) and Hezel and McNally (2014), it is expected that social anxiety levels will negatively correlate with objective and self-report measures of affective and cognitive ToM ability.

(2) Given the suggestions of ToM ability deficits in SAD (Washburn, 2012; Hezel & McNally, 2014) and negative self-evaluation in SAD (Clark & Wells, 1995), it is expected that objective and self-report measures of cognitive and affective ToM will be positively associated.

Method

Design

This study used a correlational, within-subjects design. The variables correlated were self-reported social interaction anxiety; self-reported perspective taking ability; cognitive ToM ability; affective ToM ability.

Participants

A priori power analysis, conducted using Free Statistics Calculators Version 4.0 (Soper, 2019), specified that 385 participants were required in order to have 80% power for detecting a small effect ($f^2 = .02$) when using the .05 criterion for statistical significance. For a medium effect size ($f^2 = .15$), with the same parameters, a sample size of 54 was required, however, due to resource restrictions the study comprised 36 individuals (29 females; age range 18-27, $M = 19.42$, $SD = 1.65$). There were no exclusion criteria for this study. Participants were fully informed of the nature of questions that would be asked prior to taking part. The participants were recruited through an opportunity sample of Aston University Psychology undergraduates. The study was advertised through the SONA Psychology Research Participation System and individuals were awarded credits for their participation.

Materials

Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998). The SIAS is a twenty-item self-report questionnaire that presents characteristic experiences of social interactions and measures anxiety through the extent participants identify with said

characteristics (see Appendix A). Participants' responses are on a 5-point Likert-scale ranging from 0 (*not at all characteristic or true of me*) to 4 (*extremely characteristic or true of me*). The focus on anxiety involved in social interactions makes this measure of particular relevance to this research. The SIAS has been shown to have strong internal consistency in clinical and non-clinical samples (Heimberg, Müeller, Holt, Hope, & Liebowitz, 1992; Mattick & Clarke, 1998).

Interpersonal Reactivity Index (IRI; Davis, 1983). The IRI is a twenty-eight-item self-report questionnaire that presents situational statements in which participants are required to rate how well the statement describes them (see Appendix B). Responses are on a 5-point Likert-scale from A (*does not describe me well*) to E (*describes me very well*). The IRI is comprised of four subscales – perspective taking, empathetic concern, personal distress and fantasy – each with seven items, and separate scores being produced for each subscale. The IRI has been used extensively to measure perspective taking and empathetic concern and all subscales have been demonstrated to have acceptable internal and test-retest reliabilities (Davis, 1980; Baldner & McGinley, 2014).

Yoni Task (revised version: Shamay-Tsoory & Aharon-Peretz, 2007). The Yoni Task is a computer-based assessment of affective and cognitive ToM (programmed using PsychoPy), as shown in Figure 1. The task consists of multiple trials, each presenting a cartoon image of a face (called 'Yoni') in the centre of the screen, and four images of objects from the same category (e.g. cars or musical instruments) in each corner of the screen (see Appendix C). Participants are required to identify the object Yoni is indicating towards based on the written information at the top of the screen and the cues provided by the Yoni character such as eye gaze and facial expression. This task has three conditions which are randomised: the cognitive condition, the affective condition and the physical condition (see Figure 1). The cognitive

condition requires participants to infer the object of Yoni's focus based on neutral written stimuli "Yoni is thinking of ____" and a neutral facial expression. The affective condition requires participants to infer the object of Yoni's focus based on emotive written stimuli "Yoni loves ____" or "Yoni does not love ____" (findings suggest the valence of the written cue does not impact accuracy or RT; Shamay-Tsoory & Aharon-Peretz, 2007) and the facial expression of the Yoni character (smiling or frowning). The physical condition is for control purposes in which participants are not required to make any mental inferences, instead they are asked to identify which object "Yoni is closest to ____". For these trials the Yoni character is physically closer to one of the four objects. The Yoni Task has been shown to be a sensitive measure of ToM impairment across several different clinical conditions (Rossetto et al., 2018). For example, this measure has been used to identify cognitive and affective ToM impairments in Obsessive-Compulsive Disorder (Liu et al., 2017), Schizophrenia, Bipolar Disorder and Major Depressive Disorder (Wang et al., 2018).

Affective ToM (12 trials)	Cognitive ToM (12 trials)	Physical (8 trials – 4 straight ahead, 4 directed gaze)
<p>1. Yoni loves ____ 2.</p> <p>3. 4.</p>	<p>1. Yoni is thinking of ____ 2.</p> <p>3. 4.</p>	<p>1. Yoni is close to ____ 2.</p> <p>3. 4.</p>

Figure 1

Sample of items for the affective, cognitive and physical conditions of the Yoni Task. Depicts the cartoon, drawn and realistic image types used. The number of trials in each condition replicates that of Shamay-Tsoory and Aharon-Peretz's (2007) original design.

The Yoni Task was adapted from the original version for the purposes of this study in four ways. The first being that rather than clicking on one of the four objects in response to the trial cues, as is the case in Shamay-Tsoory and Aharon-Peretz's (2007) original design, the objects were numbered '1', '2', '3', and '4' and participants were asked to select the corresponding number on the keyboard in response. In addition, the style of the images used to represent the objects was varied and counterbalanced – there were twenty different object categories and three different image styles (realistic, cartoon and drawn). The location of the correct response was also counterbalanced throughout the trials. Finally, Shamay-Tsoory and Aharon-Peretz's (2007) Yoni Task involves second order trials following the trials already described. The second order trials were not included in this study as there were no clear hypotheses around SAD and second-order ToM.

Paper and Pencil Sandbox Task (Sandbox; Coburn, Bernstein, & Begeer, 2015). The Sandbox task assesses cognitive ToM and consists of nine separate scenarios (see Appendix D). It has been shown to be a sensitive measure of false-belief reasoning in adults (Coburn et al., 2015; Samuel, Legg, Lurz, & Clayton, 2018), making it an appropriate task for the current study sample. Each scenario requires participants to take the viewpoint of a character and is presented on an A4 piece of paper with two images of a container on one side, and one image of a container on the other side (see Figure 2). Written information regarding the location of an object, and the character in question, in the first half of the scenario is at the top of the page and relates to a cross (in the image of the container) below. The second side of the A4 paper has a critical question regarding the scenario which requires the participant to mark a cross in the container in response. A distractor task of a word search is used in between the scenario and question sections. Four of the scenarios are 'memory control' (MC) trials in which the second half of the

scenario involves the location of a different object to the one in question and as such the critical question only requires participants to remember the first location in the scenario. Four of the scenarios are ‘false belief’ (FB) scenarios whereby there is a change of location of the object, however, the character is not aware of this change and thus requires the participant to make mental inferences of the character when answering the critical question. One trial is a ‘true belief’ (TB) trial in which there is a change of location of the object, but in this instance the character is aware of the new location. This is a control condition in order to avoid practice effects revealing that the answer to the critical question is always the first location in the scenario. Movement of the target object location from left to right or right to left was counterbalanced across the scenarios and conditions.

The MC scenarios replicated that used by Coburn et al. (2015) – originally created by Sommerville, Bernstein, & Meltzoff (2013) – however, for the purposes of this study new FB and TB scenarios were created. In Coburn et al.’s (2015) version of the Sandbox task, the MC and FB scenarios are very similar, involving the same characters and objects. However, this could risk participants identifying the true aims of the study and may result in a response bias. Therefore, new FB and TB trials were created so that all nine scenarios used in this study were different. Two additional changes to the original Sandbox task (Coburn et al., 2015) were also made for this study. The first being that the container image was replaced with a singular black line, 213mm in length, with a cross on it in order to maintain consistency between the different scenarios (see Figure 2). Furthermore, in Coburn et al.’s (2015) design the researcher read out the written information for each scenario to the participant. In this study, the participants were instead requested to read this information independent of researcher input. This is because the

researcher was aware of the study objectives so the decision was made to avoid unintentional researcher bias through potential word emphasis and tone of voice.

Sally and Ann are outside playing in the sandbox. Sally hides a red toy dog in the sand here and goes inside to get a drink of water.

_____ X _____

While Sally is inside, Ann finds the toy dog and hides it here.

_____ X _____

When Sally comes back outside to play, where is she going to look for her red toy dog?

Figure 2

Example Sandbox task false belief scenario.

Procedure

This study received ethics approval from the Aston University Psychology Ethics Committee. All the tasks were completed in the Aston University Psychology Laboratories. The researcher provided participants with the information necessary for participation when they first arrived, gave an opportunity for questions, and made them aware that they could withdraw at any time and that doing so would not affect the course credits received. Participants provided informed consent before taking part in the research. All participants completed every task due to the within-subjects design; the order of which were counterbalanced in the interests of avoiding order effects. The researcher was physically present throughout the testing session to discourage disengaged participation, however, other than providing instructions and answering questions, was not actively involved when participants were completing tasks. This was made clear before testing began and the researcher read a book to demonstrate that their attention was focused elsewhere.

For the SIAS and the IRI, participants were given verbal instruction on the Likert-scale nature of the questionnaires, which was reiterated in written form on the questionnaire document. All questionnaires were printed and participants provided written responses. For the SIAS, an additional disclaimer was given regarding the potentially sensitive nature of the questionnaire and the participants were again reminded that they could withdraw at any point.

For the Yoni Task, participants sat in front of a computer monitor. The researcher explained that the instructions for the task would appear on the screen first and that these would move through automatically. These informed participants that the task included two practice trials, after which there was an opportunity to ask questions, and thirty recorded trials; the task took approximately six minutes to complete, and measured the accuracy of their responses and

their RTs for each trial. The instructions also included information regarding the wording of the written information that would appear at the top of the screen during the trials and that they were required to press ‘1’, ‘2’, ‘3’, or ‘4’ on the keyboard, corresponding to the object they deemed the correct answer. Additionally, participants were shown an image of Yoni prior to starting the task. The practice trials consisted of one cognitive ToM trial and one affective ToM trial in a fixed order, however, the remaining thirty trials were randomised. Eight of these were in the physical condition, as was the case in Shamay-Tsoory and Aharon-Peretz’s (2007) first order trials, with the remaining trials being evenly split into the cognitive ToM condition and affective ToM condition. Each trial was displayed until the participant responded, or, for a maximum of four seconds, followed with a 500ms fixation cross between each trial (see Figure 3). There was no break during the recorded trials. On completion of the task, participants were instructed to inform the researcher that they had finished. PsychoPy automatically saved the data to a Microsoft Excel spreadsheet.

Figure 3

Design of Yoni Task. Shows 3 of the 32 total trials. For the specific Affective ToM, Physical, and Cognitive ToM trials in the figure, the correct responses are 1, 3, and 3, respectively.

Before completing the Sandbox task, participants were given verbal instruction for the task. For each scenario, the A4 paper was initially covered with a black piece of card in order to hide the details of the scenario from the participants until they were due to start the task. The researcher then moved the card so that the top half of the paper was showing, revealing the first half the scenario. Participants were instructed to read the information and look at the location marked on the line (see Figure 4). Once they had read through the information, they moved onto the second half of the scenario by moving the black card up so that the top half the A4 page was covered and the bottom half revealed. Participants were also informed that once the first half of the scenario had been covered they would not be able to look at it again. The participants then read the information detailed in the second half the scenario alongside the location marked on the black line. Participants were instructed to cover the A4 page with the black card once they had read through the information in the second half of the scenario, and were again informed that they would not be able to look at this once it had been covered. They then completed a distractor task: find any three words in a word search as quickly as possible. In order to avoid causing distress, participants were informed that the word search had been designed to be difficult and that there was no difference in the marking of longer or shorter words, just that they needed to find any three words as fast as possible. Whilst participants completed the distractor task, the researcher turned over the A4 page to the side detailing the critical question, still ensuring that it was covered with the black card until the participant had finished the word-search task. Once the critical question was revealed, the participant was instructed to mark a cross on the black line in answer to the question. This was repeated for the subsequent eight scenarios (see Figure 4).

Figure 4

Design of the Sandbox task. (1 = first half the scenario, 2 = second half the scenario, 3 = distractor task, 4 = critical question)

Following the guidance of Coburn et al. (2015), the scenarios were in a fixed order. The first two scenarios were in the MC condition, followed by two FB scenarios, the fifth scenario was the TB condition and the order was then reversed with the sixth and seventh scenarios being in the FB condition, and the final two being MC scenarios.

After completing all four tasks participants were debriefed on the aims of the study, given the opportunity to ask questions and informed they had up to ten days to request the removal of their data from analysis before their specific data was no longer identifiable as them. The study in its entirety took approximately fifty minutes per participant, for which they were awarded ten course credits.

Data Analysis

Data pre-processing was conducted using the Statistical Program for the Social Sciences (SPSS) Software, Version 25.0 for the SIAS, IRI and Sandbox task. Since PsychoPy automatically recorded the data for the Yoni Task in a Microsoft Excel file, the pre-processing of this particular data set was completed in Microsoft Excel.

SIAS scores (from 0-4) for each participant were input to SPSS and the reverse scoring of three of the twenty items was programmed. These were added to produce a total score out of eighty for each participant. In a similar fashion, IRI scores (from 0-4, where A=0 and E=4) were input to SPSS and the reverse scoring for nine of the twenty-eight items was programmed. The scores for each subscale of the IRI (perspective taking, fantasy, empathetic concern and personal distress) were totaled for each participant out of twenty-eight. Only the total perspective taking (PT) score was carried forward to the data analysis stage as the other subscales are not relevant to the objectives of this study.

For the Sandbox task, the point on the 213mm line that the participants drew a cross, marking the location of the object, was measured in mm for each scenario and input to SPSS. SPSS was then used to calculate the error in mm from the correct location. A total error rate in mm for the MC condition and FB condition was calculated. Only the total error rate in the FB condition was included in the data analysis as this was most relevant to the hypotheses investigated in this study.

All the Yoni Task accuracy scores and RTs for the participants was merged into one Microsoft Excel file. This allowed the production of a pivot table. This identified that many of the participants had reached the ceiling point of accurate responses on the Yoni Task. The mean

RT for correct responses was calculated for the affective and the cognitive ToM conditions separately, on a participant by participant basis.

The total SIAS score, IRI PT score, Sandbox task total FB error rate in mm, mean affective ToM RT (Yoni Task), and mean cognitive ToM RT (Yoni Task) were collated into a single SPSS dataset, alongside descriptive data of sex and age. This dataset was input to Jeffrey's Amazing Statistics Program (JASP) Software, Version 0.9.2.0. To allow for the investigation of the hypotheses, JASP was used for the Pearson's r correlation analyses of the variables and the production of a Correlation Matrix.

Results

Preliminary Analyses

Tests of normality were ran for all data sets and the distributions assessed in SPSS. Given the small sample size, the Shapiro Wilk test was deemed the most appropriate for this function (Ghasemi & Zahediasl, 2012). This revealed the IRI PT data ($p = .133$), the Yoni Task affective condition data ($p = .052$), the Yoni Task cognitive condition data ($p = .604$), and the Sandbox data ($p = .123$) to all be normally distributed and it was thus deduced that Pearson's correlation coefficient would be the most suitable for analyses (Dancey & Reidy, 2017). However, the Shapiro Wilk test demonstrated a significant result for the SIAS ($p = .048$), suggesting a potentially skewed dataset. However, on visual inspection of the histogram, and given that the Shapiro Wilk test can lead to erroneous conclusions with sample sizes in the same region as this study (Le Boedec, 2016), the use of Pearson's correlation coefficient was determined to be warranted as the deviation was minor. Descriptive statistics regarding the mean, median, standard deviation (SD), range, minimum and maximum results for each measure is included in Table 1.

Table 1

Descriptive statistics showing the mean, median, standard deviation (SD), range, minimum and maximum results on the SIAS, IRI perspective taking (PT), Sandbox false belief (FB), Yoni affective and Yoni cognitive tasks and conditions.

	Mean	Median	SD	Range	Minimum	Maximum
SIAS	32.03	30.00	15.29	51.00	10.00	61.00
IRI_PT	19.94	20.50	5.00	20.00	8.00	28.00
Sandbox_FB	36.85	34.13	19.91	93.00	4.25	97.25
Yoni_affective	1.94	1.85	.65	2.83	.98	3.80
Yoni_cognitive	1.83	1.71	.57	2.33	.84	3.17

Social anxiety and ToM ability

Since the first hypothesis predicted a negative association between social anxiety levels and ToM ability, this analysis was one tailed for a positive association between SIAS score and Sandbox error rates, and Yoni Task RTs (both affective and cognitive conditions). The justification for this being that increased Sandbox error rates, and RTs on the Yoni task is indicative of lower ToM ability.

As shown in Table 2, no significant associations were found between SIAS score (social anxiety) and Yoni Task RTs in the affective and cognitive conditions, and Sandbox error rates (ToM ability).

Table 2

Correlation Matrix for SIAS scores, IRI perspective taking (PT) scores, Sandbox false belief (FB) error rates in mm, and Yoni Task mean RTs for the affective and cognitive conditions

		SIAS	IRI_PT	Sandbox_ FB	Yoni_affective	Yoni_cognitive
SIAS	Pearson's <i>r</i>	—				
	p-value	—				
IRI_PT	Pearson's <i>r</i>	-.323*	—			
	p-value	.027	—			
Sandbox_FB	Pearson's <i>r</i>	.187	.166	—		
	p-value	.137	.833	—		
Yoni_affective	Pearson's <i>r</i>	-.124	.120	.237	—	
	p-value	.765	.756	.082	—	
Yoni_cognitive	Pearson's <i>r</i>	-.149	.117	.181	.924**	—
	p-value	.807	.752	.146	< .001	—

Note. All tests one tailed, bold figures were one tailed for negative associations, otherwise figures were one-tailed for positive associations.

* $p < .05$, ** $p < .001$

Social anxiety and self-reported ToM

This analysis was for the purposes of investigating the study aim related to the association between social anxiety and belief of poor social function i.e. self-reported ToM ability. Therefore, this correlation was one tailed for a negative association between SIAS score and score for the PT subscale of the IRI, in that as self-reported PT abilities increase it was predicted that social anxiety would decrease.

Table 2 demonstrates that a significant negative association was found between SIAS score and IRI PT score ($r = -.323$, $p = .027$; see figure 5). This is indicative of a significant relationship between social anxiety and self-reported PT (ToM) ability.

Figure 5

Significant negative association between SIAS score and IRI perspective taking (PT) score

A simple linear regression was calculated to predict social anxiety based on self-reported perspective-taking ability. A non-significant regression equation was found: SIAS score = $51.723 - .988 * \text{IRI PT score}$, $R^2 = .104$, $F(1, 34) = 3.963$, $p = .055$.

Association between ToM tasks

Correlations between the Sandbox error rates and Yoni Task RTs were one tailed for a positive association as both represent reduced ToM ability through higher results (RTs or error rates in mm). As demonstrated in Table 2, no significant associations were found between Yoni Task RTs and Sandbox error rates, however, the affective and cognitive conditions of the Yoni Task demonstrated a near-perfect positive correlation ($r = .924$, $p < .001$).

The association between the IRI PT score and Yoni Task RTs (affective and cognitive conditions) and Sandbox errors was one tailed for a negative association as higher IRI scores are

indicative of higher self-reported PT ability, however, higher RTs on the Yoni Task and higher error rates on the Sandbox task are indicative of lower cognitive and affective ToM ability. As shown in Table 2, no significant associations were found between the different measures of ToM ability.

Discussion

The objective of this study was to assess the relationship between cognitive and affective ToM and social anxiety levels in a non-clinical sample, and to determine if this differed from the relationship between self-reported ToM ability and social anxiety levels. It was hypothesised that those generating higher social anxiety scores would demonstrate poorer performance on tests of cognitive and affective ToM ability and lower self-reported perspective taking ability. The findings did not support the hypotheses and the results concerning actual ToM ability and self-reported ToM ability are discussed separately below.

Actual ToM Ability and Social Anxiety

This is the first study to explore the potential association between cognitive and affective ToM deficits and social anxiety. The non-significant associations between SIAS score and all measures of ToM ability (Yoni affective and cognitive conditions, and Sandbox error rate) was surprising given the previous findings of ToM decoding and reasoning deficits in SAD (Washburn, 2012; Hezel & McNally, 2014; Washburn et al., 2016). However, this is consistent with Lenton-Brym et al. (2018) – the only other study to have assessed social anxiety and ToM in a non-clinical sample. Therefore, it could be postulated that ToM deficits are only seen in clinical SAD, as opposed to having a linear relationship with social anxiety levels in the general population.

Moreover, if the correlations between SIAS score and tests of affective and cognitive ToM ability had been significant, the association with the Yoni Task was in the opposite direction to that predicted for both the affective and cognitive conditions. If the results were significant, this would have implied that as social anxiety levels increase, cognitive and affective ToM ability increases – as demonstrated through a reduction in RTs. Despite the results not being significant, discussing this finding is arguably relevant as it may help provide an explanation for the discrepancy in ToM ability seen between high levels of social anxiety in general population samples and clinical SAD samples.

It may be that when social anxiety is experienced at a clinical level, inferences are less accurate through self-focused attention and over-attribution of meaning to subtle social cues (Heimberg et al., 2010), resulting in a ToM deficit. High levels of social anxiety without SAD, however, may allow for more accurate interpretations of social cues, through certain characteristic traits of social anxiety being present, such as excessive monitoring, but without the negative interpretation biases. This elucidation indicates that certain traits of social anxiety may be advantageous when navigating social situations as individuals may be more observant of those around them, and as such demonstrate elevated ToM ability. However, maladaptive thoughts associated with SAD diminishes this advantage and results in a ToM deficit.

This suggestion is purely speculative and the association between social anxiety scores and cognitive and affective ToM ability was not found to be significant. However, given that the limited research in this area has demonstrated a reasonable argument that there may be a difference in the ToM abilities of individuals with SAD (Washburn, 2012; Hezel & McNally, 2014; Washburn et al., 2016) and individuals without SAD but highly scoring on measures of

social anxiety (Lenton-Brym et al., 2018), it is of importance to discuss the potential reasons for this as it is not a matter that has been explicitly explored.

Furthermore, regarding the second aim of this study, the lack of significant associations between ToM ability (both cognitive and affective) and social anxiety levels suggests that social anxiety is not best characterised by true poor social function. The findings supporting this argument have proved to be reliable as no relationship between social anxiety and ToM ability was consistently found with two separate measures of ToM: Yoni Task and Sandbox Task. Therefore, the atypical social functioning seen in SAD (Davila & Beck, 2002; Sparrevoorn & Rapee, 2009; Wittchen et al., 2000) may not be the result of deficits in the ability to infer what others are thinking (cognitive ToM) or feeling (affective ToM). This has implications for the theoretical models of SAD.

Specifically, the Heimberg et al. (2010) model suggests that individuals with SAD have a negative attentional bias towards perceived threat and over-attribute meaning to subtle social cues. As discussed in the introduction, this implies a ToM deficit through over-mentalization. As a result of this over-mentalization, individuals with SAD make inaccurate inferences of the way others perceive them, with the recommended way to treat this being through cognitive restructuring (Heimberg et al., 2010). The findings of the present study exhibits clear issues with the current understanding and treatment of SAD as no association was found between social anxiety levels and ToM ability.

However, the lack of association between ToM ability and social anxiety levels does provide support for certain aspects of the theoretical framework outlined in the introduction. The safety behaviours described by Clark and Wells (1995) indicates individuals with SAD engage in habits (such as avoiding eye contact) that prevent them from collecting evidence that disproves

the negative thoughts they are associating with social interactions. This aspect of the cognitive model suggests that those with SAD do not possess a ToM deficit as, if they used the social cues available to them they would be able to interpret them accurately, however, they do not use these social cues. This is exacerbated through the pre- and post-event processing (Clark & Wells, 1995) that is likely to lead to avoidance, and thus less opportunity to counteract the negative beliefs held.

As stated in the introduction, there are no current publications comparing the two recommended CBTs for SAD – based on the Clark and Wells (1995) model, and the Heimberg et al., (2010) model (NICE, 2013). This study perhaps has implications regarding the recommended CBT for SAD, as findings indicate that methods such as cognitive restructuring (Heimberg et al., 2010) may not be beneficial for patients as there are no apparent social cognitive deficits. Conversely, the findings support techniques such as video feedback (Clark & Well, 1995) as given the opportunity to note one's safety behaviours may enable patients to start tackling these, and thus notice social cues that negate their negative beliefs. This is supported by the findings of Morgan and Raffle (1999) in that their comparison of individuals with SAD receiving standard CBT, and those receiving treatment specifically tailored towards the recognition and removal of safety behaviours, revealed the latter group showed significantly greater improvements. Recommendations for future research in this area are advised later in this discussion.

Self-Reported ToM Ability and Social Anxiety

At face value, the significant negative correlation found between SIAS score and IRI PT score indicates that as social anxiety levels increase, self-reported perspective taking ability decreases. This provides support for the Clark and Well's (1995) model of SAD in that it shows a link between negative self-evaluation and social anxiety levels, especially when considering no

significant relationship was found between actual ToM ability and social anxiety. However, a simple linear regression revealed that IRI PT score was not a significant predictor of SIAS score. This indicates that social anxiety levels could not be predicted on the basis of self-reported perspective taking. Therefore, the association between these two variables cannot be discussed as if it were significant.

The findings therefore suggest that social anxiety may not be best characterised as a belief of poor social function as the self-reported ToM ability was not a predictor of social anxiety levels. This indicates that an individual's perception of their ability to infer the mental states of others does not underlie the extent to which they experience social anxiety. Thus, it is implied that the social dysfunction typically seen in SAD cannot be explained through a belief of poor social function. This finding has potential implications for the understanding of SAD as it is not in agreement with one of the most influential theories in the area: the cognitive model of SAD (Clark & Wells, 1995).

As considered in the introduction, the cognitive model suggests that the root of SAD is negative self-imagery and highly self-critical appraisals of one's ability to perform in social interactions (Clark & Wells, 1995). If this were the case (and as the hypothesis suggests), it would be expected that as social anxiety levels increase, individuals' self-reported perspective taking ability would decrease as a result of the negative self-evaluation (Clark & Wells, 1995). Instead, the findings demonstrated that social anxiety levels were not predicted by self-reported perspective taking, and as such, implies that the current ideologies surrounding the understanding and treatment of SAD need assessing.

However, the current study is the first to explore self-reported perspective taking alongside social anxiety so it is therefore difficult to assess the full extent of the impact on

current theoretical standpoints. Moreover, the Clark and Wells (1995) model suggests that the unconditional negative beliefs about the self are prominent during situations which provoke anxiety, however, when individuals with SAD are on their own, there is a marked reduction in the negative self-image held. Given that for the purposes of this study, participants were asked to independently complete the self-report measure of perspective taking, it is unlikely that this would be an anxiety provoking situation. Therefore, this study has limited ability to discredit Clark and Wells (1995) suggestion – that individuals with SAD have a negative self-image of their ability to function socially – as the study setting was specifically designed to not induce stress or anxiety.

Equally, opposed to what was originally predicted, participants' IRI PT score did not significantly correlate with any of the ToM ability measures (Yoni Task – affective and cognitive conditions – and Sandbox Task). This indicates that belief of ToM ability is not associated with actual ToM ability. This is interesting as it suggests that individuals – in general – may not be able to accurately report their perspective taking ability; if this were the case, their actual ability would correlate with their self-reported ability. This may provide partial explanation as to why, contrasting to the hypotheses, self-reported perspective taking did not predict social anxiety levels. It may be that all participants, regardless of social anxiety levels, were not accurate in their perception of their ability to infer the mental states of others. Therefore, this suggests that an inaccurate perception of one's perspective taking abilities is not exclusive to those experiencing high levels of social anxiety.

Adding to the previous point, the notion that all participants may have inaccurately scored their own perspective taking ability means that the Clark and Wells (1995) model of SAD cannot be discredited using the results of this study. This is because the current study was

correlational in design, meaning that evaluation of the extent of the inaccuracies of self-reported perspective taking in individuals high-scoring on the SIAS and low-scoring on the SIAS have not been completed as there were no group comparisons. Therefore, it may still stand that individuals with SAD have more of a negative self-image than those without SAD (Clark & Wells, 1995).

The results of this study indicate that individuals are not able to accurately portray their perspective taking ability – it cannot be distinguished if this phenomena is more exaggerated, or indeed more negatively biased, in those highly scoring in social anxiety.

Limitations and Future Directions

Arguably, the main limitation of this study pertains to the small sample size. The underpowered nature of the study means that there is no certainty that the findings are not demonstrative of a type II error (a false indication of statistical insignificance as a result of the small sample). This means that whilst speculations can be made regarding whether social anxiety is better characterised by a belief of poor social function or true poor social function, and the implications of this on the current understanding of SAD, there is no firm support for the arguments made. Further investigation with an appropriate sample size for results with statistical power is required. Research in this area will remove the ambiguity surrounding the findings of this study as it should provide answers as to whether the relationships between the variables are truly insignificant, or if the sample size was too small to detect a small or medium effect size. Furthermore, given that the limited publications in this area do not have full agreement of the relationship between social anxiety and ToM ability, additional research will add to the debate, guiding towards a clearer understanding of the nature of this relationship.

Moreover, the present study did not exclude or screen for SAD when recruiting participants. This means that it cannot be irrefutably determined that those that participated did

not have a diagnosis of (or undiagnosed) SAD. This presents a limitation as the findings demonstrate – in the context of current publications – differential ToM ability in individuals scoring high in social anxiety but without a clinical disorder (Lenton-Brym et al., 2018), and individuals with SAD (Washburn, 2012; Hezel & McNally, 2014; Washburn et al., 2016). However, it cannot be assumed that this study did not include participants with SAD, and as such the interpretations of the results cannot be conclusive. It is recommended that future research compares the ToM ability of individuals with SAD, and individuals without SAD but scoring highly on measures of social anxiety. The aim of this would be to explore the speculation that certain characteristics of SAD enable enhanced ability to infer the mental states of others, but that maladaptive, negative thoughts associated with SAD, result in a ToM deficit. This is not an area to have previously been investigated and findings would add to the current understanding of the nature of SAD.

In addition, the validity of the measures used has to be questioned given the lack of correlation between measures of the same variables. The Yoni Task and the Sandbox Task did not significantly correlate, however, both are measures of cognitive ToM ability. Despite both previously demonstrated to be valid measures of cognitive ToM independently (Rosetto et al., 2018; Samuel et al., 2018), there have been no direct comparisons of the two. This presents a limitation of the current study as the measure of ToM ability may not be entirely valid. Thorough investigation into the validity and reliability of measures of affective and cognitive ToM is required.

Further research is also necessary to provide clarity regarding the nature of the relationship between social anxiety and ToM ability. The evaluation of the extent of the discrepancy between self-reported perspective taking ability and actual ToM ability in groups

scoring high and low in measures of social anxiety is advised. This is to address the discussion point suggesting a general incapacity to perceive one's ability to infer the mental states of others. Further exploration of this proposal would provide clearer indication as to whether negative self-evaluation is a true and prominent characteristic of social anxiety, thus having theoretical implications.

Finally, a comparison of the effectiveness of different treatments of SAD is crucial given the stark differences in CBT approaches (Clark & Wells, 1995; Heimberg et al., 2010) and criticisms of the effectiveness of current interventions (Carpenter et al., 2018; Chapdelaine et al., 2018). Exploration of CBT for SAD based on different theoretical models may aid the understanding of SAD in a bottom-up fashion by indicating which strategies are most effective, thus providing insight into the underlying mechanisms. This is of paramount importance for improving the interventions available to patients with SAD.

Conclusion

In summary, the results demonstrate no significant relationship between affective and cognitive ToM ability and social anxiety levels in a non-clinical sample. Moreover, it was found that social anxiety levels could not be significantly predicted on the basis of self-report measures of ToM ability. This indicates that social anxiety may not be best characterised by a belief of poor social function, or indeed true poor social function. This disagrees with fundamental features of SAD models in the key characteristics of SAD outlined, such as over-mentalization (Heimberg et al., 2010), and negative self-evaluation (Clark & Wells, 1995), and thus the subsequent CBTs based on these approaches. The disparity between the findings and current treatment for SAD is consistent with recent criticisms of the treatment options available (Chapdelaine et al., 2018) and highlights the necessity for updated recommendations. However,

the findings regarding ToM deficits in SAD have not been unanimous with some, like this study, not finding an association with social anxiety (Lenton-Brym et al., 2018), and others finding an association (Washburn, 2012; Hezel & McNally, 2014; Washburn et al., 2016). This demonstrates the complexity of the relationship between social anxiety and ToM ability, and means that more concordance in the literature regarding the mechanisms and characteristics of SAD is required before firm recommendations for treatment can be made.

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Appendix A

Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998)

Participant number: _____

Date: _____

Instruction: For each item, please circle to number to indicate the degree to which you feel the statement is characteristic or true for you. The rating scale is as follows:

0 = **Not at all** characteristic or true of me.

1 = **Slightly** characteristic or true of me.

2 = **Moderately** characteristic or true of me.

3 = **Very** characteristic or true of me.

4 = **Extremely** characteristic or true of me.

CHARACTERISTIC	NOT AT ALL	SLIGHTLY	MODERATELY	VERY	EXTREMELY
1. I get nervous if I have to speak with someone in authority (teacher, boss etc.).	0	1	2	3	4
2. I have difficulty making eye contact with others.	0	1	2	3	4
3. I become tense if I have to talk about myself or my feelings.	0	1	2	3	4
4. I find it difficult to mix comfortably with the people I work with.	0	1	2	3	4
5. I find it easy to make friends my own age.	0	1	2	3	4
6. I tense up if I meet a new acquaintance in the street.	0	1	2	3	4
7. When mixing socially, I am uncomfortable.	0	1	2	3	4
8. I feel tense if I am alone with just one other person.	0	1	2	3	4
9. I am at ease meeting people at parties etc.	0	1	2	3	4
10. I have difficulty talking with other people.	0	1	2	3	4
11. I find it easy to think of things to talk about.	0	1	2	3	4
12. I worry about expressing myself in case I appear awkward.	0	1	2	3	4
13. I find it difficult to disagree with another's point of view.	0	1	2	3	4
14. I have difficulty talking to attractive persons of the opposite sex.	0	1	2	3	4
15. I find myself worrying that I won't know what to say in social situations.	0	1	2	3	4
16. I am nervous mixing with people I don't know well.	0	1	2	3	4
17. I feel I'll say something embarrassing when talking.	0	1	2	3	4
18. When mixing in a group, I find myself worrying I'll be ignored.	0	1	2	3	4

19. I am tense mixing in a group.	0	1	2	3	4
20. I am unsure where to greet someone I know only slightly.	0	1	2	3	4

Appendix B

Interpersonal Reactivity Index (IRI; Davis, 1980)

Participant number: _____

Date: _____

The following statements inquire about your thoughts and feelings in a variety of situations. For each item, indicate how well it describes you by choosing the appropriate letter on the scale at the top of the page: A, B, C, D, or E. When you have decided on your answer, fill in the letter next to the item number. READ EACH ITEM CAREFULLY BEFORE RESPONDING. Answer as honestly as you can. Thank you.

ANSWER SCALE:

A	B	C	D	E
DOES NOT DESCRIBE ME WELL				DESCRIBES VERY WELL

1. I daydream and fantasize, with some regularity, about things that might happen to me.	A	B	C	D	E
2. I often have tender, concerned feeling for people less fortunate than me.	A	B	C	D	E
3. I sometimes find it difficult to see things from the "other guy's" point of view.	A	B	C	D	E
4. Sometimes I don't feel very sorry for other people when they are having problems.	A	B	C	D	E
5. I really get involved with the feelings of the characters in a novel.	A	B	C	D	E
6. In emergency situations, I feel apprehensive and ill-at-ease.	A	B	C	D	E
7. I am usually objective when I watched a movie or play, and I don't often get completely caught up in it.	A	B	C	D	E
8. I try to look at everybody's side of a disagreement before I make a decision.	A	B	C	D	E
9. When I see someone being taken advantage of, I feel kind of protective towards them.	A	B	C	D	E
10. I sometimes feel helpless when I am in the middle of a very emotional situation.	A	B	C	D	E
11. I sometimes try to understand my friends better by imagining how things look from their perspective.	A	B	C	D	E
12. Becoming extremely involved in a good book or movie is somewhat rare for me.	A	B	C	D	E
13. When I see someone get hurt, I tend to remain calm.	A	B	C	D	E
14. Other people's misfortunes do not usually disturb me a great deal.	A	B	C	D	E
15. If I'm sure I'm right about something, I don't waste much time listening to other people's arguments.	A	B	C	D	E
16. After seeing a play or movie, I have felt as though I were one of the characters.	A	B	C	D	E

17. Being in a tense emotional situation scares me.	A	B	C	D	E
18. When I see someone being treated unfairly, I sometimes don't feel very much pity for them.	A	B	C	D	E
19. I am usually pretty effective in dealing with emergencies.	A	B	C	D	E
20. I am often quite touched by things that I see happen.	A	B	C	D	E
21. I believe that there are two sides to every question and try to look at both of them.	A	B	C	D	E
22. I would describe myself as a pretty soft-hearted person.	A	B	C	D	E
23. When I watch a good movie, I can very easily put myself in the place of a leading character.	A	B	C	D	E
24. I tend to lose control during emergencies.	A	B	C	D	E
25. When I'm upset at someone, I usually try to "put myself in his shoes" for a while.	A	B	C	D	E
26. When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me.	A	B	C	D	E
27. When I see someone who badly needs help in an emergency, I go to pieces.	A	B	C	D	E
28. Before criticizing somebody, I try to imagine how I would feel if I were in their place.	A	B	C	D	E

ANSWER SCALE:

A	B	C	D	E
DOES NOT DESCRIBE ME WELL				DESCRIBES VERY WELL

Appendix C

Yoni Task (Shamay-Tsoory & Aharon-Peretz, 2007)

In this task you will complete 2 practice trials followed by 30 recorded trials.

This will take approximately 6 minutes.

This is Yoni.

You will be asked which of the four images on the screen Yoni loves, is thinking of, or is close to.

Press 1, 2, 3, or 4 on the keyboard to answer.

Please press the space bar when you are ready to start the practice trials.

+

1.

Yoni loves —

2.

3.

4.

+

1.

Yoni is thinking of —

2.

3.

4.

If you have any questions please ask the researcher now.

When you are ready please press the space bar to start the remaining 30 trials.

+

Yoni is close to —

1.

2.

3.

4.

+

1. Yoni does not love — 2.

3.

4.

+

Yoni is thinking of —

1.

2.

3.

4.

+

1.

Yoni loves —

2.

3.

4.

+

1.

Yoni is close to —

2.

3.

4.

+

Yoni does not love ____

1.

2.

3.

4.

+

Yoni is thinking of —

1.

2.

3.

4.

+

Yoni is thinking of —

1.

2.

3.

4.

+

1.

Yoni is close to —

2.

3.

4.

+

Yoni does not love —

1.

2.

3.

4.

+

Yoni is thinking of —

1.

2.

3.

4.

+

Yoni loves —

1.

2.

3.

4.

+

Yoni is close to —

1.

2.

3.

4.

+

Yoni is thinking of —

1.

2.

3.

4.

+

Yoni is thinking of —

1.

2.

3.

4.

+

Yoni is close to —

1.

2.

3.

4.

+

Yoni is thinking of —

1.

2.

3.

4.

+

1.

Yoni is close to —

2.

3.

4.

+

Yoni does not love —

1.

2.

3.

4.

+

Yoni loves —

1.

2.

3.

4.

+

Yoni loves —

1.

2.

3.

4.

+

1.

Yoni is thinking of__

2.

3.

4.

+

Yoni is close to__

1.

2.

3.

4.

+

Yoni does not love —

1.

2.

3.

4.

+

Yoni is thinking of ____

1.

2.

3.

4.

+

Yoni does not love

1.

2.

3.

4.

+

Yoni is close to__

1.

2.

3.

4.

+

Yoni is thinking of —

1.

2.

3.

4.

+

Yoni is thinking of ____

1.

2.

3.

4.

+

Yoni loves —

1.

2.

3.

4.

Thank you for your participation. Please let the researcher know you have now finished the task.

Appendix D

Paper and Pencil Sandbox Task (Coburn, Bernstein & Begeer, 2015)

Emily and Phoebe are washing up after cooking dinner. Emily puts a saucepan here and then goes to the dining room to collect the plates.

While Emily is in the dining room, Phoebe puts a baking tray here.

When Emily comes back to the kitchen, where is she going to look for the saucepan?

George and Ryan are hiding prizes for a scavenger hunt in a shed. George hides gold coins here and goes inside to find another hiding spot for the next prize.

While George is inside, Ryan hides a pirate sword here.

When George comes back outside, where is he going to look for the gold coins?

Max and his mum have just come home from the supermarket and are putting the groceries away. Max puts the ice cream in the freezer here and then goes outside to play.

While Max is outside his mum opens the freezer and moves the ice cream here.

When Max comes back inside, where is he going to look for the ice cream?

Sally and Ann are outside playing in the sandbox. Sally hides a red toy dog in the sand here and goes inside to get a drink of water.

While Sally is inside, Ann finds the toy dog and hides it here.

When Sally comes back outside to play, where is she going to look for her red toy dog?

Amy and Elinor were going to an exercise class together and decided to share a locker in the changing room. Amy puts their belongings here.

Elinor preferred a different locker so moved their belongings here before they both went to the exercise class together.

When Amy comes back, where is she going to look for her belongings?

Daniel and his dad are planting flowers in the planter box to surprise his mum. Daniel's dad buries the flower here and then goes to the shed to find a shovel.

While Daniel's dad is gone, Daniel decides to move the flower here.

When Daniel's dad comes back, where is he going to look for the flower?

Bradley and Sam are taking a bubble bath together while playing with toys. Bradley drops a truck in the water here and then goes to get a towel.

While Bradley is gone, Sam moves the toy truck here.

When Bradley comes back, where is he going to look for the toy truck?

Chris and Rebecca bought some new clothes and are putting them away. Chris puts his new shirt here and goes downstairs to watch television.

While Chris is downstairs, Rebecca puts a new pair of jeans here.

When Chris comes back upstairs, where will he look for his new shirt?

Rachel and Liam are packing boxes to move house. Rachel puts a framed picture here before going to the bathroom.

While Rachel is in the bathroom, Liam puts a cushion here.

When Rachel comes back from the bathroom, where will she look for the framed picture?

Appendix E
Sandbox Distractor Task

Participant number: _____

Date: _____

Your Body

ANITBODIES
APOCRINE
ARTERIES
BLADDER
BRAIN
CAPILLARIES
CARBON DIOXIDE
CHEMICAL STABILITY
COMPACT BONE
CRANIAL NERVES
ENDOCRINE SYSTEM
EPIGLOTTIS
EXCRETORY SYSTEM

HORMONES
INVOLUNTARY
KIDNEYS
LARYNGOPHARYNX
LIVER
MOUTH
MUSCLE FIBERS
MUSCLES
NASAL SEPTUM
NASOPHARYNX
NERVE IMPULSES
ONE WAY VALVE
OROPHARYNX

OVARIAN TUMORS
OXYGEN
SEBACEOUS
SKELETAL
SMOOTH
SPINAL CORD
SPINAL NERVES
SUDORIFEROUS
TEMPERATURE
URETERS
URETHRA
VEINS
VOLUNTARY