Examining the relationship between shyness, anxiety and Type D personality

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The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

Background and Objectives*:* Previous research has focused on the relationship between shyness and anxiety, for example, social anxiety has been widely linked to shyness, with Type D personality being previously linked to anxiety. However, there has been no previous research that has focused on the relationship between shyness, anxiety and Type D personality together, although they have previously shown similar traits.

Methods: There were two parts to the study. Part one: Nineteen University students from Leeds Trinity University on a course with a presentation component participated. 24 hours prior to or after the presentation task, participants completed an online survey with four validated measures: the Revised Cheek and Buss Shyness Scale (RCBS), the Standard assessment of negative affectivity, social inhibition, and Type D personality scale (DS14), State-Trait Anxiety Inventory (STAI-T) and the Brief Fear of Negative Evaluation Scale (BFNE-S). Immediately prior to and after the presentation task, heart rate measures were taken. The Rey-Osterrieth Complex Figure Task (ROCF) was completed immediately after the presentation task.

Part two: Ten participants in the study opted to take part in a semi-structured interview following the presentation task to explore views and experiences regarding shyness and anxiety.

Results: As hypothesised, shyness, anxiety and Type D personality were found to be similar constructs. Results showed some differences between peak heart rate and the high and low groups of each of the concepts, with shyness also showing some significant differences on the ROCF scores.

Themes on perceived judgement by others, anticipation and pressure of expectations were found from the interview data.

Conclusion: This study showed patterns between the constructs and the timing of peak heart rates during the presentations, showing that they may share similar traits. As University students undertake presentations as part of assessed modules, this suggests the value of further investigation in Higher Education settings, to ensure that all students are supported effectively.

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Abbreviations

BFNE – Brief Fear of Negative Evaluation Scale

DS14 – Type D personality Scale

HPA-axis – Hypothalamic-Pituitary-Adrenal axis

NA – Negative Affectivity sub-scale of Type D personality

RCBS – 13-item Revised Cheek and Buss Shyness Scale

ROCF – Rey-Osterrieth Complex Figure task

SI – Social Inhibition sub-scale of Type D personality

STAI-T – State-Trait Anxiety Inventory, trait aspect

Introduction

The constructs of shyness, anxiety and Type D personality have never been researched together, to the author's knowledge, although previous research suggests that they may be similar constructs. Increasingly, anxiety is being induced in educational settings, such as Universities, due to assessment pressures and academic expectations. Assessments at Universities are often focused around presentations, in order to enhance the employability skills of students, however, they can often enhance anxiety in individuals. Focusing on the constructs of shyness, anxiety and Type D personality in University students undertaking presentations, will provide more information on the impact of these constructs on individuals who take part in an assessed presentation, which can inform future practice in University settings. The definitions of the constructs of shyness, trait anxiety, social anxiety, Type D personality and the sub-scales of Type D, negative affectivity and social inhibition will be discussed in detail.

University environment

University is seen as an important life milestone for young adults, with many moving away from home for the first time, which is seen as a big life event (Norbury & Evans, 2019). This is also seen as a big life event for mature students entering the unknown. Katz and Somers (2017) suggest that going to University can cause high stress in shy young adults, however, they do further state that some shy individuals cope well with their shyness and are comfortable with it. This is due to some shy individuals having better coping strategies than others and some shy individuals being more social,

which enables them to cope well with their shyness. They further suggest that social support has also been seen as a factor which can impact upon the University experience for shy individuals. Zander, Brouwer, Jansen, Crayen and Hannover (2018) focused on the impact of social support in a sample of 580 University students, from 30 seminar groups, in the Department of Education and Psychology,. Each group was assessed at both the beginning and end of a semester. They found that those students who were helpful and supportive academically at the beginning of the semester, were more socially involved at the end of the semester. Furthermore, students who perceived themselves to be helpful and supportive academically, were also perceived to be helpful academically by others. They also found that students who were perceived to be supportive academically, were approached more by peers on a social basis. This shows that providing academic support to peers, or being perceived as being supportive, can provide more opportunities for integration socially. Deghani (2018) found that University students who perceived having less social support were classed as having Type D personality. Socialising and having social support at University is seen as an important aspect to the experience, however, some individuals may find this aspect more challenging for example those high in shyness or social anxiety.

Shyness

Shyness has been described as feeling discomfort in social situations that have a perceived social evaluation element (e.g. Ang, Chan & Lee, 2018; Kwiatkowska & Rogoza, 2019; Kwiatkowska, Rogoza & Poole, 2019).

Research has proposed that shyness is related to perception of self within new social settings (Durkin, Toseeb, Botting, Pickles & Conti-Ramsden, 2017). This is said to occur in both real social situations as well as situations that have been imagined by the individual (Beaton, Schmidt, Schulkin & Hall, 2013; Tang et al., 2017). Fear is also said to be present in shyness in social situations that include perceived evaluation (e.g. Bowker, Santo & Adams, 2019; Chen, 2019; Schmidt & Poole, 2018). Fear has been defined as "an unpleasant emotion or thought that you have when you are frightened or worried by something dangerous, painful, or bad that is happening or might happen" ("Fear", n.d.). For shy individuals, fear occurs in social situations due to the potential negative evaluation. Therefore, shy individuals may feel uncomfortable and find it difficult starting at University, due to the new social environment in which they may feel peer evaluation will occur. Nevertheless, some shy individuals often want to interact in social situations but due to the anxiety they feel, this can become problematic (Schmidt & Miskovic, 2013).

Interestingly, previous studies have suggested two different types of shyness; avoidant and conflicted. Avoidant shyness sees individuals showing high shyness and low sociability, and conflicted shyness sees those individuals showing high shyness and high sociability, due to anxiety (Xu, Poole, Van Lieshout, Saigal & Schmidt, 2019). These have also been known as negative and positive shyness respectively (Kopala-Sibley & Klein, 2017). Poole and Schmidt (2019) focused on negative and positive shyness, suggesting that negative shyness occurs in stressful social situations, as the individual would seek to avoid the potential threatening or dangerous situation. They further state that positive shyness can play an important role

for shy individuals in social situations, by regulating social anxiety, allowing individuals to feel less anxious and more able to socialise. Scott (2004) also suggests that shy individuals may not always experience shyness in every social situation and that shy individuals can sometimes feel misunderstood in social situations. Participants in their study reported that others assumed that the shy individual was being rude for not communicating when in reality, the anxiety becomes so overwhelming that they cannot communicate. This leads to perceived negative evaluation from others towards the shy individual. Nelson, Lee and Duan (2015) focused on shyness in emerging adulthood in a sample of 616 undergraduates in China and found that participants that self-reported as being high in shyness, also reported feeling more anxiety and more depressive symptoms than those lower in shyness. Shy individuals appeared to be more at risk of internalising behaviours, which may impact upon their socialisation at University. Due to internalising feelings and emotions, shy University students have also been found to experience more negative affect (Coplan et al., 2019). This is likely to have a significant impact on the mental health and wellbeing of University students.

Social anxiety

Links between the concepts of shyness and social anxiety can be seen as social anxiety has also been described as a fear in social situations with unknown people (Nelemans et al., 2019), with Kizilak, Gregory, Baillie and Crome (2016) suggesting that social anxiety is caused by a fear of the negative evaluations and expectations of others. This shows comparisons

with shyness, which is also seen as including feeling fear in social situations due to the potential negative evaluations from others. In addition, Qiu, Han, Zhai and Jia (2018) describe SAD (social anxiety disorder) as a "…persistent fear of negative evaluation by others and a tendency to encode others' expressions as negative" (p.79), showing that this may be a personality trait. Peschard and Philippot (2017) concentrated their research on social anxiety and the reaction of individuals to social cues. They found that participants with high social anxiety experienced more ambiguous cues as being negative and therefore perceived these cues to be a form of negative evaluation from others.

Weeks, Ooi and Coplan (2016) stated that shyness and social anxiety are similar constructs with perceptions of negative judgements and negative thoughts leading to social anxiety, in a study of 686 participants between the ages of 10 and 14. Poole, van Lieshout and Schmidt (2017) state that shyness, social anxiety and unsociability have previously been used interchangeably as it is difficult to differentiate between shyness and SAD as they share traits, which is further suggested by Henderson, Gilbert and Zimbardo (2014). They state that SAD and shyness can exist together or individually. Interestingly, Brook and Willoughby (2019) and Tang et al. (2017) suggest that the traits associated with the aspects affective, cognition, behaviour and physiology of shyness are shared by shyness and social anxiety which can make them very difficult to set apart. Scott, Boyle, Czerniawska and Courtney (2018) researched social media, in particular Facebook, alongside shyness, loneliness, narcissism and social anxiety with a sample of 264 participants through an online questionnaire. They found that individuals who were socially anxious spent more time on Facebook

and used this in a positive way. On the other hand shy individuals posted less photos of themselves and less photos in social situations. This suggests that although previous research has shown similarities between shyness and social anxiety, they may also differ.

The social self-preservation theory

The social self-preservation theory provides a framework for the concepts of shyness and social anxiety. Social self-preservation theory is a threat to an individual's self-esteem or self-worth through the threat of social evaluation, with the social self-preservation system coordinating "…psychological, physiological, and behavioural responses to cope with such threats" (Dickerson & Kemeny, 2004, p357). Woody, Hooker, Zoccola and Dickerson (2018) further describe this theory as wanting to keep good self-esteem, which may not happen in a situation that includes a social evaluative aspect. The social self-preservation theory has been used to explain behaviour in studies that contain potential social evaluative threat. Lamarche, Kerr, Faulkner, Gammage and Klentrou (2012) reported that physiological responses, such as sweating and a faster heart rate, support the individual to protect their self-esteem and social self from any more threat. This is due to the physiological responses causing withdrawal from the situation, causing the individual to protect themselves, through the 'fight' or 'flight' response. Through interviews, they found that the potential of social evaluation enhanced body image concerns, with participants reporting more negative feelings in these situations. As both shyness and social anxiety contain a fear of negative evaluation, the framework of social self-

preservation theory appears to encompass these concepts well in terms of helping us to understand behaviours and responses.

Stress response

Stress occurs when there is a perceived or actual threat to an individual, causing the body to go into 'flight' or 'fight' mode. Social evaluation is said to be a factor in stress response with the fear of social evaluation playing a key role in social anxiety (von Dawans, Trueg, Kirschbaum, Fischbacher & Heinrichs, 2018). There is a cortisol increase during stressful tasks, such as public speaking tasks with a social evaluation element, although this is decreased when there is just anticipation of the stressor (Raspopow, Abizaid, Matheson & Anisman, 2014). Many previous studies using a public speaking task have used The Trier Social Stress Test (TSST) as this is one of the most reliable tasks for inducing acute stress (Bogdanov & Schwabe, 2016; Olver, Pinney, Maruff & Norman, 2015). The TSST involves preparing for a speech as if interviewing for a job and delivering this in front of an audience, video camera or both (e.g. Metz & James, 2019; Monteleone et al., 2019; Seitz et al., 2019), followed by a mental arithmetic task. However, some studies have told participants after the preparation stage that they do not need to do the speech (Dietrich, Andreatta, Jiang & Stemple, 2019). The TSST has been found to induce stress, which causes the hypothalamic-pituitary-adrenal (HPA) axis to become activated, sending signals for stress hormones to be released to the brain (Oei, Tollenaar, Spinhoven & Elzinga, 2009; Rimmele et al., 2009). The HPA-axis is also

activated in situations that individuals view to be intimidating (Poole & Schmidt, 2019).

As stress impacts upon the autonomic nervous system, this can also lead to increased heart rate (Arnold, MacPherson & Smith, 2014; Human et al., 2013). The autonomic nervous system includes both the sympathetic and parasympathetic nervous systems, with the sympathetic nervous system increasing heart rate, and parasympathetic decreasing heart rate (Sommerfeldt, Schaefer, Brauer, Ryff & Davidson, 2019). Yuenyongchaiwat, Baker and Sheffield (2017) suggest that psychological stressors cause greater reactions in heart rate in high anxiety individuals.

Chronic stress causes increased activation of the HPA axis and increases sympathetic activity (Kupper et al., 2018), with previous studies suggesting that tasks that have a stress element with an evaluative aspect have caused reactivity with both the sympathetic-adrenal-medullary (SAM) axis and the HPA axis (Auer, Calvi, Jordan, Schrader & Byrd-Craven, 2018; Kothgassner et al., 2016). Dysregulation of the HPA axis has been found in previous studies, with Tang, Santesso, Segalowitz, Schulkin and Schmidt (2016) suggesting that baseline cortisol levels were lower in shy adults than non-shy, due to the dysregulated HPA axis that has been affected by the long term stressful social situations. Shy individuals may be "…genetically and/or developmentally predisposed to neuroendocrine dysregulation." (Beaton et al., 2013, p.709), showing that shyness has a genetic element that may affect stress responses for individuals. Dysregulation of the biological stress response system (HPA and SAM axis), is also related to constructs such as Type D personality and health outcomes (e.g. cardiovascular issues) (Bibbey, Carroll, Ginty & Phillips, 2015).

Type D personality

The construct of Type D personality is a distressed personality type that includes the aspects of negative affectivity (NA) and social inhibition (SI). Those individuals that are classed as Type D tend to experience increased "…negative emotions across time and situations…" and are reluctant to share their emotions with others (Nie et al., 2019, p.97). NA has been described as "… a general dimension of subjective distress and unpleasurable engagement that subsumes a variety of aversive mood states, including anger, contempt, disgust, guilt, fear, and nervousness" (Watson, Clark & Tellegen, 1988; p.1063), with SI being described as the inhibition of emotions in social situations (Allen, Wetherall & Smith, 2019). Both the NA and SI aspects of Type D personality can be assessed independently through the Standard assessment of negative affectivity, social inhibition, and Type D personality scale (DS14) (Appendix A).

Kupper, Pelle and Denollet (2013) suggest that the autonomic nervous system in individuals classed as Type D may be affected which may cause coronary issues. Additionally, it is stated by Horwood, Anglim and Tooley (2016) that Type D is associated with poor health, in particular, cardiovascular issues, with individuals classed as Type D also experiencing more somatic issues (van den Tooren & Rutte, 2016). Jandackova, Koenig, Jarczok, Fischer and Thayer (2017) conducted a cross-sectional investigation with a focus on Type D and poor health, using a sample of 646 participants, who all completed the DS14 scale (Appendix A), which measures Type D personality, alongside other self-reported measures. A number of physiological measures were also used such as blood pressure, with findings suggesting that Type D is linked to poor health. There have

been a number of studies that have suggested heart rate differences in individuals classed as having Type D personality when compared to a control group during a stressor, however, Li et al. (2018) did not find any differences. Higher heart rate reactivity was found in Type D individuals during a speech performance in a study by Gramer, Haar and Mitteregger (2018), with Bibbey et al. (2015) finding that there were higher heart rates for those classed as Type D personality, when the stress task involved social evaluation. Nasirzadeh and Keraskian (2017) further suggest that Type D may be linked to psychosocial stressors, with O'Riordan, Howard and Gallagher (2019) stating that those who are likely to have Type D personality will be more vulnerable to social stressors. Cornwell, Heller, Biggs, Pine and Grillon (2011) discuss how previous studies have found inconsistencies between autonomic measures such as heart rate and social anxiety and Type D personality. Kupper and Denollet (2014) found in a study that the SI aspect of Type D was associated with social anxiety and shyness and NA was linked to general anxiety. NA is also associated with negative emotions, with high NA linked to anxiety and anticipatory anxiety (Alcaraz, Hildalgo, Godoy & Fernández, 2018). Allen et al. (2019) discuss that negative affectivity and anxiety as well as depression and stress are similar constructs and can overlap. Beaton et al. (2013) further suggest that high negative affectivity alongside low positive affectivity are present in shyness. The social inhibition (SI) aspect of Type D personality has been linked to discomfort in social situations (Alcaraz et al., 2018). This shows some links between SI and shyness which was found by de Moor, Denollet and Laceulle (2018) and Deghani (2018). SI has also been linked to extraversion and social interaction anxiety with all three aspects

overlapping, which makes it difficult to differentiate between them (Van Mortfort, Kupper, Widdershoven & Denollet, 2018), and therefore it could be inferred that shyness and social anxiety have similar traits to SI.

Aluja, Malas, Lucas, Worner and Bascompte (2019) propose that neuroticism has strong associations with Type D personality with further strong positive correlations found between the negative affectivity (NA) aspect of Type D personality and neuroticism (Horwood & Anglim, 2017). Neuroticism has also been found to be associated with trait anxiety (Heeren, Bernstein & McNally, 2018), suggesting further similarities between shyness, trait anxiety and Type D personality.

Trait anxiety

Trait anxiety has been widely researched alongside state anxiety and has been described as being a stable trait, with an individual experiencing increased negative feelings and anxiety more frequently (e.g. Lemche, Chaban & Lemche, 2016; Pačesová & Šmela, 2020). Trait anxiety has also been described as a personality trait by Weeks, Hayley and Stough (2019), who found that higher trait anxiety was linked to difficulties with sleep in older adults. Wiggert, Wilhelm, Nakajima and al'Absi (2016) focused on trait anxiety, smoking and the stress response in a sample of 152 adults, who used a variety of self-reported measures including the trait aspect of the State-Trait Anxiety Inventory (STAI-T) (Appendix D). Alongside these measures they used a public speaking task and a mental arithmetic task as stressors, with results suggesting that "…high trait anxiety is associated with

an inadequate regulation of the sympatho-adrenal system during acute stress (p.1625).

Public speaking

Public speaking tasks can evoke a stress response and often include a social evaluation aspect. Public speaking tasks are being increasingly used in Universities, with presentations being used as assessments, however, in a study by Ferreira Marinho, Mesquita de Medeios, Côrtes Gama and Caldas Teixeira (2017) they found that 63.9% of the undergraduates in their study reported a fear of public speaking. Increases in presenter anxiety have also been found in public speaking tasks that have formed an assessment, which has impacted upon the result (Nash, Crimmins & Oprescu, 2016).

Anticipation of a public speaking task

The anticipation of a public speaking task has been found to increase anxiety in University students in previous studies. In a study by Beaton et al. (2006) they focused on a public speaking task alongside self-reported measures and physiological measures in a sample of University students. The public speaking task was to talk for 3 minutes about their opinions on classroom presentations, with the presentation recorded and participants told it would be shown to others. They found that those in the socially phobic group reported more anxiety after the preparation stage and in anticipation of the speech. Both the socially and non-socially phobic groups had a higher heart rate from baseline to speech preparation, showing that the anticipation

of the upcoming speech was evoking a physiological response. Riskind, Calvete and Black (2017) conducted a study on the anticipation of a speech in a study of 93 undergraduates (75% female). They focused on different time points leading up to the presentations, e.g. one week before, and found that anxiety was highest when the presentation task was first mentioned and then on the day in anticipation of the speech. Pulopulos, Vanderhasselt and De Raedt (2018) found that heart rate variability decreased between baseline and the anticipatory period of a speech task, with higher cortisol levels found, suggesting that the anticipation period of a speech task increases anxiety. Interestingly, Price and Anderson (2011) suggest that anxiety during the anticipation period of a speech increases performance anxiety, however, they found that the anticipation period had the highest anxiety and not the performance in a study of 51 socially phobic participants.

Further increases in anticipatory anxiety of a speech task were found by de Oliveira, Zuardi, Graeff, Queiroz and Crippa (2012) who used a sample of 28 males in a study focused on oxytocin and public speaking. They found that there was an increase in anxiety from pre-test to anticipation phase with those participants who had been administered oxytocin having a reduction of anxiety from baseline to pre-test, suggesting that oxytocin may decrease anticipatory anxiety. Raspopow et al. (2014) further evidenced that anxiety and anger levels increased in participants during the anticipation stage of a stressor with a social evaluation aspect, with the anticipation period being enough to use as a stressor. It should be noted, however, that their study only included women due to focusing on emotional eating and anticipation, with women said to have altered ghrelin levels and therefore this was the focus group for their study. On the other

hand, individuals are said to regulate their emotions when faced with an emotional event or the anticipation of said event (Nasso, Vanderhasselt, Demeyer & De Raedt, 2019), suggesting no differences between anticipation and any other stage of an emotional event.

The anticipation of a public speaking task has also been impacted by the presence of an audience. Cornwell et al. (2011) found during the anticipation of a speech task that individuals reported a greater fear of negative evaluation with an audience present than without an audience, however, they used a VR headset to replicate the audience and therefore this may have impacted upon the outcomes. Davies et al. (2017) conducted a study using a sample containing 70 social anxiety disorder participants with a control group of 16 participants, who were told that they were going to complete the dot probe task once they had been in the fMRI scanner and in anticipation of these, observed a live feed of the room this was to be undertaken in. However, towards the end of the fMRI, they were informed that they had been assigned to the wrong group and would be completing a speech task immediately after the scanner session. Their results showed that in anticipation of a speech and when observing perceived audience members walking into the room through a live feed, anxiety increased for all participants. They also found the socially anxious participants showed more prolonged amygdala activation than the control group during the anticipation of a speech.

Task vs anticipatory stress

As well as anticipatory anxiety in presentations, the task itself can provoke anxiety and stress in participants. This could be due to mental workload, as attention and memory may be focused on the task, with some individuals anxious about remembering what they have to say for their presentations. Gonzalez-Bono et al. (2002) found that participants who had high speech anxiety, reported more anxiety at all times, with a significant increase from baseline to the speech. This shows that not only did these participants have more anxiety during the anticipation period but that there was also an element of task stress as their anxiety was still high during the speech. This was also found by Deiters, Stevens, Hermann and Gerlach (2013) in a study of 58 students, as those high in speech anxiety had increased anxiety throughout with more focus on self, compared to those in the low speech anxiety group. They also found that both high and low speech anxiety groups showed heart rate increase from baseline to the anticipation period of the speech with no other significant heart rate changes found. This suggested that the anticipation period was significant for all participants. Kupper, Denollet, Widdershoven and Kop (2013) suggest that the increase of heart rate at baseline differed between personality types, however, this could be due to their task as the speech required participants to talk about their strengths and weaknesses in social contact with others and their difficulties with social interactions. Therefore, within their study, the task stress could have influenced the anticipatory anxiety. Some studies have also found that just the task has impacted upon anxiety, for example, Chen, McLean and Kemps (2018) found that if positive feedback was given immediately after the speech this lessened the anxiety of the participant.

They used a sample of 151 undergraduates, the majority female, with an audience who gave feedback to participants after the speech. This shows that the task and task performance impacted upon anxiety, with positive feedback validating the performance of the individual to lessen anxiety.

Laboratory vs natural settings

A large number of studies have used laboratory settings when using public speaking tasks, although some studies have used natural settings. It has been suggested that there is greater cardiovascular reactivity to acute laboratory stressors for Type D individuals in non-clinical settings (Borkoles et al., 2018). Interestingly, Dijk, van Emmerik and Grasman (2018) also conclude that social anxiety is less evident in natural settings compared to laboratory settings. This shows that laboratory settings may be more effective in inducing physiological reactivity in individuals undertaking a presentation. However, a number of studies have used a natural setting for presentations with Merz, Hagedorn and Wolf (2019) suggesting that for presentations that take place in everyday environments and not in laboratories, there is an assumption that there is "higher anticipatory anxiety, negative affect, cortisol levels and a longer duration of the cortisol stress response." (p.2). Furthermore, Auer et al. (2018) state that many previous studies have used laboratory settings when focusing on public speaking, however, they used University students undertaking presentations as part of a module and found increased stress reactivity in participants. It could be suggested from previous studies that natural settings for presentations increase stress reactions in participants and therefore are better to use when focusing on

presentations and their impact. Interestingly, Loeffler, Hennig and Peper (2017) used both an oral presentation as part of a module at University and the Trier Social Stress Test (TSST), which is widely used in laboratory settings. They used a measure of additional heart rate (AHR), to account for both heart rate and physical activity. This was calculated to focus on the stress of the task. They found that those in the University module group had greater AHR during the anticipation of their presentation, whereas the TSST group had higher AHR during the actual task. Furthermore, Kothgassner et al. (2016) focused their study on virtual and real life environments of a public speaking task. They used a virtual lecture hall with a virtual audience, a real lecture hall with a real audience and the control group had the same virtual lecture hall as the first group but without an audience. They found that both the virtual and real life groups with audiences showed increases in cardiovascular reactivity, suggesting that the social self-preservation theory can apply to virtual perceived evaluative threat as well as real life.

Cognitive tasks

In stress tasks, such as the TSST, cognitive tasks have also been used. Taverniers, Taylor and Smeats (2013) used the Rey-Osterrieth Complex Figure task (ROCF) and found that under moderate stress, cognitive performance can be enhanced. The ROCF has often been used previously in a clinical setting, due to the complex scoring system that is widely used, requiring professional analysis (e.g. Catricalà et al., 2019; Salimi et al., 2019). The task contains both a copying and recall aspect and focuses on

memory and visuospatial organisation. It is a cognitive task which has not been as widely used as others such as the digit span and emotional Stroop and allows the testing of memory without words and numbers. Suárez-Pellicioni, Núñez-Peña and Colomé (2015) discuss the Processing Efficiency Theory which involves the individual having worrying thoughts due to the anxiety, which then impacts upon working memory and means that there are less resources for the individual to use when completing a cognitive task. Human et al. (2013) state that previous research has shown varied results on the effects of stress on memory. Interestingly, Maresh, Teachman and Coan (2017) suggest that a fear of being evaluated can cause negative reactions on cognitive performance. Lukasik, Waris, Soveri, Lehtonen and Laine (2019) used a number of cognitive tasks such as a complex span as well as n-back tasks, where participants were required to decide if the item was the same as one seen previously. They found that those participants that reported increased anxiety had decreased working memory. The n-back task was also used by Cornelisse, van Stegeren and Jöels (2011) with a sample of 77 second-year psychobiology students. They concluded that working memory was not affected by stress in women, but that men saw some improvements in working memory after stress. A further cognitive task that has been used is the emotional Stroop task. This involves participants saying the colour that the word is written in, with a variety of words being given that may have emotional relevance to participants (Imbir, Spustek, Bernatowicz, Duda & Zygierewicz, 2017). The digit span task has also been widely used in studies on working memory. Participants are required to memorise a sequence of numbers that they see or hear, before repeating in the correct order, with sequences gradually increasing.

Lumpkin and Sheerin (2019) used a digit span task with a sample of older adults and found that failing on some of the trials was associated with a diagnosis of a neurocognitive disorder.

Summary

Previous studies have found that the anticipation of a public speaking task has often increased heart rate and anxiety in individuals. However, mixed results have been found on the impact of the anxiety and stress of a public speaking task on a cognitive task, completed after a stressful task, such as a presentation.

Interestingly, previous research has suggested links between the concepts of shyness, trait anxiety, social anxiety and Type D personality. However, Brook and Willoughby (2019) state that confusion still exists between shyness and social anxiety as conflicting research differs on if the concepts are the same or different, which is difficult to distinguish through self-reported scales.

Current study

The aim of this study is to look at the impact of assessed University presentations on shyness, anxiety (trait and social) and Type D personality in a sample of University students. This study will incorporate a physiological measure alongside the scales, with a cognitive task also given to focus on the impact of anxiety on memory.

This study hypothesizes that:

1. All students will have increased heart rates as a result of the presentations as Auer et al. (2018) state that most people have had experience of worry or fear when speaking in the presence of others and this may appear to be a natural response. It would be expected in this study that all participants would be worried or anxious about their presentations, which would impact upon heart rates.
2. The anticipation period has been seen as the key time point which increases heart rate and therefore the biggest increases would be expected to be seen during this time. Increased anxiety during the anticipation period is explained by Wong and Moulds (2011) who state that during this phase, anticipatory processing takes place, with individuals focusing thoughts on the impending social evaluation which increases anxiety.
3. As social anxiety and shyness both contain a fear of negative evaluation, it can be inferred that individuals high in these concepts would have increased heart rate due to the evaluation aspect. This would also be expected through the social self-preservation theory, which suggests that physiological responses can occur due to the evaluative threat in the social environment.
4. The concepts of shyness, social anxiety, trait anxiety, Type D personality and the sub-scales of Type D (negative affectivity and social inhibition) will be similar constructs as previous

research has shown similarities between some of the concepts.

A qualitative aspect of this study aims to provide more insight into experiences and views of shyness and anxiety from participants. As a number of definitions have been previously used when looking at shyness, this study will use the definition of a fear of evaluation by others that can be present in real or imagined social situations as this has been used previously when focusing on shyness (e.g. Ang et al., 2018; Beaton et al., 2013; Chen, 2019; Kwiatkowska et al., 2019).

Method

Design: This study uses a mixed-method design to gain insight into the personal experiences of the participants when engaging in public speaking. Ethical approval was sought from Leeds Trinity University (SSHS-2018-051).

The independent variables (IVs) of this study, shyness, trait anxiety, social anxiety, Type D personality and the sub-scales of Type D, negative affectivity and social inhibition, have two levels, high and low and will be used to analyse and investigate the effects of personality types on the dependant variables (DVs) of heart rate and Rey-Osterrieth task performance. Heart rate (HR) will be measured at 5 time points, to look at any differences throughout the study. A priori test was conducted using

G*Power (Version 3.1) (Faul, Erdfelder, Lang & Buchner, 2007), which suggested a minimum of 28 participants with an effect size of 0.25, *f* of 0.05 and power of 0.80. There are a number of variables in which this study focuses on, however due to the number of variables and the small sample size, power may be affected.

As the focus of this study is on the effect of personality types on heart rate and cognitive task performance, the variables of age and gender were considered, due to differences found in previous studies, however, they were not used in this study. Previous studies have shown a decrease in heart rate variability (HRV) in older individuals (Estévez-Báez et al., 2019; Sakaki et al., 2016). Furthermore, Kumral et al. (2019) focused on resting heart rate variability and functional brain connectivity, in a sample of 388 participants between the ages of 20 and 80. They found that HRV decreased in older participants and that there was a link between medial frontal regions of the brain and age, with an increase of connectivity in this area in younger participants but not older, however they found no differences between genders. Some studies have suggested differences between males and females and the autonomic nervous system, which would suggest differences in heart rate (Kuang et al., 2019). Morandi et al. (2019) also found differences between males and females and the autonomic nervous system. They found that high frequency HRV was associated with memory in females and suggest that personality may play a role in this, as in previous studies females have been found to report higher trait anxiety than males.

Participants: Twenty-five students (1 male and 24 females) between the ages of 18 and 45 years (*m* = 25.28; S.D. = 8.319) from Leeds Trinity University took part in this study with 19 of the students (1 male and 18 females), all between the ages of 18 and 45 (*m* = 26.53; S.D. = 8.540) completing all heart rate and task measures alongside the online survey with four validated measures. To meet the criteria for this study, students had to be from Leeds Trinity University and be on a course with a presentation component. Participants with heart conditions were excluded from the study due to the heart rate measures as a number of previous studies have excluded participants with a history of cardiovascular diseases that have included cardiovascular measures (e.g. Dietrich et al., 2019; Loeffler et al., 2017; Lü, Wang & You, 2016; O'Riordan et al., 2019). Of these 19 participants, 10 also completed a semi-structured interview for part two and were all females between the ages of 19 and 45 years. At the end of part one of the study, participants were reminded about the optional interview aspect and were asked to contact the researcher if they would like to take part in this, and a date and time was agreed. As the interviews were optional, participants could choose to take part or not, with 10 women opting to take part.

Materials:

Part one

For part 1 of the study, participants were required to fill out an online survey containing four validated measures and a demographic sheet (Appendix B) at least 24 hours before or at least 24 hours after taking part in the

presentation aspect of the study, to enable participants to complete them without any bias from the study (Durlik, Brown & Tsakiris, 2014). As some participants did not consent to the study at least 24 hours before their presentations, the option was given to complete the online survey at least 24 hours after the presentations. These were the 13-item Revised Cheek and Buss Shyness Scale (RCBS) (See appendix C), the DS14 (Appendix A), the State-Trait Anxiety Inventory (Trait aspect only –STAI-T) (Appendix D), and the Brief Fear of Negative Evaluation Scale (BFNE-S version) (Appendix E). Heart rate measures were taken five times throughout the study and a cognitive task was undertaken after the presentations (Rey-Osterrieth Complex Figure Task – ROCF) (Appendix F).

The 13-item Revised Cheek and Buss Shyness Scale (13-item RCBS)

The 13-item Revised Cheek and Buss Shyness Scale is a valid and reliable shyness scale, with Kwiatkowska and Rogoza (2017) suggesting $\alpha = 0.91$ for general shyness in adults. It contains 13-items that need to be scored on a 5-point Likert scale, from 1 to 5, "1 – Very uncharacteristic, untrue or strongly disagree" to "5 - Very characteristic, true or strongly agree". Items 3,6,9 and 12 are recoded before analysis in order to fit in with the rest of the scale, with a higher score showing high shyness.

The scale has been widely used in previous studies with Hopko, Stowell, Jones, Armento and Cheek (2005) focusing on the 13-item RCBS and its validity alongside constructs measuring social reticence, social anxiety and general anxiety, with moderate to strong links found between them. Strong correlations were found between the 13-item RCBS and the

Fear of Negative Evaluation Scale, with further correlations between the 13-item RCBS and the Social Interaction Anxiety Scale. Scott et al. (2018) also used the 13-item RCBS alongside the Liebowitz Social Anxiety Scale and discovered strong positive correlations, with a moderate correlation being found between the 13-item RCBS and the UCLA Loneliness Scale. Piko, Prievara and Mellor (2017) used both college and University students and they concluded that problematic internet use was linked to stress, loneliness and shyness and further suggest that shyness had a negative correlation to verbal aggression, however they only used self-reported measures. Self-reported measures were also used by Liu et al. (2018), who used the 13-item RCBS with adults in China and found that the link between shyness and subjective well-being (life satisfaction and negative or positive affect) was mediated by optimism which was key to the relationship, with shy individuals feeling more negative and pessimistic and therefore having lower life satisfaction and more negative affect. Interestingly, Katz and Somers (2017) focused on the 13-item RCBS alongside a number of other scales that are associated with adjusting to University life and they found that shyness had the greatest impact upon adjustment to University life and maladaptive coping.

DS14

The DS14 (Denollet, 2005) assesses Type D personality through the concepts of social inhibition (SI) and negative affectivity (NA) which can be assessed individually and collectively through the DS14. The DS14 scale contains two 7-item subscales, one measuring SI and one measuring NA,

with participants answering the items given using a 5-point Likert scale from 0-4 with "0 – False" and "4 - True". A cut off score of $\geq$10 on both the social inhibition and negative affectivity scales classifies Type D personality (e.g. Kupper et al., 2018; Spek et al., 2018; Williams, O'Connor, Grubb & O'Carroll, 2011) and provides a dichotomous score, with a dimensional score found by the interaction between NA and SI (NA x SI) (Talaei-Khoei, Mohamadi, Fischerauer, Ring & Vranceanu, 2018). In previous studies by Allen et al. (2019), Denollet (2005), Kupper et al. (2013) and Li et al. (2018) they suggest Cronbach $\alpha = 0.88$ for the negative affectivity aspect and $\alpha = 0.86$ for social inhibition on the DS14. NA is associated with worry and measured by items 2 and 12 on the DS14, dysphoria, measured by items 4, 7 and 13 and irritability by items 5 and 9 with SI associated with discomfort in social situations (items 6, 8 and 14), reticence (items 10 and 11) and social poise (items 1 and 3) (Aluja et al., 2019; Denollet, 2005; Malas, Lucas, Lario & Aluja, 2018).

Previous studies on Type D personality have used the DS14 (e.g. Allen et al., 2019; Bibbey et al., 2015; Dehghani, 2018; Kupper et al., 2013; Li et al., 2018) and it has been previously used alongside a number of health scales such as the Perceived Stress Scale, which revealed that Type D individuals reported more anxiety and perceived stress (Allen et al., 2019). Furthermore, Gramer et al. (2018) identified that Type D individuals had higher perceived stress, as well as greater heart rate reactivity during a speech performance. Interestingly, Horwood and Anglim (2017) used the DS14 alongside items such as the Revised Neo-Personality Inventory and identified a strong negative correlation between SI and extraversion and a strong positive correlation between NA and neuroticism, which was also

verified in studies by Denollet (2005) and Holdŏs (2017). Habra, Linden, Anderson and Weinberg (2003) discovered in a study of undergraduates that higher levels of NA in men showed lower heart rate reactivity but this was not the same for women. They also reported that SI was linked to increased reactions (physiological) to acute stress, however, they used the DS24 which contains more items than the DS14.

State-Trait Anxiety Inventory (STAI) – Trait anxiety aspect (STAI-T)

The STAI has been widely used in previous studies on anxiety (e.g. Cornwell et al., 2011; Gonzalez-Bono et al., 2002; Philippot, Vrielynck & Muller, 2010). It contains a 20 point state anxiety scale which measures short term anxiety and a 20 point trait anxiety scale which measures long term anxiety through how the individual feels in general (Wiglusz, Landowski & Cubata, 2019). As the focus of this study is longer term anxiety, only the trait aspect of the questionnaire was used (STAI-T), however, this aspect has been used successfully in previous studies (e.g. Baas, Nijstad, Koen, Boot & De Dreu, 2019; Hotton, Derakshan & Fox, 2018; Human et al., 2013; Suárez-Pellicioni et al., 2015; Wirtz, Rohrbeck & Burns, 2019). Participants are required to answer 20 questions on the STAI-T, on a 4 point Likert scale, from "1 – Almost never" to "4 – Almost always" about how they feel in general in response to the questions. Questions 1,3,6,7,10,13,14,16 and 19 are recoded to fit in with the rest of the questionnaire. A score of 40 or more shows high anxiety (Wiglusz et al., 2019), although trait anxiety varies for individuals, with items on the scale differing in what part they play in trait anxiety.

Heeren et al. (2018) used the French version of the STAI-T as they focused on trait anxiety and what this involves. After in-depth analysis of the items on the scale they found that intrusive thoughts and being unable to get disappointment out of mind were central to trait anxiety, however, they do discuss that trait anxiety is very individual and can vary. The STAI-T was also used by Norbury and Evans (2019), who focused on sleep in a sample of University students, through a number of sleep scales, and found that over one third of the students were sleep deprived, with poor sleep causing increased anxiety. Franklin, Tsujimoto, Lewis, Tekok-Kilic and Frijters (2018) also used University students but focused on anxiety, self-regulation and executive functioning. They found that high levels of trait anxiety resulted in lower functioning of executive function and that trait anxiety was a predictor of self-regulation of emotion, self-motivation, self-restraint, self-organisation and self-management to time. However they suggest that their findings may be influenced by the participants who were all lower achieving undergraduates who may experience increased trait anxiety.

Brief Fear of Negative Evaluation Scale (BFNE-S version)

The BFNE scale measures social anxiety, as it focuses on the fear of receiving negative feedback from other people (Harpole et al., 2015; Liu & Lowe, 2016; Weeks et al., 2005), which can link to shyness, anxiety and Type D personality and has been used in a number of previous studies that have focused on social anxiety disorder or have an element of social evaluation (Harpole et al., 2015; Liang, 2018).

It is proposed that the BFNE-S version is a better scale to use as it uses eight straightforward worded items taken from the original BFNE scale and has been found to be a more reliable scale than the original (Liu & Lowe, 2016). Rodebaugh et al. (2004) suggest an internal consistency of α = 0.94 with the BFNE-S version and recommend its use over the original BFNE due to the 4 re-worded items on the original scale which they advise may reduce validity. Weeks et al. (2005) further recommend that the BFNE-S is the better scale to use, although they used a clinical sample. The BFNE-S contains 8 questions and uses a 5-point Likert scale that requires participants to respond to how like them each question was from "0 –Not at all characteristic" to "4 – Extremely characteristic", with a high score showing a greater fear of negative evaluation. Carleton, Collimore, McCabe and Antony (2011) suggest a cut off score >25.

A number of previous studies have used the BFNE-S (e.g. Durlik et al., 2014; Harpole et al., 2015; Villarosa-Hurlocker, Whitley, Capron & Madson, 2018; Weeks, Howell, Srivastav & Goldin, 2019), with Kane, Bahl and Ouimet (2018) using this scale alongside a number of other self-reported questionnaires related to reassurance with undergraduates. They also asked participants to imagine they had completed a presentation in front of their peers and to imagine that they were unsure of how they had done. They found that those who reported a higher fear of negative evaluation wanted more reassurance to evaluative threat from others. Weeks and Zoccola (2016) also had an undergraduate sample, who had to deliver a speech in front of two people which was videotaped, with heart rate being recorded. They found that heart rate was increased for those high in fear of negative evaluation and fear of positive evaluation from anticipation of

speech to during the speech. Maresh et al. (2017) also used University students who completed a number of self-reported questionnaires alongside a number of visual n-back tasks that involved different scenarios, and found that the higher the fear of negative evaluation, the longer the reaction times to complete the task when an experimenter was present.

Demographic sheet

Participants were asked to fill out a demographic sheet online after completing the online survey. Items included gender, aged above or below 30, smoker or non-smoker and if they are currently taking any prescribed medication, to ensure that any potential factors to differences in heart rate were taken into account.

Presentations

Three different modules were used across the area of Psychology for this study. One module used was Hormones and Behaviour which is part of the MSc Psychology (Conversion) course. Students were required to pick a topic area in advance of the presentations and asked to prepare a presentation to last between 10-12 minutes. This was an individual presentation delivered to two lecturers and peers. The second module used in this study was part of Level 4 Psychology and Child Development. Students had to work in groups to put together a presentation to deliver to at least one lecturer. Students were given the brief for their presentations in the morning on the day of presentations and were given a time to present in the

afternoon. Presentations lasted no longer than 15 minutes. The third module used was a Level 4 Forensic Psychology module. Students had to work in groups to prepare a presentation to deliver to a lecturer. They were given the brief in advance of the presentations and were asked to prepare. Presentations lasted no longer than 15 minutes.

Heart rate measures

Heart rate was taken five times during the study using a Garmin Vivoactive HR smartwatch, measured in beats per minutes (BPM), as this is less intrusive and a more natural measurement of heart rate, however, previous studies suggest mixed results of heart rate measures using smartwatches (Thomson et al., 2019). Mocny-Pachońska et al. (2020) effectively used a Garmin Vivoactive 3 GPS smartwatch to measure HR in beats per minute (BPM) and the stress response in dentistry students undertaking stressful tasks. The Garmin Vivoactive smartwatch contains "…Elevate™ wrist heart rate technology…" (Garmin vívoactive, n.d.), which has been used to measure HR during exercise previously as the HR sensor is located on the underside of the watch and therefore is less intrusive.

Previous studies have found increases in heart rate with Human et al. (2013) finding in a study that heart rate increased in participants after being put under stress. Furthermore, Åhs, Sollers, Furmark, Fredrikson and Thayer (2009), Bershad, Jaffe, Childs and de Wit (2015) and Sakaki et al. (2016) suggest that the activation of the sympathetic nervous system, which happens during stressful events, increases heart rate.

The first HR measure was taken at baseline, at least 5 minutes before the participants entered the presentation room, followed by a second HR measure immediately before participants started their presentations, to look at the impact of immediate anticipation of the presentation. Presentations lasted between 10 and 15 minutes, with an additional HR measure taken after the participants had completed their presentations. Within 5 minutes of finishing presentations, participants were taken to another room to complete the ROCF task, with a HR measure taken once the instructions had been given for this task, immediately before they started the task. The ROCF task lasted a total of 2 minutes, after which a final HR measure was taken. HR measures were taken over a time period of 40 minutes.

Rey-Osterreith Complex Figure Task (ROCF)

The ROCF is a complex neuropsychological task that tests both visuospatial organisation and memory and has been used previously in studies on extreme stress (Taverniers et al., 2013; Taverniers, van Ruysseveldt, Smeets & Von Grumbkow, 2010). This has also been used in clinical studies (e.g. Catricalà et al., 2019; Salimi et al., 2019; Venneri et al., 2019). However, in this study it was used as a cognitive task after a presentation, which is said to induce anxiety or stress.

The ROCF involves copying the image to begin with whilst looking at the image, then an unexpected recall aspect in which the participant has to recall and replicate the image after a period of time (Human et al., 2013; Pelati et al., 2011; Sapozhnikova & Smith, 2017). However, as this study is focusing on the impact of the anxiety from the speech task upon memory, to

see if those individuals that self-report as high in shyness, anxiety and Type D personality are still anxious during this task, only the immediate recall aspect will be used (Cella & Wykes, 2019). Participants in this study were asked to look at the picture placed in front of them for one minute, before being given further instruction to recall the image and replicate this in one minute. Taverniers et al. (2013) used a high intensity stress task alongside the ROCF and used the immediate recall only, giving participants 45 seconds looking time followed by three minutes recall. They found that high intensity stress caused a decline in the visuospatial memory. As this study is using less stress it was felt one minute recall would be sufficient. The recall aspect is said to test episodic memory (Catricalà et al., 2019), with Cella and Wykes (2019) using the immediate recall score to measure task performance.

Various scoring systems have been used for the ROCF, however, many are complex and are for a clinical environment. Therefore, as this study used the ROCF as a memory task after a stressor, this study used its own scoring system, based on the Savage-Deckersbach, a simple organisational scoring system, which includes points for producing complete aspects, e.g. the rectangle (Smith et al., 2007). It is further suggested that the Savage-Deckersbach scoring system is reliable when assessing organisation of the ROCF task. This study used two scoring methods, the ROCF 20 which focused more on shapes, and the ROCF 30 which gave marks for reproducing each line within the shapes in the correct place during the recall phase.

Procedure:

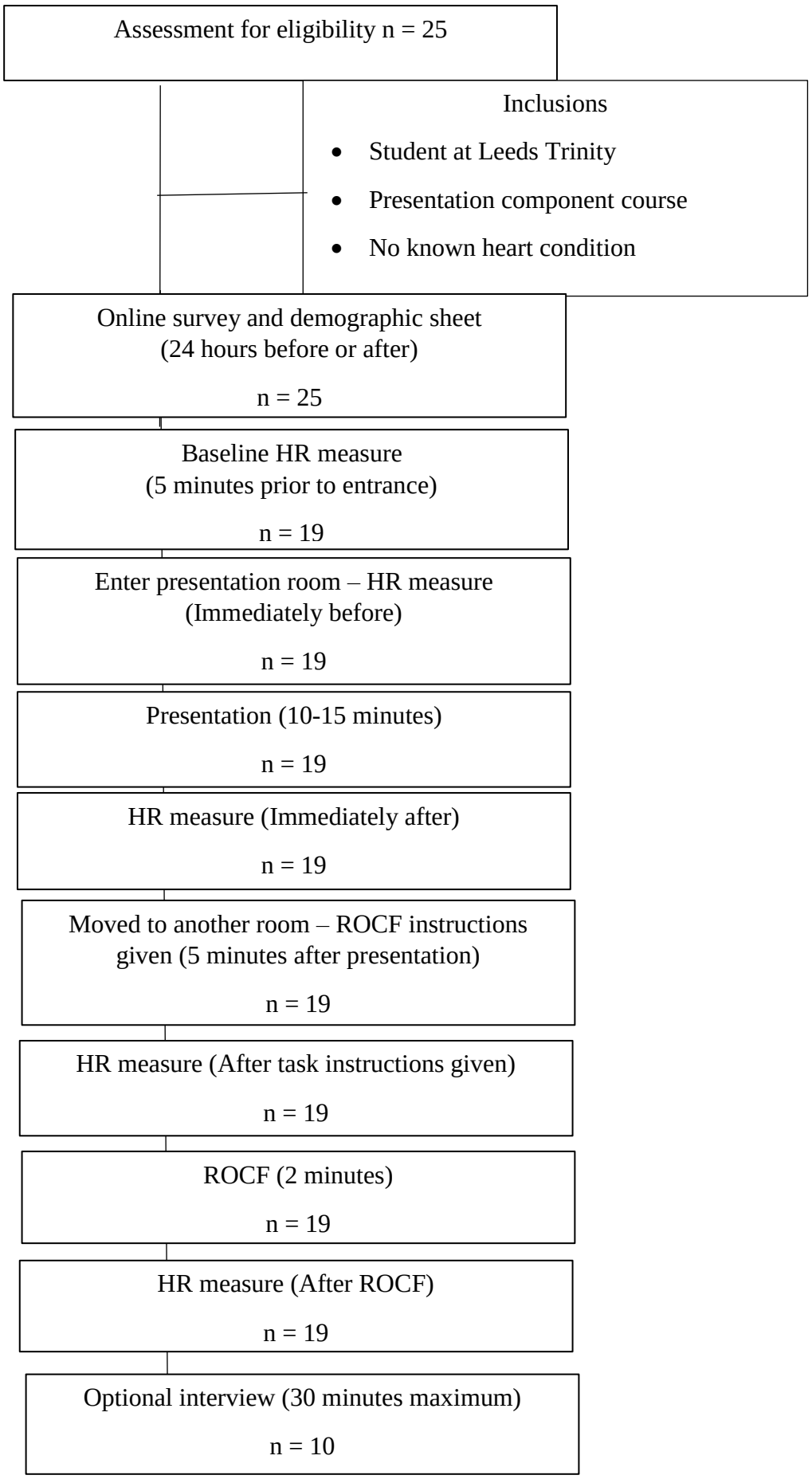

Figure 1: Procedure followed in this study

Recruitment was limited to Leeds Trinity University with numerous emails sent to lecturers about the study with a poster introducing this (Appendix G). Lecturers passed the study information onto students. Participants were informed that taking part in the study would not affect their grades for their presentations or the module they were studying. Figure 1 shows the procedure followed in this study, from recruitment to the interview in part two. Participants who had any known heart conditions were unable to take part in the heart rate measures of this study and were given the ineligibility criteria (Appendix H).

Interested participants emailed the researcher of this study and were sent a participant information sheet (Appendix I) and consent form (Appendix J). Once participants had agreed to take part in the study, they were sent the link to the online survey. At least 24 hours before or after the presentations, participants were required to complete the online survey containing a demographic sheet and the four validated measures: The 13-item revised Cheek and Buss Shyness Scale (RCBS), DS14, State-trait anxiety inventory (STAI) (Trait aspect) and the Brief Fear of Negative Evaluation (BFNE-S). Participants were also reminded to refrain from caffeine two hours before their presentations as this can affect heart rate and this criteria has been used in previous studies (e.g. Bibbey et al., 2015; Kupper et al., 2013; Li et al., 2018; Nasso et al., 2019). Caffeine has been found to lower heart rate in a study of 12 healthy young adults, although this depended on the amount of caffeine administered, with the placebo and high caffeine group showing no heart rate changes (Crooks, Hansen, Satterfield, Layton & Van Dongen, 2019). Grant, Magruder and Friedman (2018) also suggest that caffeine may lower heart rate. They state that “In short,

consumption of caffeinated coffee shortly prior to participation in a psychophysiological study involving aerobic or psychological stressors may conceivably confound results" (p.194). However, heart rate was not affected by caffeine in a study focusing on the effects of caffeine and stress, although it is suggested this was due to the amount of daily caffeine consumed by participants which was said to have impacted on the response in this study (Bennett, Rodrigues & Klein, 2013). Lanini, Galduróz and Pompéia (2016) also found that heart rate was not affected by caffeine, although they do discuss previous studies which have found changes to heart rate due to caffeine intake.

Participants were asked to arrive at least five minutes before the presentations were due to begin in order to have a baseline heart rate measure taken and to check consent before going into the presentation room. The researcher met each participant in a separate room to the presentations (Metz & James, 2019; Monteleone et al, 2019), to ensure that this did not increase the anxiety at baseline and impact upon the results. Heart rate measures were taken using a smartwatch as this method was less intrusive and more natural for participants, with results being recorded on the results sheet (Appendix K). Once a baseline heart rate measure had been taken, participants were asked to go into the presentation room. Before each participant began their presentations, a further heart rate measure was taken at this anticipation stage, as this stage is said to enhance anxiety and social threat (Oskinsky, Karl & Hewig, 2017; Wong & Moulds, 2011). This is due to the social evaluative threat involved (Davies et al., 2017). An increase in heart rate in women with trait anxiety has also been found at this stage (Gonzalez-Bono et al., 2002).

After they had completed their presentations, a further heart rate measure was taken. Participants were taken into another room to complete the Rey-Osterreith task (ROCF) (Appendix F). Participants were read the instructions for the ROCF task (Appendix L) before another heart rate measure was taken. Finally, after the ROCF, a final heart rate reading was taken and recorded on the results sheet. Participants were then fully debriefed (Appendix M) and asked to contact the researcher if they would be interested in taking part in the interview aspect of the study (Part two). If they did not wish to do an interview then this was their final involvement in the study.

Part two

In order to gain people's views and experiences of shyness and anxiety, an optional semi-structured interview was included for part two of this study. Each interview was audio recorded and transcribed by the researcher at a later date. The interviews took place after the presentations at the University, at an agreed time with the researcher, and lasted no longer than 30 minutes, with only the participant and researcher present. Before starting the interviews, participants were informed about the study aims and the importance of getting people's views and experiences of shyness and anxiety. They were notified that they would not be identified from their interview, as well as being reminded that they could withdraw from the study at any time. Participants were asked at this stage if they had any questions before starting the interview and asked if they still consented to

the interview being audio recorded, before being thanked for consenting to take part (Appendix N).

Throughout the interview process the researcher was aware that some participants may find the process difficult due to shyness or anxiety and therefore participants were put at ease as much as possible throughout as suggested by Scott (2004). Participants were asked a number of questions around the topic areas of shyness and anxiety in order to gain a further insight into their experiences. A number of questions focused on the presentations and how participants felt in regards to their presentations, with further questions asked around the topic areas of shyness and anxiety and people's perceptions and experiences of these concepts (Appendix O). However, as the interviews were semi-structured, not all participants were asked all of the questions, as some questions may have already been answered within the responses given. At the end of the interviews, participants were thanked again for taking part. Audio recordings were transcribed anonymously and at this stage, recordings were deleted.

All data for the study was stored on the researcher's University OneDrive and only shared in anonymous form with supervisors. Signed consent forms were also stored securely on the researcher's University OneDrive.

Data Analysis – Part one

All analysis for the quantitative aspect of the study was undertaken using IBM SPSS Statistics version 26. Descriptive statistics were ran on the data to gain information regarding ages of the participants, with further

descriptives ran on the heart rate (HR) results at each of the 5 time points (Baseline, before presentations, after presentations, pre-ROCF and post ROCF). These are shown in Table 1.

Table 1.

Descriptive statistics for heart rate at each of the 5 time points

	Heart rate time points (BPM)				
	HR baseline	**HR before presentation**	**HR after presentation**	**HR pre ROCF**	**HR post ROCF**
Average HR	90.74	99.26	98.11	99.79	94.47
(SD)	(13.353)	(21.707)	(15.649)	(12.541)	(9.155)

Table 1 shows that the highest heart rate was pre ROCF, with HR before presentations also high.

Data analysis was decided with the hypotheses of this study in mind. The hypotheses of this study are:

1. All students will have increased heart rates at some stage of the presentations as it would be expected in this study that all participants would be worried or anxious about their presentations, which would impact upon heart rates.

2. The anticipation period has been seen as the key time point which increases heart rate and therefore the biggest increases would be expected to be seen during this time.
3. It can be inferred that individuals high in social anxiety and shyness would have increased heart rate due to the evaluation aspect.
4. The concepts of shyness, social anxiety, trait anxiety, Type D personality and the sub-scales of Type D (negative affectivity and social inhibition) will be similar constructs.

Tests of normality were also used to ensure that the data was normally distributed before further analysis was undertaken.

As hypothesis 4 of this study suggests similarities between each of the concepts, Pearson correlations were conducted to look at the relationship between each of the independent variables (IVs). Further correlations were conducted between the IVs and the dependent variables (DVs) of heart rate (HR) and the Rey-Osterrieth task scores (ROCF), to see if there were any additional similarities between the IVs and DVs and to look at any relationships between the DVs of HR and ROCF task scores.

For each of the IVs, dichotomisation was used (high and low), to look at differences between the two groups. As previous studies have found similarities between the concepts, this study aimed to focus on the high and low aspects of each to look for any further relationships. Consideration was given to the small sample size, which may impact upon the results, but as hypothesis 3 of this study focuses on individuals high in social anxiety and

shyness, dichotomisation was used to consider the relationship between high and low groups and HR.

To look at the 4 hypotheses of this study, six 2 x 5 repeated measures ANOVAs were conducted to focus on the five different time points of HR; baseline, before presentations, after presentations, before task and after task alongside each of the IVs (shyness, trait anxiety, social anxiety, Type D, negative affectivity sub-scale of Type D and the social inhibition sub-scale of Type D) at two levels, high and low. A 2 x 5 ANOVA was also conducted to examine any relationship between those undertaking an individual or a group presentation and HR at each of the five different time points, to see if the type of presentation showed any relationships between HR.

To analyse the data further, four t-tests were conducted to look at HR reactivity between HR baseline to HR peak. HR reactivity was analysed to see if there were any relationships between the time points and the IVs, notwithstanding the small sample size, as this may have provided an indication of significance. For the majority of IVs, a t-test was conducted on the concepts of trait anxiety, Type D and the sub-scales of Type D (negative affectivity and social inhibition), with Mann Whitney U tests conducted on the constructs of shyness and social anxiety due to data not being normally distributed.

T-tests were conducted during analysis for each IV and the DV of ROCF scores (ROCF 20 and ROCF 30) to see if any significant relationships were found. As this study was focusing on examining the relationship between shyness, anxiety and Type D personality, due to

previous associations found between the concepts, heart rate measures were also considered to see if any relationships occurred between the concepts and at various time points within the study. Furthermore, as anxiety and stress are said to affect memory, a cognitive task was included to see if this was the case. For the concepts of shyness and social anxiety, Mann Whitney U tests were used due to data not being normally distributed.

Data Analysis – Interviews (Part two)

Thematic analysis (Braun & Clarke, 2006) is widely used in psychology studies and was suitable here as an analysis tool to organise the data and answer the research question. The six stages of thematic analysis as proposed by Braun and Clarke (2006) were followed. A detailed outline of this process as used in this study is shown in Table 1. The first four stages were conducted independently by the researcher and one of her supervisors for two randomly selected transcripts. Following a detailed discussion at this point, the rest of the transcripts were analysed and stages five and six were completed for all data by the student with input from her supervisors. This process was two-fold; to ensure the consistency and transparency in the analysis process and on reflection of subjectivity, the researcher identified personally with the topic areas of shyness, anxiety and Type D personality but the supervisor did not. A process of constant reflexivity through the analysis stage highlighted that some of the coded data did not always reflect the research question but instead had personal significance to the researcher, this process of analysis involving two people helped to ensure themes were developed solely from the data. Reflexivity is vital in qualitative research as

the researcher's experience of the phenomenon of interest can influence the relevance of the findings and being an 'insider' can impact upon the themes developed (Ross, 2017). Subjectivity is unavoidable in qualitative research so transparency is vital (Veseth, Binder, Borg & Davidson, 2017).

Table 2

Stages of Thematic Analysis

Stages of analysis as described by Braun and Clarke (2006)	Process undertaken
1. Familiarising yourself with your data	This stage involved the researcher listening to the recordings a number of times and then transcribing. Transcripts were read through once before checking them against the original audio for accuracy and were read again once this had been done. Initial notes were made on the transcript to show the relevance to the research question which was to explore the relationship between shyness and anxiety through the views and experiences of University students.
2. Generating initial codes	The interview data was colour coded to highlight sections of text that appeared relevant in relation to the research question of exploring the relationship between shyness and anxiety through the views and experiences of University students. Colours were used to identify data that appeared to

	have the same relevance or meaning to the research question, to allow for codes to be formed with similar data grouped together.
3. Searching for themes	This stage began with any codes that formed common ideas such as links to anticipation, being grouped together to form the beginning of themes (See appendix M for mind map). Coded data that did not fit into one of the potential themes developed at this stage, were grouped separately until their meaning was adequately summarised in a theme. Some potential themes were given sub-headings if necessary at this stage.
4. Reviewing themes	All data was re-read under each of the potential themes to check for patterns. A number of coded extracts did not fit the themes, so themes were re-worked to include the data and a thematic map was produced (Appendix N). The research question of exploring the relationship between shyness and anxiety through the views and experiences of University students was kept in mind whilst re-reading the whole data set to ensure that no data had been missed previously and that all themes fitted in with the research question.
5. Defining and naming themes	Stage five involved further reading of coded extracts for each theme, which were then organised into a narrative that relates back to the research question. During this stage a number of sub-themes were developed as some themes covered a wide topic area.

	Names were then given to themes and sub-themes and finalised. Discussions with the Supervisors were had at this stage.
6. Producing the report	Stage six began with the themes being written up, with extracts to support the outcomes. When writing up each theme, the research question was considered to ensure that the data was relevant to the study.

The interview data was also considered alongside the findings of part one of this study as this study uses a mixed-method design, which has been widely used in previous studies. Hjeltnes, Moltu, Schanche, Jansen and Binder (2019) used a mixed methods design, with quantitative data used to find participants to take part in the qualitative aspect. Through analysis of people's experiences of the Mindfulness-based stress reduction course for people with social anxiety disorder, they found that participants reported their new self-awareness into how they feel in certain situations and how this may benefit them in the future. Di Malta, Oddli and Cooper (2019) also used a mixed methods study with emphasis on qualitative data and used interviews after session four of therapy and then conducted a further interview one month after participants had completed their therapy sessions. Their quantitative aspect focused on correlations between participants attitudes to the particular type of therapy and added to their qualitative aspect of their study. On the other hand, Ramos, Bianchi, Rebello and Martins (2019) used their quantitative data on improvements to executive functions using games in an educational context alongside their interview

responses which affirmed their quantitative outcomes. Qualitative methods were also used alongside quantitative in a study, to gain more of an insight into how people complete a task and their self-awareness (Zamariola, Frost, Van Oost, Corneille & Luminet, 2019). The qualitative aspect of this study focused on exploring the relationship between shyness and anxiety through the views and experiences of University students, which will provide detailed information to enhance the findings from part one of the study.

Results

Part one

Tests of Normality

Before further analysis was undertaken, tests of normality were performed to check for normal distribution on all of the independent variables; shyness, social anxiety, trait anxiety, Type D personality, and the sub-scales of Type D, negative affectivity and social inhibition. Further normality tests were conducted on the dependent variables of heart rate and Rey-Osterrieth task scores to check for normal distribution before running further analysis.

For the 13-item Revised Cheek and Buss Shyness Scale (RCBS), the DS14, the negative affectivity (NA) sub-scale of the DS14, the social inhibition (SI) sub-scale of the DS14 and the State-Trait Anxiety Inventory trait version (STAI-T), a Shapiro-Wilk's test ($p > .05$) and a visual inspection of normal Q-Q plots and box plots on the data for all 25 participants was conducted, showing normal distribution. However, when

testing for normality of the Brief Fear of Negative Evaluation (BFNE) scale, the Shapiro-Wilk's test showed that the data is not normally distributed ($p = 0.009$), although the box plot shows normal distribution (See Appendix R – Table 1 and Figure 1).

As 19 participants took part in all aspects of the study, further normality tests were undertaken. In order to confirm normality of the DS14, the NA scale of DS14, the SI scale of the DS14 and the STAI-T, a further Shapiro-Wilk's test ($p > .05$) was conducted on completed data from 19 participants with data showing normal distribution. Data for both the 13-item RCBS and the BFNE was not normally distributed ($p = 0.039$), with Q-Q plots and box plots showing more people being lower in shyness and social anxiety than higher (Appendix S – Table 1 and Figure 1). After further analysis of the box plots for both the RCBS and the BFNE (See Appendix S - Figures 1.1. and 1.6), no clear outliers were shown so non-parametric tests will be used for each of these scales due to the data not being normally distributed.

All heart rate (HR) and Rey-Osterrieth (ROCF) task score data showed normal distribution (Appendix S – Table 1 and Figures 2 & 3).

Pearson correlations on the independent variables (IVs) of shyness, trait anxiety, Type D and the sub-scales of negative affectivity and social inhibition (25 participants)

As data showed normality for the majority of the scales, correlations were performed to see if there were any relationships between the independent variables, shyness, trait anxiety, Type D personality and the sub-scales of

Type D (negative affectivity and social inhibition), using data from 25 participants. The Pearson correlation coefficients for the correlations between each of the IVs are show in Table 3.

Table 3.

Pearson Correlations between the IVs of shyness, trait anxiety, Type D personality and the sub-scales of negative affectivity and social inhibition (25 Participants)

			DS14	
	DS14	**STAI-T**	**NA sub-scale**	**SI sub-scale**
RCBS	0.89**	0.73**	0.58**	0.94**
DS14		0.83**	0.85**	0.88**
STAI-T			0.76**	0.69**
NA sub-scale				0.51**

** Correlation is significant at the 0.01 level (2-tailed)

As shown in Table 3, there was a significant positive relationship between the IVs of shyness, trait anxiety and Type D personality which shows that each of the IVs are similar concepts. Additional correlations were run to look at the relationship between each of the sub-scales of the DS14,

negative affectivity (NA) and social inhibition (SI) and each of the other IVs which also found significant positive relationships as shown in Table 3.

Spearman's rho – Brief Fear of Negative Evaluation (BFNE) (25 participants): As the Brief Fear of Negative Evaluation (BFNE) data was not normally distributed a Spearman's rho test was used (Dancey & Reidy, 2014). Significant positive relationships were found between the mean scores of the BFNE and the 13-item Revised Cheek and Buss scale (r (23) = 0.73, p = < 0.001), BFNE and the DS14 complete scale (r (23) = 0.69, p = < 0.001), the BFNE and the State-Trait Anxiety Inventory trait version (r (23) = 0.78, p = < 0.001) and the BFNE and the social inhibition scale of the DS14 (r (23) = 0.65, p = < 0.001). A further significant positive relationship was found between the BFNE and the negative affectivity scale of the DS14 (r (23) = 0.57, p = 0.003), showing that the BFNE was still significantly positively related to the other IVs when accounting for the distribution of the data.

Pearson correlations between the IVs of trait anxiety, Type D and the sub-scales of negative affectivity and social inhibition and the DV of the Rey-Osterreith (ROCF) task scores (19 participants)

Further Pearson correlations were undertaken on the data of the 19 participants, to look at the relationships between the IVs. Table 4 shows the Pearson correlation coefficients between trait anxiety, Type D and the sub-scales of negative affectivity and social inhibition (IVs) and the Rey-Osterrieth (ROCF) task scores (DV) for the 19 participants.

Table 4.

Pearson Correlations between the IVs and the DV of Task Scores (19 Participants)

			DS14			
	DS14	**STAI-T**	**NA sub-scale**	**SI sub-scale**	**ROCF 20**	**ROCF 30**
DS14		0.80**	0.86**	0.93**	-0.50*	-0.45
STAI-T			0.73**	0.72**	-0.50*	-0.36
NA sub-scale				0.63**	-0.38	-0.36
SI sub-scale					-0.50*	-0.45
ROCF 20						0.91**

** Correlation is significant at the 0.01 level (2-tailed)

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

As shown in Table 4, there were significant positive relationships found between the scores of all the questionnaires (IVs) as well as the sub-scales of the DS14, negative affectivity (NA) and social inhibition (SI). This shows that significance is still present between all the IVs when the number of participants is reduced and therefore, the relationship is strong.

Pearson correlations between the IVs of trait anxiety, Type D and the sub-scales of negative affectivity and social inhibition and the DVs of heart rate and task scores (19 participants)

Additional Pearson correlations were undertaken to see if there were any relationships between the IVs; trait anxiety, Type D and the negative affectivity (NA) sub-scale of the DS14 and the social inhibition (SI) sub-scale of the DS14 and the DVs; heart rates (At each of the 5 different time points) and both versions of the Rey-Osterrieth (ROCF) task scores.

Analysis showed that there were no significant correlations between any of the IVs and the DV of HR. The correlations were either weak positive correlations or weak negative, showing no significant relationships between any of the IVs and the DV of HR at 5 time points. Further analysis showed no significant correlations between any of 5 HR time points or either of the ROCF scores. Additionally, Pearson correlations showed no significant correlations between the DVs of HR and ROCF task scores. (See Appendix T – Table 1), showing that there are no relationships between any of the IVs and HR.

As shown in table 4, there were some significant negative relationships between the ROCF 20 and the SI scale of the DS14, the DS14 and the STAI-T, showing moderate correlations. The ROCF 30 showed close to significant negative relationships with the SI scale of the DS14 (r (17) = -0.45, p = 0.056ns) and the DS14 (r (17) = -0.45, p = 0.051ns). This shows that there is some relationship between the IVs and the task scores, in particular the ROCF 20, which needs further analysis. Interestingly, both of the ROCF scoring scales showed a significant positive relationship between

themselves, which shows that the scales may not be that different from each other.

***Spearman's rho – Brief Fear of Negative Evaluation (BFNE) scale and the 13-item Revised Cheek and Buss Shyness Scale (19 participants)*:** As the Brief Fear of Negative Evaluation (BFNE) and 13-item Revised Cheek and Buss Shyness Scale (RCBS) data was not normally distributed for 19 participants, a Spearman's rho test was used (Dancey & Reidy, 2014). Table 5 shows the results from the Spearman's rho test on the relationships between the RCBS and the BFNE with the other scales and the DV of the Rey-Osterreith (ROCF) task scores. A further Spearman's rho test was used to look at the relationships between the RCBS and BFNE and the DV of heart rates (At each of the 5 time points) (See Appendix U –Table 1).

Table 5.

Spearman's rho results showing the relationship between the RCBS and the BFNE Scales and the DS14, NA Scale of DS14, SI Scale of the DS14 and the STAI-T and the DV of ROCF Task Scores

				DS14			
	BFNE	**DS14**	**STAI-T**	**NA sub-scale**	**SI sub-scale**	**ROCF 20**	**ROCF 30**
RCBS	0.70**	0.86**	0.75**	0.61**	0.92**	-0.63**	-0.56*
BFNE		0.58**	0.73**	0.44	0.60**	-0.26	-0.13

** Correlation is significant at the 0.01 level (2-tailed)

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

As shown in Table 5, significant positive relationships were found between the RCBS and all the other scales. There were no significant relationships between the RCBS and any of the HR time points, however, the RCBS showed a significant negative relationship with both the ROCF 20 and the ROCF 30.

The BFNE showed significant positive relationships with all scales apart from the negative affectivity (NA) sub-scale of the DS14 (r (17) = 0.44, p = 0.059ns), although this was nearing significance. The BFNE also showed a significant negative relationship with the HR baseline measure (r

(17) = -0.46, p = 0.050), with no further significant relationships found (See Appendix U – Table 1). As is shown in table 5 the BFNE showed no significant relationships between either of the ROCF scores.

ANOVAs for each of the IVs (Shyness, social anxiety, trait anxiety, Type D and the sub-scales negative affectivity and social inhibition) and the DV of heart rate at five time points

In order to answer the hypotheses of this study (See pages 39-40), six 2 x 5 ANOVAs were used to investigate the IVs of shyness, trait anxiety, Type D and social anxiety, with two levels (high and low) and the dependent variable (DV) of heart rate (HR), at each of the five time points (baseline, before presentations, after presentations, before task, after task).

A: Shyness (IV) and HR measures at five time points (DV): A 2 x 5 ANOVA was required to investigate the relationship between the IV of shyness with two levels (high and low) and the DV of HR at five time points (baseline, before presentations, after presentations, before task, after task). Descriptives are reported in Table 6.

Table 6.

Mean Values of HR (DV) at five time points for the High and Low Shyness groups

	Heart rate time points (BPM)				
	HR baseline	**HR before presentation**	**HR after presentation**	**HR pre ROCF**	**HR post ROCF**
Shyness					
low	92.00 (14.014)	97.45 (23.649)	98.18 (13.355)	102.00 (12.961)	94.82 (10.333)
high	89.00 (13.115)	101.75 (20.012)	98.00 (19.361)	96.75 (12.092)	94.00 (7.910)

Sphericity was assumed ($p>0.05$) with results suggesting that there is no main effect of shyness (high/low) on HR [$F(1,17) = 0.044$, $p = 0.836$ns., partial $\eta^2 = 0.003$], no main effect of time [$F(4,68) = 1.676$, $p = 0.166$ns., partial $\eta^2 = 0.090$], and no interaction [$F(4,68) = 0.351$, $p = 0.843$ns., partial $\eta^2 = 0.020$]. Analysis shows that there is no difference in HR at any of the five time points between the high or low shyness groups, which can also be seen in Table 6. As the data was not normally distributed for the 13-item Revised Cheek and Buss Shyness scale (RCBS) (See page 39-40), a Friedman test was used to look at HR measures at the different time points and shyness, with $\chi^2(5) = 44.385$, $p < 0.001$.

HR Time points 1 to 2 (T1-T2) and 1 to 4 (T1-T4): Looking at the data in Table 6, it can be seen that individuals low in shyness had HR peak pre-ROCF (T4). Individuals high in shyness had a HR peak before presentations (T2). Therefore, HR reactivity was analysed with a focus on baseline HR (T1) to peak. As the data was not normally distributed for the RCBS scale (See page 47), a Mann-Whitney U test was undertaken to look at HR from baseline to HR peak. The Mann-Whitney U test showed no significant differences between the high and low shyness groups and the time points T1-T2 ($U = 35.500$, $p = 0.492$) and T1-T4 ($U = 40.500$, $p = 0.778$).

B: Social anxiety (IV) and HR measures at five time points (DV): A 2 x 5 ANOVA was required to investigate the relationship between the IV of social anxiety with two levels (high and low) and the DV of HR at five time points (baseline, before presentations, after presentations, before task, after task). Descriptives are reported in Table 7.

Table 7.

Mean Values of HR (DV) at five time points for the High and Low Social Anxiety groups

	Heart rate time points (BPM)				
	HR baseline	**HR before presentation**	**HR after presentation**	**HR pre ROCF**	**HR post ROCF**
Social anxiety					
low	98.89 (14.313)	104.56 (21.795)	99.33 (15.387)	100.22 (13.055)	93.22 (10.918)
high	83.40 (6.947)	94.50 (21.609)	97.00 (16.627)	99.40 (12.756)	95.60 (7.662)

Sphericity was assumed ($p>0.05$) with results suggesting that there is no main effect of social anxiety (high/low) on HR [$F(1,17) = 1.372$, $p = 0.258$ns., partial $\eta^2 = 0.003$], no main effect of time [$F(4,68) = 1.693$, $p = 0.162$ns., partial $\eta^2 = 0.091$], and no interaction [$F(4,68) = 1.622$, $p = 0.179$ns., partial $\eta^2 = 0.087$]. Analysis shows no significant relationship between social anxiety high and low groups and HR at any of the five time points. As the data from the BFNE was not normally distributed (See page 47) a Friedman test was undertaken with the BFNE and the five HR time points with $\chi^2(5) = 44.835$, $p <0.001$.

HR Time points 1 to 2 (T1-T2) and 1 to 4 (T1-T4): Looking at the data in Table 7, it can be seen that individuals low in social anxiety had a peak HR before the presentations (T2). For individuals high in social anxiety, peak HR was pre ROCF (T2). Therefore, HR reactivity was analysed with a focus on baseline HR (T1) to peak. As the data was not normally distributed for the BFNE scale (See page 47), a Mann-Whitney U test was undertaken. The Mann-Whitney U test showed no significant differences between the high and low socially anxious groups and the time point T1-T2 (U = 38.000, p = 0.604). However, there was significance between the high and low socially anxious groups and HR between T1-T4 (U = 19.500, p = 0.035).

C: Trait anxiety (IV) and HR measures at five time points (DV): A 2 x 5 ANOVA was required to investigate the relationship between the IV of trait anxiety with two levels (high and low) and the DV of HR at five time points (baseline, before presentations, after presentations, before task, after task). Descriptives are reported in Table 8.

Table 8.

Mean Values of HR (DV) at five time points for the High and Low Trait Anxiety groups

	Heart rate time points (BPM)				
	HR baseline	**HR before presentation**	**HR after presentation**	**HR pre ROCF**	**HR post ROCF**
Trait anxiety					
low	90.64 (14.624)	96.36 (24.295)	98.27 (13.305)	100.09 (13.050)	94.82 (10.333)
high	90.88 (12.369)	103.25 (18.360)	97.88 (19.409)	99.38 (12.682)	94.00 (7.910)

Sphericity was assumed ($p>0.05$) with HR measures and trait anxiety (STAI-T) showing that there is no main effect of trait anxiety (high/low) on HR [$F(1,17) = 0.048$, $p = 0.828$ns., partial $\eta^2 = 0.003$], no main effect of time [$F(4,68) = 1.684$, $p = 0.164$ns., partial $\eta^2 = 0.090$], and no interaction [$F(4,68) = 0.299$, $p = 0.878$ns., partial $\eta^2 = 0.017$]. These results and the descriptives in Table 8 show no significant difference between the high and low trait anxiety groups on each of the five time points of HR.

HR Time points 1 to 2 (T1-T2) and 1 to 4 (T1-T4): Looking at the data in Table 8, it can be seen that individuals low in trait anxiety had peak heart rate pre ROCF (T4). Individuals high in trait anxiety had peak HR before

presentations (T2). A t-test was undertaken to analyse HR reactivity from HR baseline to HR peak. The t-test showed no significant differences between the low and high trait anxiety groups and the time points T1-T2 as t (17) = -0.596; p = 0.559ns and T1-T4 as t (17) = 0.107; p = 0.916ns.

D: Type D personality (IV) and HR measures at five time points (DV): A 2 x 5 ANOVA was required to investigate the relationship between the IV of Type D personality with two levels (high and low) and the DV of HR at five time points (baseline, before presentations, after presentations, before task, after task). Descriptives are reported in Table 9.

Table 9.

Mean Values of HR (DV) at five time points for the High and Low Type D Personality groups

	Heart rate time points (BPM)				
	HR baseline	**HR before presentation**	**HR after presentation**	**HR pre ROCF**	**HR post ROCF**
Type D					
low	88.90 (13.144)	100.20 (24.156)	96.90 (14.387)	101.80 (14.995)	94.70 (11.156)
high	91.67 (14.318)	98.22 (20.036)	99.44 (17.728)	97.56 (9.501)	94.22 (6.960)

Sphericity was assumed (p>0.05) with results suggesting that there is no main effect of Type D (high/low) on HR [F (1,17) = 0.010, p = 0.920ns., partial η^2 = 0.001], no main effect of time [F (4,68) = 1.598, p = 0.185ns., partial η^2 = 0.086], and no interaction [F (4,68) = 0.214, p = 0.930ns., partial η^2 = 0.012]. Results suggest that there are no differences between the high and low Type D personality groups and HR at the five different time points.

HR Time points 1 to 3 (T1-T3) and 1 to 4 (T1-T4): Looking at the data in Table 9, it can be seen that individuals low in Type D had peak HR pre ROCF (T4). Individuals high in Type D had peak HR after presentations (T3). A t-test was undertaken to analyse HR reactivity from HR baseline to HR peak. The t-test showed no significant differences between the low and high Type D groups and the time points T1-T3 as *t* (17) = -0.076; *p* = 0.940ns and T1-T4 as *t* (17) = 0.692; *p* = 0.498ns.

E: Negative affectivity aspect of Type D (IV) and HR measures at five time points (DV): A 2 x 5 ANOVA was also used to investigate the relationship between the IV of the negative affectivity (NA) aspect of Type D personality with two levels (high and low) and the DV of HR at five time points (baseline, before presentations, after presentations, before task, after task) to see if there were any differences when the NA aspect was separated from the SI aspect of Type D. Descriptives are reported in Table 10.

Table 10.

Mean Values of HR (DV) at five time points for the High and Low NA groups

	Heart rate time points (BPM)				
	HR baseline	**HR before presentation**	**HR after presentation**	**HR pre ROCF**	**HR post ROCF**
NA					
low	88.90 (13.262)	98.50 (25.514)	97.50 (14.328)	100.10 (14.798)	94.40 (11.335)
high	92.78 (13.944)	100.11 (18.065)	98.78 (17.943)	99.44 (10.357)	94.56 (6.635)

Sphericity was assumed ($p>0.05$) with results showing no main effect of negative affectivity (NA scale – high/low) on HR [$F(1,17) = 0.072$, $p = 0.791$ns., partial $\eta^2 = 0.004$], no main effect of time [$F(4,68) = 1.595$, $p = 0.186$ns., partial $\eta^2 = 0.086$], and no interaction [$F(4,68) = 0.082$, $p = 0.988$ns., partial $\eta^2 = 0.005$]. Results show that there are no differences between those high and low in NA and HR at any of the five time points.

HR Time points 1 to 2 (T1-T2) and 1 to 4 (T1-T4): Looking at the data in Table 10, it can be seen that individuals low in NA had peak HR pre ROCF (T4). Individuals high in NA had peak HR before presentations (T2). A t-test was undertaken to analyse HR reactivity from HR baseline to HR peak. The t-test showed no significant differences between the low and high NA

groups and the time points T1-T2 as t (17) = 0.204; p = 0.841ns and T1-T4 as t (17) = 0.519; p = 0.611ns.

F: Social inhibition aspect of Type D (IV) and HR measures at five time points (DV): A 2 x 5 ANOVA was also used to investigate the relationship between the IV of the social inhibition (SI) aspect of Type D personality with two levels (high and low) and the DV of HR at five time points (baseline, before presentations, after presentations, before task, after task) to see if there were any differences when SI was analysed separately from Type D. Descriptives are reported in Table 11.

Table 11.

Mean Values of HR (DV) at five time points for the High and Low SI groups

	Heart rate time points (BPM)				
	HR baseline	**HR before presentation**	**HR after presentation**	**HR pre ROCF**	**HR post ROCF**
SI					
low	94.63 (14.706)	103.13 (23.925)	97.75 (15.881)	101.38 (14.222)	96.00 (10.043)
high	87.91 (12.194)	96.45 (20.661)	98.36 (16.250)	98.64 (11.750)	93.36 (8.778)

Sphericity was assumed (p>0.05) with results suggesting that there is no main effect of social inhibition (SI scale - high/low) on HR [F (1,17) =

0.611, p = 0.445ns., partial η^2 = 0.035], no main effect of time [F (4,68) = 1.535, p = 0.202ns., partial η^2 = 0.083], and no interaction [F (4,68) = 0.265, p = 0.900ns., partial η^2 = 0.015]. This further supports the results that there are no differences in HR at each of the five time points for the high or low SI groups.

HR Time points 1 to 2 (T1-T2) and 1 to 4 (T1-T4): Looking at the data in Table 11, it can be seen that individuals low in SI had peak HR before presentations (T2). Individuals high in SI had peak HR before presentations (T4). A t-test was undertaken to analyse the data further. The t-test showed no significant differences between the low and high SI groups and the time points T1-T2 as *t* (17) = -0.004; *p* = 0.997ns and T1-T4 as *t* (17) = -0.449; *p* = 0.659ns.

ANOVA for each type of presentation (individual or group) and heart rate (HR)

As both group and individual presentations took place, an ANOVA was required to look at any differences between HR at each of the five time points between those that did individual presentations and those that took part in group presentations.

Individual/group presentations and HR at five time points: A 2 x 5 ANOVA was used to investigate the relationship between the type of presentation, with two levels (individual and group) and the DV of HR at

five time points (baseline, before presentations, after presentations, before task, after task). Descriptives are reported in Table 12.

Table 12.

Mean Values of HR (DV) at five time points for both Group and Individual Presentations

	Heart rate time points (BPM)				
	HR baseline	**HR before presentation**	**HR after presentation**	**HR pre ROCF**	**HR post ROCF**
Presentation					
individual	96.38 (13.564)	100.00 (20.277)	94.37 (12.165)	98.75 (12.279)	92.88 (10.842)
group	86.64 (12.176)	98.73 (23.656)	100.82 (17.832)	100.55 (13.269)	95.64 (8.066)

Sphericity was assumed ($p>0.05$) with results suggesting that there is no main effect of type of presentation (individual/group) on HR [$F(1,17) = 0.000$, $p = 1.000$ns., partial $\eta^2 = 0.000$], no main effect of time [$F(4,68) = 1.416$, $p = 0.238$ns., partial $\eta^2 = 0.077$], and no interaction [$F(4,68) = 1.069$, $p = 0.379$ns., partial $\eta^2 = 0.059$]. These results show that both groups (individual and group) are similar in HR measures.

Independent t-tests to analyse any differences between the IVs (Trait anxiety, Type D and the sub-scales Negative Affectivity and Social Inhibition) and the Rey-Osterreith (ROCF) task scores (DV)

Four independent t-tests for each of the IVs (Trait anxiety, Type D and the sub-scales of NA and SI, with two levels, high and low) and the DV of Rey-Osterreith (ROCF) task scores (ROCF 20 and ROCF 30) were utilised to assess for any differences. As the data for the RCBS and the BFNE was not normally distributed (See page 47), a Mann-Whitney test will be used for these scales and the ROCF task scores.

Independent t-test for Type D (IV) and ROCF task scores (DV): An independent t-test was carried out to find any differences between Type D (high and low) and the ROCF task scores (ROCF 20 and ROCF 30). Analysis showed no significant differences between Type D (high and low) and the ROCF 20 as t (17) = 1.331; p = 0.201ns and no significant differences between Type D (high and low) and the ROCF 30 as t (17) = 1.718; p = 0.104ns.

Independent t-test for the Negative Affectivity (NA) aspect of Type D (IV) and ROCF task scores (DV): An independent t-test was carried out to find any differences between the NA aspect of Type D (high and low) and the ROCF task scores (ROCF 20 and ROCF 30). Analysis showed no significant differences between the NA aspect of Type D (high and low) and the ROCF 20 as t (17) = 1.160; p = 0.262ns and no significant differences

between the NA aspect of Type D (high and low) and the ROCF 30 as t (17) = 1.487; p = 0.155ns.

Independent t-test for the Social Inhibition (SI) aspect of Type D (IV) and ROCF task scores (DV): An independent t-test was carried out to find any differences between the SI aspect of Type D (high and low) and the ROCF task scores (ROCF 20 and ROCF 30). Analysis showed no significant differences between the SI aspect of Type D (high and low) and the ROCF 20 as t (17) = 1.404; p = 0.178ns and no significant differences between the SI aspect of Type D (high and low) and the ROCF 30 as t (17) = 0.868; p = 0.398ns.

Independent t-test for trait anxiety (IV) and ROCF task scores (DV): An independent t-test was carried out to find any differences between trait anxiety (high and low) and the ROCF task scores (ROCF 20 and ROCF 30). Analysis showed no significant differences between trait anxiety (high and low) and the ROCF 20 as t (17) = 2.093; p = 0.052ns, although this is nearing significance, and no significant differences between trait anxiety (high and low) and the ROCF 30 as t (17) = 1.622; p = 0.123ns.

Mann-Whitney test for shyness (IV) and ROCF task scores (DV): As the Revised Cheek and Buss Shyness Scale (RCBS) data was not normally distributed (See page 47), a Mann-Whitney U test was conducted. The Mann-Whitney U test showed significant differences between the high and

low shyness groups and ROCF 20 scores (U = 19.500, p = 0.041). Figure 2 shows the significant differences between the groups. Significant differences between the high and low shyness groups and ROCF 30 scores (U = 18.500, p = 0.033) were also found. Figure 3 shows the significant differences between the groups. For both the ROCF 20 and 30, the high shyness group scored less on the ROCF 20 compared to the low shyness group. This shows that those high in shyness may have still been affected by anxiety which impacted upon their memory.

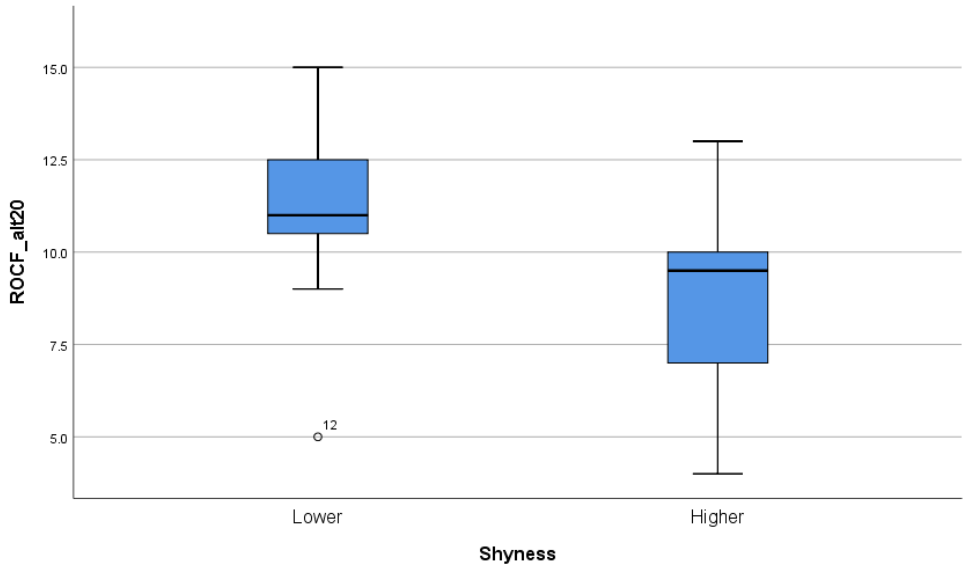

Figure 2: Box plot showing the distribution for shyness groups and the ROCF 20 scores

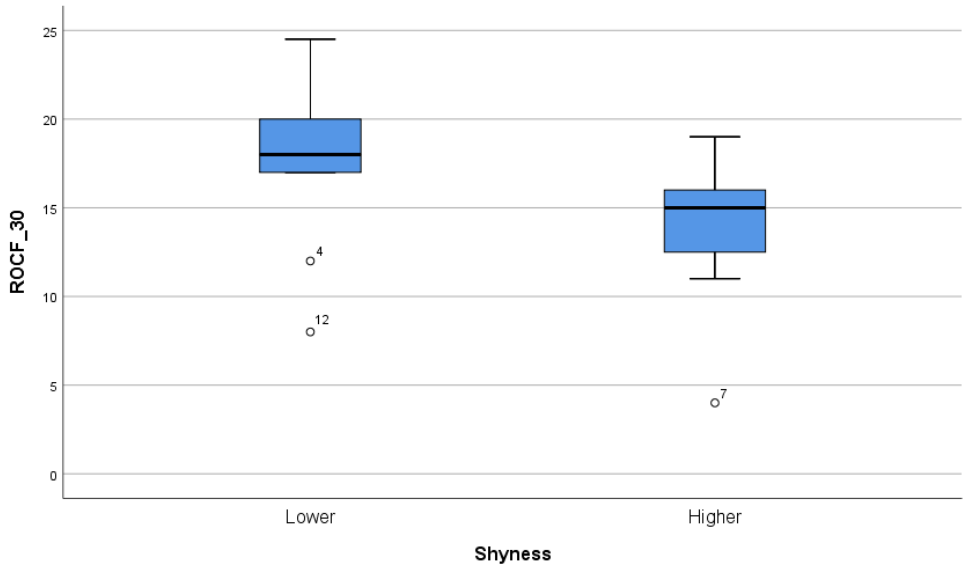

Figure 3: Box plot showing the distribution for shyness groups and the ROCF 30 scores

Mann-Whitney test for social anxiety (IV) and ROCF task scores (DV):

As the data for the BFNE was not normally distributed (See pages 39-40), a Mann-Whitney U test was conducted. The Mann-Whitney U test showed no significant differences between the high and low social anxiety groups and ROCF 20 scores (U = 42.500, p = 0.842ns) and no significant differences between the high and low social anxiety groups and ROCF 30 scores (U = 37.500, p = 0.549ns).

Summary of results (Part one)

The results from part one of this study show that each of the measures (RCBS, BFNE, STAI-T, DS14 and the sub-scales NA and SI) have significant positive relationships with each other, showing that each of the IVs are similar constructs. The BFNE had a significant negative relationship

with baseline HR ($p = 0.050$), with no further relationships found between the IVs and HR. The ROCF 20 scoring showed significant negative relationships with the SI sub-scale, STAI-T, DS14 and the RCBS, with the RCBS showing a significant negative relationship with the ROCF 30.

Individuals low in shyness, trait anxiety, Type D personality and negative affectivity had HR peak at T4 (Pre-ROCF), with individuals high in shyness, trait anxiety and negative affectivity having HR peak at T2 (Before presentations). However, those high in Type D had peak HR at T3 (After presentations). Individuals low in social anxiety and social inhibition had HR peak at T2 (Before presentations), with those high in social anxiety and social inhibition showing peak HR at T4 (Pre-ROCF). From the t-tests conducted significance was shown between individuals high and low in social anxiety and T1-T4. No significance differences in HR were found between those undertaking individual or group presentations as HRs were similar for both groups.

Results showed significant differences between the high and low shyness groups and the scores for the ROCF 20 and 30, with this nearing significance for those high and low in trait anxiety and the ROCF 30.

Part two – Semi-structured interviews

As this study focused on examining the relationship between shyness, anxiety and Type D personality, it was felt necessary to include a number of questions within the semi-structured interview about perceptions of anxiety and shyness. This data did not constitute a theme and therefore has been presented below separately to the thematic analysis.

Anxiety

Anxiety was described as having a number of physiological symptoms such as sweating and fast heart beats as well as being "…a clouding of judgements…" (Participant 2, female aged 38). Additionally, it was described as being related to fear and worry about things that cannot be controlled. Interestingly, it was also discussed as being OK at a low level but "…life disabling…" (Participant 4, female aged 36) at an extreme level, with it being very difficult to control.

Shyness

In contrast to anxiety, shyness was described as something that you could control as you could put yourself into situations that may be uncomfortable to be begin with but that would help to overcome the shyness. Every participant stated how shyness was related to being around others and that shy individuals may find it difficult to approach and communicate with other people. Interestingly, most participants discussed how they were shy as a child but that as an adult they had to do certain tasks, within their jobs for example, that helped them to build up a tolerance to cope in those situations, leading to less shyness. They did state though that as an adult, although they felt less shy, they did feel more anxious.

Three themes were developed using thematic analysis: Theme 1 - Perceived judgement by others with the sub-theme of audience, Theme 2 – Anticipation, with sub-themes of immediate build up and key life events and

Theme 3 - Pressure of expectations, with sub-themes of preparation and self. Quotes from the interviews are included below.

Theme 1: Perceived judgement by others:

Throughout the interviews participants expressed their views on presenting or talking in front of others with many stating that anxiety is heightened when they are the centre of attention due to perceived judgement by others. The impact on their emotional wellbeing of this perceived judgement was mentioned. This suggests a potential relationship between anxiety and shyness as this study focuses on the "fear of negative evaluation" as the definition of shyness. The sub-theme of audience further describes this theme. Many described the impact of presenting in front of others:

> "…I feel as if oh everybody's just gonna laugh at me…"
>
> (Participant 9, female aged 35)
>
> "…some people can make you feel so uncomfortable that you think you're not worthy of anything" (Participant 9, female aged 35)

> "…yeah you know you don't wanna look a fool in front of people" (Participant 2, female aged 38)

> "…just the embarrassment I think I was really worried about completely embarrassing myself…" (Participant 4, female aged 36).

Sub-theme – Audience

The majority of participants expressed that presenting or talking in front of others caused more anxiety if they knew the audience, with a fear of their reaction towards them and their views of them being discussed.

> "…I think it is always more difficult doing it in front of people that you know…" (Participant 1, female aged 39).

> "…actually a small number of people that you know is way scarier than erm you know a hundred people of a hundred faces of of strangers…" (Participant 1, female aged 39).

> "…it's just the anxiety about it just the worry about it that well what if I make a mess and I say something stupid and then tomorrow when I see him he's gonna laugh at me…" (Participant 10, female aged 45)

> "…but the added stress of being judged by people that you know…" (Participant 2, female aged 38)

> "…there is a judgement element of you know what my peers think of me… and that made the build up to this particularly more stressful." (Participant 2, female aged 38)

Likewise, participants reported feeling more anxiety when presenting in front of a larger group of people stating that a smaller audience was better in terms of how it made them feel in relation to nerves.

> "…if there was a whole bunch of other students there even that I do know it's like no one person is fine it's just like a conversation but like I said a hundred no no" (Participant 6, female aged 20)

> "…I mean if there had been more people I think that would have been much worse erm so I think the small group size helped…" (Participant 3, female aged 30)

Theme 2: Anticipation

What is clear from the interviews is that presentations cause anxiety for all of the participants, with anxiety starting as soon as presentations are mentioned. A number of the participants stated that they started feeling an emotional response to anxiety, in the form of nerves towards the presentation, in advance of the day. The anticipation period of a presentation came across as being a really significant event for all participants although each had varying time points of when they felt the most anxious. This theme includes the sub-themes of immediate build up and key life events:

> "Erm very nervous I think nervous building up to it in like the week or two before…" (Participant 3, female aged 30)

"I was nervous in the morning" (Participant 1, female aged 39)

"…last night actually they started last night didn't sleep well from when I drove here this morning I had several panic attacks on the way here erm so right from kind of thinking about it last night" (Participant 4, female aged 36)

"Since he first told us that we were gonna have a presentation" (Participant 5, female aged 24)

"Yeah as soon as I hear the word presentation even if it's like two months beforehand I'm like I'm stressing out…" (Participant 6, female aged 20)

Sub-theme - Immediate build-up

The data in part one of this study found a small increase in heart rates from the baseline period to the anticipation period immediately before the presentation. This was reflected in the qualitative interviews with the majority of participants feeling most anxious immediately before presenting:

"More anxious going from the introduction because I knew that my part was right after that." (Participant 6, female aged 20)

"…because I knew I were walking to the room I were absolutely in a complete state I couldn't even speak even but then walking into the room I thought I were gonna die" (Participant 10, female aged 45)

"…at the beginning at the beginning it was really really bad (Participant 5, female aged 24)

"…when I went up to the front I felt a little bit like I don't understand what people are telling me…I just felt a bit frazzled like oh I can't cope with anything outside of what I am trying to deal with right now…"

(Participant 7, female aged 34)

"…I think it's just as I'm beginning to say something you know and I I yeah I think I feel that yeah oh it's my time now oh my God…" (Participant 9, female aged 35)

Sub-theme - Key life events

The interviews also showed some interesting discussion between anticipation and key life events with many participants discussing how key life events such as starting at University can cause anxiety. Many expressed that once they had got to University and met others, their anxiety had lessened as it was more about the anticipation of the unknown. This was

also mentioned in the context of job interviews and new jobs, with participants not knowing what to expect and the anxiety this causes in the anticipation of the event. Exams and assessments were also described as being anxiety provoking as often it is not known what is expected or what will happen, which can be seen through the reactions to the presentations the participants took part in.

> "I don't know what it's gonna be like I don't know what's expected" (Participant 1, female aged 39)
>
> "it's the anticipation of it I think more than the actual reality." (Participant 1, female aged 39)

> "…the most recent one would be my first day here erm at University coming back into University erm and just being with people and making small talk about things…" (Participant 2, female aged 38)

> "…before a job interview like with a job that I would really want erm….. or… erm.. on my wedding day I felt quite anxious but in a different way as I wanted that to happen rather than the presentations erm er yeah maybe just before any kind of tests or exam really." (Participant 3, female aged 30)

> "…I'm in a situation where I've got to meet somebody I don't know or a situation where there's something that I'm gonna have to say then I'm not sure I'm gonna say it right and whether I'm gonna be forgetting information and just in like I say interviews and stuff like that just the unknown really…" (Participant 10, female aged 45)

Theme 3: Pressure of expectations

Expectations and the pressures these bring were mentioned continuously throughout the interviews by the participants. When talking about their anxieties, participants recalled their presentations and described how as they had never done a presentation at the University before, they were unsure of expectations, including the content required for their degree level. This category has sub-themes of preparation and self. Many also described how lecturers had been really supportive and they did not want to let them down in the presentations and wanted to prove to them that they were capable of doing well. The lecturers were seen as the experts in the field and therefore participants did not want to look silly or foolish in front of them which added extra pressure and anxiety:

> "…is a sort of different kind of assessment to the ones we are used to here with erm normally all being written and you are just not entirely sure what is expected of you…" (Participant 1, female aged 39)

"…kind of this you know professionalism like don't want to come across as somebody who was really amateur." (Participant 1, female aged 39)

"…so I think there's that pressure to to prove that you've erm put the work into it and that you've erm mmm sort of deserved to be there and and that you're as hard working as the next person kind of thing" (Participant 3, female aged 30)

"Like I think I was concerned that I wouldn't have hit the spot if you know what I mean so that I hadn't really I I know I've put a lot of work into it but I wasn't sure that the work I'd done was what was expected…" (Participant 7, female aged 34)

Sub-theme – Preparation

Many of the participants discussed how they felt that they had not had enough time to prepare, which then increased anxiety before the presentations as they felt that they were not meeting expectations. Furthermore, other participants felt that even though they had prepared, the time restraints on the presentation and the expectations were huge:

"…I hadn't possibly put enough time in …my particular amount of time this week has been short so it's been a bit stressful in that sense" (Participant 2, female aged 38)

> "…I had practised it a few times and it had been around the 10 to 12 minute mark which is what it had to be but other times I had had said it and it was like 7 minutes so the time pressure was definitely something that I was aware of" (Participant 3, female aged 30)

What was expected of participants within the preparation stage seemed to continue into the presentations. Not being fully aware of expectations of others, in regards to what is needed for a task, increased anxiety in the majority of participants which may have influenced the heart rate measures in part one of this study. This appeared to be something which was familiar to participants and something which may be related to society and expectations of individuals:

> "…was I conveying the correct amount of information…"
>
> (Participant 2, female aged 38)

> "my worry was that I wouldn't have enough material that I wouldn't have…it wouldn't appear that I had done enough work…"
>
> (Participant 7, female aged 34)

Sub-theme – Self

As well as expectations from others, many participants focused on their own self expectations. A number of participants expressed how they have high

expectations of themselves and want to do well as they want to go onto further study and so put more pressure on themselves to do this. Interestingly, those who took part in group presentations felt more individual pressure and anxiety as they did not want to let the group down as a whole:

> "…so you have your own self-worth and your own self judgement and you want to do well…" (Participant 2, female aged 38)

> "I think it's 'cos I wanna do well so the thought or if I stumble at any point I just feel that I haven't been I haven't done as well as I should have" (Participant 8, female aged 19)

> "…I was trying to live up to that expectation not only to let myself down 'cause I have those expectations of myself…" (Participant 1, female aged 39)

> "…'cause I know like you get graded on it and I don't wanna fail 'cause I love academic things so if I start failing I just break down" (Participant 6, female aged 20)

Expectations of self was also discussed in relation to key events in life such as driving tests and interviews with increased anxiety being experienced. It

was often difficult to untangle the expectations of self as often it appeared through the interviews that the expectations they experienced were from themselves and not others, although this was not often explicitly discussed:

> "…I think anything where you are being really scrutinised and judged…" (Participant 7, female aged 34)

> "…you know going for a test, going for an interview, something that's really important to me and I know I've got to perform well then I feel this sort of level of stress" (Participant 7, female aged 34)

> "…the fact that you sort of think well what are my other options and you sort of put a lot of pressure on yourself to achieve it because you think right this is what I wanna do erm and you have sort of planned it out in your head as to how it will work alongside everything else in your life…" (Participant 3, female aged 30)

Discussion

This study aimed to look at anxiety and presentations as presentations at Universities are becoming more common, due to enhancing employability and transferrable skills. It is so important that focus is on reducing anxiety for individuals to ensure that mental health is not affected. As anxiety has been associated with other concepts previously, this study looked at the concepts of shyness, Type D personality, the sub-scales of Type D (negative

affectivity and social inhibition) and both trait anxiety and social anxiety, to look for similarities.

The results showed that all three concepts are similar as all showed strong correlations between each other, further supporting findings of previous studies that found that social anxiety and shyness are similar constructs (e.g. Ran, Zhang & Huang, 2018; Tang et al., 2017), with social inhibition also previously linked to social anxiety (Alcaraz et al., 2018). Further links have also been found previously between Type D and anxiety (Allen et al., 2019) and therefore this study has built on previous research by bringing together shyness, trait anxiety, social anxiety, negative affectivity, social inhibition and Type D personality showing that they are similar concepts. This is important when focusing on anxiety and presentations at University as knowing that the concepts are similar and may share similar traits, can help Universities provide effective support for more individuals.

In part two of this study, which consisted of semi-structured interviews, participants discussed their perceptions of shyness and anxiety, with many stating differences between the concepts, contrasting the results from part one. Within the semi-structured interviews participants suggested that shyness involves the relationship between the shy individual and communication with others, with anxiety being related to physiological symptoms alongside worry and fear. Throughout the literature, definitions of both anxiety and shyness have differed and therefore it is difficult to have a definitive idea of what each concept involves. For the purpose of this study, the definition of shyness used was a fear of negative evaluation by others that can be in real or imagined social situations as this has been used previously (e.g. Ang et al., 2018; Chen, 2019; Kwiatkowska et al., 2019).

Beaton et al. (2013) also used this definition in a study on shyness with a sample of 24 undergraduates and found that those classed as high in shyness had lower morning cortisol levels compared to the low shyness group.

Interestingly, some patterns emerged when analysing HR reactivity in participants and each of the concepts. For individuals who were low in shyness, trait anxiety, Type D personality and negative affectivity, they had a peak HR before undertaking the ROCF, with those high in the above concepts having a peak HR before presentations. This further shows that some of the constructs share similar traits. Furthermore, this supports the idea of the social self-preservation theory as those high in shyness, trait anxiety, Type D and negative affectivity may have been worried about the impending social evaluative threat of the presentations, which increased physiological responses, in order to protect individuals from any more threat (Dickerson & Kemeny, 2004; Lamarche, Kerr, Faulkner, Gammage & Klentrou, 2012). However, for those low in social anxiety and social inhibition, they experienced their peak HR before presentations, with those high in both concepts experiencing peak HR before the ROCF task. Bae et al. (2019) found strong correlations with heart rate, state anxiety and salivary cortisone levels when completing the TSST in a study, however, their sample only consisted of males and therefore would need to be researched with a wider sample. Villada, Hidalgo, Almela and Salvador (2016) state that some personality traits, such as anxiety or those that are associated with negative thoughts, can influence a response to acute stress, with Li et al. (2018) suggesting that Type D reactivity can depend upon the stressor given and therefore this may have impacted upon this study. Nasso et al. (2019) suggest that heart rate differences show individuals response to

stress and their autonomic response to the situation. Gonzalez-Bono et al. (2002) found a link between HR and anxiety with women who had high anxiety also experiencing higher increases in heart rate when told they are doing a speech with the anticipation period being key to this with reduced heart rates at the end of their study.

In addition, there was a significant difference found between the HR baseline measure and social anxiety with those classed as low in social anxiety experiencing higher heart rates. This result does not fit in with previous research as Auer et al. (2018) advise that those who have social anxiety are likely to have more fear around public speaking and evaluation and therefore this would suggest higher heart rates, which was not the case in this study. However, this could be due to the idea that participants had just arrived at the University for presentations and anxiety levels had yet to increase. Interestingly, Cody and Teachman (2011) found that during the speech, participants reported increased anxiety levels, in particular, the high social anxiety group reported higher anxiety. Individuals high in social anxiety who had thoughts on the upcoming social evaluation before taking part in a speech (anticipatory processing), had higher skin conductance and reported an increase in anxiety in a University sample in a study by Wong and Moulds (2011).

Although a pattern emerged when looking at HR reactivity, after further analysis, no significance was found and therefore this study needs to be replicated in the future with both a larger sample size to check for significance and using a larger audience for presentations. Future research could focus on presentations with an aspect of deception as this has been done previously with a focus on differences in brain regions (Dietrich et al.,

2019) and therefore may have more of a significant impact upon heart rates. Interestingly, from the interviews undertaken for part two, a number of participants reported an increase in anxiety during the anticipation period, with this decreasing immediately after their presentations. As this appeared to be the case for some participants but not others in this study, further research is needed.

Previous studies support the idea that the anticipation period is when participants feel most anxious, with Cremers et al. (2015) finding higher heart rate increases and less functional cortical-amygdala connectivity during this stage in the social anxiety disorder group. The control group in their study showed negative connectivity during the anticipation stage of a speech. This shows that those in the control group in their study may have had more positive coping strategies for anxiety than those in the socially anxious group. Furthermore, Davies et al. (2017) state that amygdala responses were more consistent for the socially anxious group, whereas these fluctuated with the control group. They also suggest various time points impacted upon the left and right amygdala of participants with social anxiety disorder during speech anticipation. However, this was dependent on the number of people they could see joining the audience for their anticipated speech. Von Dawans et al. (2018) conclude that higher heart rates were found when participants were under a social stress condition, with higher baseline heart rates in the social stress condition, which may have been due to the anticipation, however, all the participants in their study were male. Nasso et al. (2019) also found in a study that heart rate variability decreased during the anticipation stage, however their study only focused on female participants. Furthermore, Durlik et al. (2014) stated in

their study that during the anticipation period of a speech, anxiety and the fear of negative evaluation increased.

There are said to be a number of factors that can impact upon anxiety during a speech task. De Oliveira et al. (2012) found in a study that oxytocin reduced anxiety from baseline to pre-test stage but not during the anticipation or speech stages, however they do suggest that other studies have shown that particular drugs can cause an increase or decrease in anxiety during the anticipation stage. They also suggest their results could be due to the amount of intranasal oxytocin administered. Moreover, von Dawans et al. (2018) suggest differences in stress responses can be due to a number of factors such as gender, oral contraceptives and personality traits which is further supported by Shields, Sazma and Yonelinas (2016) who state that contraceptives may play a part in affecting the stress response. Furthermore, Bowen, Grady & Spaniol (2019) state that some medications are said to affect cognition e.g. pain medication. Therefore, future studies may need to exclude participants taking medication to ensure that this is not impacting upon anxiety. Pulopulos et al. (2018) suggest that the time given to the anticipation period may affect the stress response with more time allowing for differences in the HPA axis to be shown. Merz et al. (2019) suggest that anxiety is increased during the anticipation period of a presentation with more negative affect and an increased stress response. It is important that future research focuses more on the anticipation period of a speech task and the length of time this is for to enable more clarity on the effects of this time period. This could be implemented by having groups with different lengths of anticipation periods and then comparing groups. Furthermore, this study used a smartwatch as a less intrusive HR measure,

which may have influenced the results and will require more research to assess effectiveness as in a previous study by Thomson et al. (2019) it was suggested that smartwatches have produced mixed results.

Auer et al. (2018) suggest other factors that can influence the stress reaction for individuals undertaking a public speaking task; the importance of the public speaking task, differences between individuals and fear of negative evaluation from the audience. Their study used a sample of University students and found that those with higher anxiety had increased stress responses. They further suggest that any event that includes a public speaking element in front of peers or those who are perceived to be in a more powerful position, created a stressor, with stressors that include communicating to others causing a physiological response. The interviews in this study support this idea as participants stated that presenting in front of people they know causes more anxiety due to the perceived evaluation that may come after the event. This supports the idea of social self-preservation theory as when there is an element of social evaluation present, individuals can find it difficult as they are concerned with the evaluation from others (Woody et al., 2018). Due to this evaluative threat, social self-preservation theory states that the stress response may be activated to protect the individual from more threat, which increases cortisol levels (Denson, Creswell & Granville-Smith, 2012). Interestingly, Sabik et al. (2019) found that the perceived judgement of the individual's appearance also added to the stress of social evaluation, and therefore it would be interesting to look at this aspect in future studies on presentations and social evaluative theat. The social self-preservation theory underpins the findings of this study, as the idea of social evaluative threat came through strongly in

the interviews, with HR also peaking in the anticipation phase of the presentations for a number of concepts.

Although presentations are said to cause anxiety and fear, they have been found to be an important aspect to University life when undertaken as a group in the first year of University (Nash et al., 2016). They found in a study that students who practiced their presentation skills before presenting publically had less fear when presenting in front of others, although they also found that those students felt that they had less control over their nerves and eye contact. This is an important finding that needs to be considered in Universities regarding presentations, with a review of policies needed to ensure that students are given opportunities to further practice presentation skills before being assessed in them. Nasso et al. (2019) found that by catastrophizing the outcome of the speech task they suggest that participants had increased amygdala activation with an increase in negative affect due to a decrease in prefrontal activity, causing lower heart rate variability.

Interestingly, from the semi-structured interviews undertaken as part of this study, a number of participants reported negative feelings around being judged by others, with a number of participants stating that they were worried about their peers laughing at them or embarrassing themselves in front of their peers. These participants also reported feeling most anxious during the anticipation stage of the presentations, suggesting that they may have had increased HR. Many participants during the interviews suggested that they felt relieved after the presentations and more positive, which was also found in a study by Henze et al. (2017). For future assessed presentations, consideration needs to be given to the levels of anxiety felt before presentations and ways of reducing this anxiety need to be found.

The number of audience members was also mentioned within the interview data, with participants suggesting that a larger audience would increase anxiety, due to the increase in social evaluation. It would be interesting to see if increasing the number of audience members, increased HR in participants in future studies.

As both group and individual presentations were used in this study it was interesting to see that there were no significant differences in HR between those taking part in an individual or group presentation. However, interview data from this study suggested that those members in group presentations felt increased pressure and anxiety as they did not want to let other members of the group down. In contrast to this, Townsend, Kim and Mesquita (2014) found in a study that sharing an emotional response with someone else during an anxiety-provoking situation can decrease the anxiety, if the same emotion is felt by both. This suggests that presenting in a group may decrease the anxiety if a shared emotional response is felt, but this was not found in this study.

This study also used the Rey-Osterreith (ROCF) task, which participants completed after their presentations, to see if they remained anxious or stressed and to see if this had an impact upon memory. This was also used to look for any differences between each of the concepts; shyness, social anxiety, trait anxiety, Type D, NA sub-scale of Type D and SI sub-scale of Type D. Interestingly, the biggest difference was found between the high and low shyness groups and the ROCF 20, with individuals high in shyness, scoring less on the ROCF than those in the low shyness group. The strength of the relationship changed between the ROCF 30 scores and the concepts in this study, showing that the ROCF 20 may be a more reliable

scale. The ROCF 30 included marks for individual lines, with the ROCF 20 having marks for sections, for example a complete rectangle. This difference in results could be due to the fact that participants were memorising the image in sections and therefore complete shapes were recalled. However, as significance was only found between each of the ROCF scoring methods and shyness, it would be interesting to see if further research into each of the scoring methods used in this study could be undertaken. Wolfe, Zhang, Kim-Spoon and Bell (2014) discuss how individuals who are shy may have difficulties with cognitive abilities such as working memory which supports the results of this study when focusing on the ROCF 20 scale. Human et al. (2013) used the ROCF with different scoring methods and found that participants in the stress group produced less accurate representations of the ROCF task during the recall phase, however, their sample only contained males. There are also factors which can influence the outcome of the ROCF as Yamashita (2017) suggests that academics may be able to retain more and therefore this may have impacted upon the ROCF results in this study. Interestingly, Sapozhnikova & Smith (2017) suggest that anxiety can impact upon the way the ROCF is completed by the participant, although this was not shown through the ROCF scores. However, those high in social anxiety and SI had peak HR before the ROCF, with participants low in shyness, trait anxiety, Type D and NA experiencing peak HR before the ROCF. This shows that anxiety may have been present for some participants when completing the ROCF and further research is needed in future studies.

Previous studies suggest that there may be no differences between the high and low anxious individuals during cognitive tasks, although high

anxious individuals may use more cognitive resources to complete the task than the low anxious, however, this may be influenced by the task that has been given (Berggren & Derakshan, 2013). Liang (2018) focused on attentional control and social anxiety in a sample of undergraduates and found those classed as socially anxious had less efficiency when completing an attention based task. This links to Attentional Control Theory with Suárez-Pellicioni et al. (2015) hypothesising that this affects a cognitive task as attentional control is affected by the anxiety in a cognitive task and impacts upon the bottom up and top down processes of working memory. Taverniers et al. (2010) found that those participants put under extreme stress scored less on the recall aspect of the ROCF and therefore it would be interesting to see if different stress conditions impacted upon the results of the ROCF. Merz et al. (2018) conducted a similar study as they also used University presentations, however this involved both a stress condition, with presenting in front of classmates and lecturers for an assessed presentation, with the control group just watching the presentations. However, they used an alternative memory task and found that presentations were successful stressors that impaired memory retrieval in participants. Future research needs to focus on different memory tasks to see how the stress and anxiety of a real life presentation affects different aspects of the brain. Previous research has also found mixed results regarding the impact of stress upon working memory with some studies suggesting that working memory is enhanced by stress and others suggesting it is impaired, however, in a review by Shields et al. (2016) they found that the majority of previous studies found that stress impaired working memory. They further state that the impact stress can have on working memory can be affected by the

amount of time from the beginning of the stressor to the beginning of the task given.

The interviews from part two of this study showed some interesting results regarding shyness and the life span. Participants referred to being shy as a child but not as an adult, which is interesting as a lot of literature on shyness focuses on childhood shyness. Poole, Saigal, Van Lieshout and Schmidt (2019) found that prenatal stressors can impact upon the foetus and can alter biological aspects such as the HPA axis, which then can begin the development of shyness throughout the lifespan. These biological factors, alongside the environment, especially around adolescence, can impact upon shyness in adulthood. Shyness in childhood is said to be linked to behavioural inhibition and avoidance behaviours. Schmidt and Poole (2018) suggest from their findings that there may be a delay in the frontal maturation of the brain in shy children due to approach-avoidance in social situations. Therefore, more longitudinal studies in this area would be beneficial to look at if there are any biological differences for shy individuals and how these may change or develop throughout the lifespan. On the other hand, Chen (2019) states that shy children may be able to adapt to social situations if they are supported and therefore cope better in these situations as they get older. They further suggest that society is changing and in most societies, you are required to have confidence in social situations and therefore it is important that shy individuals are fully supported in society today. This fits with the interview outcomes that state that a number of the participants suggest they were shy during childhood but not as an adult. Chen (2019) also discusses cultural differences in shyness, with western cultures having more of a negative response to shyness and

shy individuals, therefore causing the shy individual to have more negative feelings. This is also seen by impact of the behaviour of parents and caregivers in response to shyness and the shy individual as if they have negative responses then they are more likely to have negative shyness and negative feelings, which leads others to be negative towards them. This is further supported by Poole and Schmidt (2019) who found that children who were classed as being negatively shy were more socially anxious, with positive shy individuals having better coping strategies and therefore coping better in stressful social situations. This could provide a reason for why a number of participants in this study felt that shyness was more a childhood trait and they didn't class themselves as a shy adult. Scott (2004) found from interviewing shy individuals that shyness is more associated with communication within social environments with others and not a fixed personality trait. However, they also make clear that shy individuals are often knowledgeable regarding social encounters as they are excellent observers. Furthermore, Scott (2004) undertook interviews with shy individuals and found that if they felt comfortable then shy individuals took part in interviews and were really articulate. Shy individuals can often feel conflicted within social situations as they want to be themselves but by being withdrawn it provides a safer environment.

The interview data also showed an interesting theme of expectations with many feeling that they had their own self-expectations, expectations of the course, expectations of the lecturers and peers and expectations from group members if completing a group presentation. It is important that within University environments, these expectations are made clear and that they do not become overwhelming for individuals. Throughout the

interviews it was clear to see that anxiety drastically increased for participants before they took part in presentations. This may have been due to the added pressures and expectations placed upon the assessments as Universities have an increased interest in building employability skills for students. By undertaking presentations at University, this allows students to build their skills so that when in the workplace in the future they are able to present and interview well. A number of participants stated that job interviews as well as exams and assessments do provide increased anxiety for them and therefore this is something which needs addressing at University level. As a number of students go to University without ever having completed a presentation, having more practice and experience in them at an earlier age within education could lessen the anxiety, making them easier for students when they go to University.

Reflexivity of the qualitative aspect

When conducting the research, from the selection of topic to the analysing and report of the qualitative data, it was difficult not to be influenced by my own experiences. However, Ross (2017) discusses how this 'insider', someone who identifies with the focus group of the study, can bring both positives and negatives to the analysis. They further discuss that during the reading of the transcripts, they had often taken the research in a particular direction that was more related to their own experiences and less about the research question, which was both beneficial to the study with opportunities also missed at times. Throughout the process there was an awareness that as the topic areas discussed in this study are of personal interest to the

researcher, this may have influenced the data gathered through the semi-structured interviews. Therefore, in future studies it may be beneficial to use a team of researchers to analyse the data to make sure that there is less chance of bias. Interestingly, Scott, Hinton-Smith, Härmä and Broome (2012) report that shy individuals may find it difficult within the researcher role due to their shyness and a fear of being exposed.

When listening to and transcribing the interviews, it was clear that my own experiences of shyness and anxiety were in my awareness. This became more prominent during stages two to four of thematic analysis. During this time, whilst coding data, it was difficult not to pick out relevant data to my own experiences. In order to ensure there was less bias, data was left for a few days before being re-read and analysed. This really helped to separate out what was actually interesting and important within the data, rather than coding my own feelings. Again, when moving onto themes, my own experiences impacted upon the original themes identified. However, Dodgson (2019) suggests that reflexivity in qualitative research revolves around the researcher taking responsibility for the impact they may have on the data and that they should consider aspects such as personal preferences, emotional responses and theoretical orientations. After discussions with the supervisors of this study, it was clear that my own experiences were involved and therefore, stepping back from the data really helped at this stage. Before re-reading the data, the research question of exploring the relationship between shyness and anxiety through the views and experiences of participants was kept in mind. This enabled stage four, reviewing themes, to be more focused and relevant to the data, however, as this study has some links to my own experiences, there is some influence throughout. Pillow

(2003) also states the importance of awareness into how researcher interests for example may impact upon the research, however, it is important to ensure that the researchers' experiences are not projected onto the data through the experiences of the participants (Berger, 2015), which can be done through reflexivity and awareness by the researcher. Reflection has taken place throughout the qualitative aspect of this study and has been really useful in ensuring less bias in the data. Literature related to shyness and anxiety has also influenced the analysis as this has been prominent throughout this study, in particular, the perceptions of shyness and anxiety and also literature on anticipation as this is a key element to this study.

Limitations

This study was discussed with thirty-nine lecturers, via email, who had presentations between March and August 2019 or between September and December 2019 to recruit participants, with 9 lecturers responding and the study being introduced to 10 groups of students in total. This is in part due to the work load of lecturers which is part of University life and was unavoidable. Due to timings, it was often difficult to present this study to students to allow enough time for consent to be given before presentations were due to take place. G*Power suggested a minimum of 28 participants with an effect size of 0.25, *f* of 0.05 and power of 0.80, however, only 19 participants took part and therefore the number of participants used in this study would need to be increased in future studies. As this study used an assessed presentation, this could have impacted upon the number of participants as assessments often cause stress and therefore, participants

may not have wanted to increase stress by taking part in this study. Assessed presentations take place at set times of year which restricts recruitment and impacts upon timings, and therefore, future studies would need to have advanced planning and time to ensure that as many students as possible were reached for recruitment. Previous studies have also used laboratory settings for presentations, however, using real settings and assessed presentations has been found to be more affective when focusing on anxiety and heart rate. There were also only 10 participants who took part in an interview for part two of this study which could be due to timings or associated with personality types as Scott (2004) suggests that shy individuals may avoid these situations. However, in their study they found that shy students were more willing to participate in interviews on shyness than shy individuals within the general population.

HR was the only physiological measure used due to presentations being assessed, however, Wong and Moulds (2011) suggest that skin conductance is the best physiological measure of anticipatory anxiety due to the response of the sympathetic nervous system and therefore this may have been a good measure to use alongside HR. HR was measured in this study by a smartwatch, as this is a less intrusive HR measure when participants are taking part in an assessed presentation. Thomson et al. (2019) found that heart rate recordings have had variable results from a smartwatch, as they found that that two smartwatches they tested underestimated heart rate when compared with ECG measurements. Shilton, Laycock and Crewther (2017) also suggest that continuous heart rate recordings using an ECG provide more detail regarding heart rate. A limited number of smartwatches were

also available for this study which influenced the number of participants able to take part.

All participants were asked to refrain from caffeine for two hours before taking part in the presentations as this has been said to affect heart rate (e.g. Li et al., 2018; Nasso et al., 2019). They were reminded the day before taking part in this study, however, it is difficult to assess whether all participants followed this guidance as this was not checked on the day and may have impacted upon HR. Furthermore, this may have impacted upon recruitment for this study as students may not have wanted to refrain from caffeine for two hours before their presentations.

The participants in this study consisted of mainly females and as men and women react differently to stress (Cornelisse et al., 2011; Shilton et al., 2017), it may be useful to do further study around this and to focus on the relationship between shyness, trait anxiety, social anxiety, negative affectivity, social inhibition and Type D personality across genders.

Due to participant numbers, data was focused around high and low groups of shyness, trait anxiety, social anxiety and Type D personality. More participants would allow for both high, low and a middle group when analysing data, which may change the results. Having two groups means that the margins between groups was very small and may have impacted upon the findings of this study.

Multiple tests were conducted in this study to focus on HR at each of the five time points and the concepts. It was decided that a Bonferroni test would not be used in this study as there were no significant results found from the ANOVAs and therefore there was less chance that Type 1 errors could have occurred. However, this does mean that some of the variances reported may have differed if a Bonferroni correction was used as $p < 0.01$, (IBM support, n.d.; Vickerstaff, Omar & Ambler, 2019). This needs to be considered in future studies.

A number of limitations in this study were due to the design of the study, for example, using assessed presentations, which provided time constraints and may have contributed to lack of statistical power due to anxieties around assessments. Therefore, with altered design choices such as not using assessed presentations, this may have provided different results.

Future research

Additional research is needed on both the ROCF 20 and ROCF 30 scales to check for validity and to find a reliable scale that can be used in non-clinical settings. As there are very little scoring methods available for the ROCF that are non-clinical, it would be beneficial to find a valid and reliable scale to use in non-clinical settings. As this study only used the recall stage, it would be interesting to focus on memory and the brain when undertaking the ROCF as Xu, Guan, Li, Xu and Zhang (2019) used the copy, immediate recall and delayed recall stages of the ROCF and found that the anterior hippocampal networks were associated more with visual rather than verbal memory.

Any future studies that focus on shyness and anxiety, need to focus on the questionnaires measuring the concepts and analyse the questions asked, to ensure that they are measuring each concept individually and not the same areas. Sawaumi, Inagaki and Aikawa (2019) used the Shyness Implicit Association Test which has been used in previous studies and involves word categorisation tasks that help to show people's attitudes to shyness. This may also be beneficial to gain an idea about how other's perceive shyness and would provide a structure to enable this.

It has been suggested that anxiety experienced during childhood and adolescence can predict anxiety during adulthood (Linke et al., 2019) and therefore it may be beneficial to do more research in schools to try to reduce some of the anxiety later in life. This is also supported by Mather and Thayer (2018) who reported that previous studies have used heart rate variability measures and effectively taught participants breathing techniques which have reduced subjective stress and anxiety. This method may be something that can be taught in future to students who are undertaking presentations earlier in education so that as students get older, assessments such as presentations are easier to manage with less anxiety. Research can evaluate the possible impact of this. It is important that there is a focus on presentations at University level to ensure that students are fully supported with any anxieties around these. Zaboski et al. (2019) state that cognitive behavioural therapy (CBT) with exposure and response prevention is effective in helping those individuals with social anxiety disorder and therefore, a lesser form of this such as CBT or mindfulness may be useful in supporting those who are anxious or shy. Future research should look at the worth in the approach with students. Future research also needs to focus on

the impact of implementing presentations at a lower stage of education, for example primary schools. This could focus on the impact of teaching techniques alongside confidence and self-esteem building at an early on presentation anxiety at University.

As there are known to be differences in cultures and their beliefs about shyness (Chen, 2019), it is important that this is considered in future research. A wider sample size would be needed to look at different cultures and how shyness is seen. It is important that culture is considered alongside shyness, as perceptions of shyness may differ between cultures, which may impact upon future studies and their outcomes.

Conclusion

This study built on previous research suggesting that the concepts of shyness, trait anxiety and Type D personality are similar concepts and found that all of them are related to each other. Furthermore, social anxiety, negative affectivity and social inhibition were found to be related to the concepts of shyness, trait anxiety and Type D personality. On the other hand, the semi-structured interviews showed that participants' perceptions of shyness and anxiety differ in some ways and this requires more in-depth research. Although heart rate reactivity showed some interesting patterns, this needs further analysis in future studies with a larger sample size.

The implications of this study mean that students need more support from Universities leading up to assessed presentations. If support is not provided, it may be that students are not reaching their academic potential, due to the anxiety they are experiencing. The anxiety may become too

overwhelming, which would impact upon the outcomes of the assessments and therefore, it is important to make sure that any anxieties are lessened. Moreover, as anxiety can impact upon mental health, support needs to be provided at an earlier stage to prevent this. Support could be provided through a peer mentor, to allow the individual to talk through any worries or anxieties before the presentations. This could also be done through a peer support group, so that a small group of students could work through their presentations together, seek advice or practice their presentations with a supportive group. Universities could also provide more opportunities to practice presentations, on an individual basis, building up to presenting in front of others. More opportunities for small group work and working with supportive peers to build confidence would help with this. Tutors having more awareness around the potential impact of presentations for individuals, means that they can provide more support through supportive meetings that can help to alleviate some of the anxieties. This is vital as Universities are encouraged to provide students with more opportunities to gain transferrable skills and increase employability, and therefore, a greater number of assessed presentations are being added to modules.

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Appendices

Appendix A

DS14

Below are a number of statements that people often use to describe themselves. Please read each statement and then **highlight** the appropriate number next to that statement to indicate your answer. There are no right or wrong answers: Your own impression is the only thing that matters.

0 = FALSE

1 = RATHER FALSE

2 = NEUTRAL

3= RATHER TRUE

4 = TRUE

1.	I make contact easily when I meet people	0	1	2	3	4
2.	I often make a fuss about unimportant things	0	1	2	3	4
3.	I often talk to strangers	0	1	2	3	4
4.	I often feel unhappy	0	1	2	3	4
5.	I am often irritated	0	1	2	3	4
6.	I often feel inhibited in social interactions	0	1	2	3	4
7.	I take a gloomy view of things	0	1	2	3	4
8.	I find it hard to start a conversation	0	1	2	3	4
9.	I am often in a bad mood	0	1	2	3	4
10.	I am a closed kind of person	0	1	2	3	4
11.	I would rather keep other people at distance	0	1	2	3	4
12.	I often find myself worrying about something	0	1	2	3	4
13.	I am often down in the dumps	0	1	2	3	4
14.	When socialising, I don't find the right things to talk about	0	1	2	3	4

Appendix B

Demographic sheet

Please indicate (Tick box):	Male ☐ Female ☐ Other ☐ Prefer not to say ☐

Please indicate your age:	Below 30 years of age ☐ Above 30 years of age ☐

Please indicate (Tick box):	Smoker ☐ Non- smoker ☐ Prefer not to say ☐

Please indicate if you are currently taking any prescribed medication (Tick box):	Yes ☐ No ☐ Prefer not to say ☐

Date: _____

Unique Participant code (What is the first letter of your first name? What is the last letter of your first name? What is the day of your birth? What is the last digit in your year of birth?):_____

Appendix C

Revised Cheek and Buss Shyness Scale (RCBS)

INSTRUCTIONS: Please read each item carefully and decide to what extent it is characteristic of your feelings and behaviour. Fill in the blank next to each item by choosing a number from the scale printed below.

1 = Very uncharacteristic or untrue, strongly disagree
2 = Uncharacteristic
3 = Neutral
4 = Characteristic
5 = Very characteristic or true, strongly agree

____ 1. I feel tense when I'm with people I don't know well.

____ 2. I am socially somewhat awkward.

____ 3. I do not find it difficult to ask other people for information.

____ 4. I am often uncomfortable at parties and other social functions.

____ 5. When in a group of people, I have trouble thinking of the right things to talk about.

____ 6. It does not take me long to overcome my shyness in new situations.

____ 7. It is hard for me to act natural when I am meeting new people.

____ 8. I feel nervous when speaking to someone in authority.

____ 9. I have no doubts about my social competence.

____ 10. I have trouble looking someone right in the eye.

____ 11. I feel inhibited in social situations.

____ 12. I do not find it hard to talk to strangers.

____ 13. I am more shy with members of the opposite sex.

Appendix D

STAI-T

SELF-EVALUATION QUESTIONNAIRE

STAI Form Y-2

Name_____ Date_____

DIRECTIONS

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	1	2	3	4
22. I feel nervous and restless	1	2	3	4
23. I feel satisfied with myself	1	2	3	4
24. I wish I could be as happy as others seem to be	1	2	3	4
25. I feel like a failure	1	2	3	4
26. I feel rested	1	2	3	4
27. I am "calm, cool, and collected"	1	2	3	4
28. I feel that difficulties are piling up so that I cannot overcome them	1	2	3	4
29. I worry too much over something that really doesn't matter	1	2	3	4
30. I am happy	1	2	3	4
31. I have disturbing thoughts	1	2	3	4
32. I lack self-confidence	1	2	3	4
33. I feel secure	1	2	3	4
34. I make decisions easily	1	2	3	4
35. I feel inadequate	1	2	3	4
36. I am content	1	2	3	4
37. Some unimportant thought runs through my mind and bothers me	1	2	3	4
38. I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39. I am a steady person	1	2	3	4
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

STAIP-AD Test Form Y
www.mindgarden.com

Appendix E

BFNE

Brief Fear of Negative Evaluation, Straightforward Items

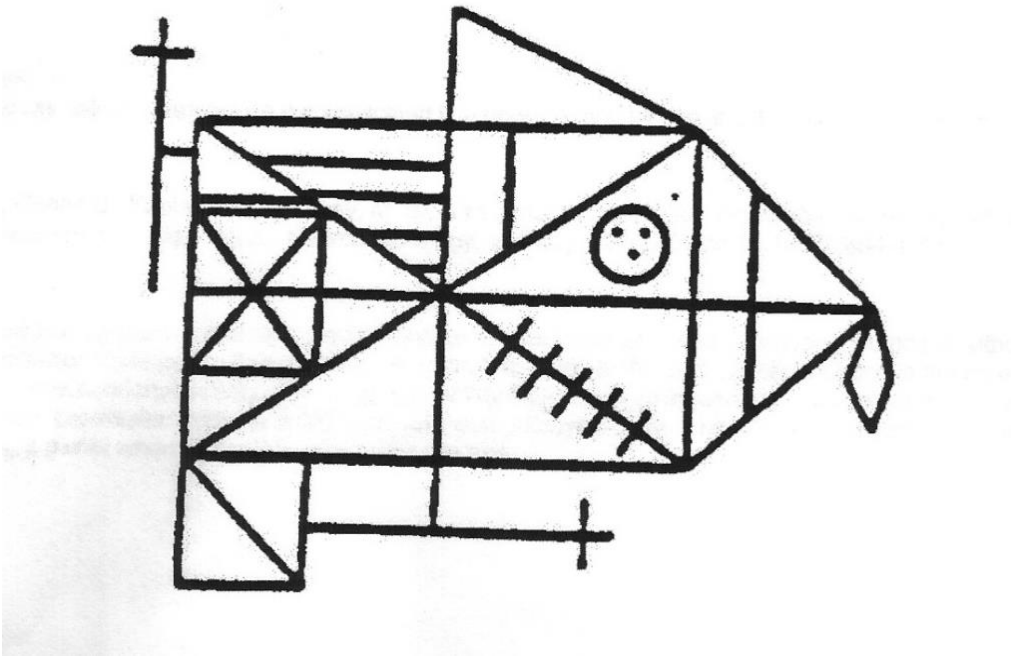
(Carleton, Collimore, McCabe, & Antony, 2011; Rodebaugh et al., 2004; Weeks et al., 2005)

Please circle the number that best corresponds to how much you agree with each item.

	Not at all characteristic of me	A little characteristic of me	Somewhat characteristic of me	Very characteristic of me	Entirely characteristic of me
1. I worry about what other people will think of me even when I know it doesn't make any difference.	0	1	2	3	4
2. I am frequently afraid of other people noticing my shortcomings.	0	1	2	3	4
3. I am afraid that others will not approve of me.	0	1	2	3	4
4. I am afraid that other people will find fault with me.	0	1	2	3	4
5. When I am talking to someone, I worry about what they may be thinking about me.	0	1	2	3	4
6. I am usually worried about what kind of impression I make.	0	1	2	3	4
7. Sometimes I think I am too concerned with what other people think of me.	0	1	2	3	4
8. I often worry that I will say or do wrong things.	0	1	2	3	4

Appendix F

ROCF task



Appendix G

Participants Required

Are you doing a presentation at University?

If so, would you be happy to complete a number of short questionnaires online (15 minutes) in the weeks before your presentation, have your heart rate measured and then take part in a task after your presentation, that will take no longer than 5 minutes.

We would also like to ask you some questions about the experience in a short interview within 48 hours after the presentation. (30 minutes)

If you are interested in taking part in this study please email the researcher, Rebecca Clarke at:

1606718@leedstrinity.ac.uk

Appendix H

Ineligibility Criteria

(Shyness, anxiety and Type D personality study)

Thank you for your interest in the study – **"Examining the relationship between shyness, anxiety and Type D personality" .** Unfortunately, due to the study involving heart rate measures, you will be unable to take any further part as the results may impact upon the data due to the heart condition. If you would like to withdraw your data from the questionnaires, please email Rebecca Clarke at: 1606718@leedstrinity.ac.uk within ten working days and state your participant code. Otherwise, this data will be included in the data set and be anonymised after this time.

Appendix I

Participant Information Sheet

(Shyness, anxiety and Type D personality study)

This study – **Examining the relationship between shyness, anxiety and Type D personality [1]-** will investigate the three concepts of shyness, trait anxiety and Type D, to see if they relate or differ from each other. Previous research has found links between shyness and social anxiety, with some research finding strong associations between general anxiety and Type D personality. As previous research has not focused on shyness, anxiety and Type D personality, this is the aim of this study. Your interest and valuable time are much appreciated.

What does the study involve?

You are being asked to take part in this study as you are going to be doing a presentation at University this semester. There are two parts to the study. Part 1: You are required to complete four online questionnaires related to shyness, anxiety and Type D personality, which can be done at home, and should take no longer than 15 minutes in total to complete. On the day of your presentation you will have your heart rate measured at various points throughout the tasks and you will take part in a memory task after your presentation. You will be required to refrain from any caffeine consumption for two hours prior to the presentation, as this can affect heart rate. Part 2. You can decide if you would be happy to be interviewed by the researcher the day after your presentation, which will be audio recorded and will last no longer than 30 minutes. These tasks, together with heart rate measures and the questionnaires will help to provide more information on shyness, anxiety and Type D personality.

Can I withdraw from this study?

Yes. It is an essential component of the British Psychological Society Code of Conduct (2009) that your right to withdraw is highlighted. You can withdraw

[1] Type D personality involves negative thoughts and social inhibition.

from the study at any time during the tasks or after the three tasks have been completed with myself (the researcher), Rebecca Clarke, you still have **ten working days** to withdraw if you so wish after completing the study. Simply email Rebecca Clarke (1606718@leedstrinity.ac.uk), state your participant code and your wish to withdraw. Alternatively, you can contact Professor Mark Russell (Chair of the School of Social and Health Sciences Ethics Committee) at Leeds Trinity University by emailing M.Russell@leedstrinity.ac.uk. If you do not withdraw, your data will be entered into the data set (after ten working days) and anonymised. Data will be held for 6 years, after which this will be destroyed in compliance with the GDPR guidelines.

How will the data be dealt with and who will see the results?

Your participation in this study is confidential and no information about your individual results will be shared with others. However, anonymised group data may form part of a publication written by the researcher. All physical materials relating to this study, including data and signed consent forms, will be stored in a secure location at Leeds Trinity University until October 2022 before being destroyed. Any electronic data will be stored in a password protected file on the Leeds Trinity internet Server. On publication, anonymised raw data (only) will be stored electronically through the data repositiory PURE, to ensure transparency and openness of findings. There is no way in which you (as an individual) will be traceable or identified by the way of this data.

Are there any benefits or risks associated with participating in this study?

There are no particular benefits, but there may be some enjoyment taken from parts of the study. There is no pressure to take part in this study and this study will not impact upon your marks for your presentation. You are entitled to ask for feedback in relation to your scores on a task undertaken. If you would like this information, you must email Rebecca Clarke (1606718@leedstrinity.ac.uk) within ten working days of completing the study. You are only entitled to information on your scores and will not be told how your scores relate to other participants or what the scores mean. Some of the tasks may make you feel uncomfortable, however, this would be expected due to nature of the study. If at any point during the study you perceive a task to be uncomfortable, you can refuse to complete the study and can withdraw without giving reasons. If you

have any concerns about any aspect of the way in which you have been approached or treated during the course of this study, you may contact the Chair of the Leeds Trinity (LTU) School of Social and Health Sciences (SHSS) Ethics panel.

Unfortunately, participants who have a known heart condition will not be able to take any further part in the study as the study involves heart rate measures and therefore this data may affect the outcomes of the study.

What if I require further information about the study or my involvement in it?

Once you have finished reading this information sheet, I will be happy to discuss it further with you and answer any questions you have. If you would like to know more at any stage of the study or if you have participated in the study and wish to withdraw, please feel free to contact me:

Rebecca Clarke (Masters by Research student): 1606718@leedstrinity.ac.uk

What if I have a complaint or any concerns?

Any person with concerns or complaints about the conduct of this study should immediately contact Professor Mark Russell, Chair of the School of Social and Health Sciences Ethics Committee, Leeds Trinity University, Brownberrie Lane, Leeds, LS18 5HD.

Email: M.Russell@leedstrinity.ac.uk

What happens next?

If you consent to taking part in the study, you will need to generate your own unique participant code using the four questions below:

1. What is the first letter of your first name? e.g. D
2. What is the last letter of your first name? e.g. E
3. What is the day of your birth? e.g. 03
4. What is the last digit in your year of birth? e.g. 9

(example of a unique participant code: DE039.

You will now be required to complete the four online questionnaires.

Appendix J

Consent Form

(Shyness, anxiety and Type D personality study)

I have read, understood, and been provided with a copy of the participant information sheet for the study – **"Examining the relationship between shyness, anxiety and Type D personality".** I have been given the opportunity to ask any questions and any questions asked have been answered to my satisfaction. I have received enough information about the study to make an informed decision to consent. I understand I am free to withdraw from the study at any time without having to give reason. I understand I can withdraw from the study within **ten working days**. Again, no reason is required and I will not be expected to provide one. I am fully aware of any potential risks involved in participating in this study and that the researchers cannot be held responsible for any detrimental effects that may occur from taking part. I agree to participate in this study.

Please confirm that you have read the participant information sheet	Tick box ☐ Date:

Please confirm that you have had the opportunity to ask any questions about the study	Tick box ☐

Please confirm that you are happy to wear a heart rate smartwatch throughout the study	Tick box ☐

Please confirm that you are happy to be interviewed and have your audio recorded	Tick box ☐

Please confirm that you are happy to take part in this study	Tick box ☐

Finally, please sign and date below to confirm your consent to taking part in this study. You are also asked to include your unique participant code generated for the online questionnaires. You will be asked to provide this code every time you take part in this study so that we can match your data. Your unique participant code should consist of the following:

1. What is the first letter of your first name? e.g. D
2. What is the last letter of your first name? e.g. E
3. What is the date of your birth? e.g. 03
4. What is the last digit in your year of birth? e.g. 9

(example of a unique participant code: DE039).

Please note that the Researcher (Rebecca Clarke) will uphold the codes of practice of the British Psychology Society (BPS), the values of Leeds Trinity University (as monitored by the School of Social and Health Sciences Ethics Committee), and the Data Protection Act. Should this study be published in the future, the data will be anonymised and no individual will be identified.

Remember that you still retain your right of withdrawal for a further ten working days, even after granting consent here.

Signature: _____ Date: _____

Unique Participant Code: _____

Appendix K

Results sheet (For use by experimenter)

Unique Participant code (What is the first letter of your first name? What is the last letter of your first name? What is the date of your birth? What is the last digit in your year of birth?):_____

Order of presentation:_____

Heart rate	
Baseline	
Beginning of anticipation period	
After anticipation period	
Before ROCF task	
After ROCF task	

ROCF Scores:

Appendix L

Instructions for the ROCF

You will now be asked to view a picture for 1 minute. After the 1 minute is up, you will be given further instruction. The time starts now.

(After the 1 minute) – You now have a piece of paper and a pen and pencil in front of you. You have 1 minute to re-draw the picture as accurately as possible. This will be scored later by the experimenter. The time starts now.

Appendix M

Debriefing Sheet

(Shyness, anxiety and Type D personality study)

Thank you for taking part in this study: "**Examining the relationship between shyness, anxiety and Type D personality" .** You may keep this debriefing sheet and take it away with you. The purpose of the study was to find out if shyness, anxiety and Type D personality are related to each other or if they differ.

Your participation in this study is confidential and no information about your participation or individual results will be shared. Your data may form part of a publication written by Rebecca Clarke, but any data disseminated will be in the form of anonymous group data from which it will be impossible to trace or identify you. This study will not affect your marks.

If after completing the tasks related to this study, you are feeling anxious, below is information on how to contact student services at the University. In addition, there is also the website www.bigwhitewall.com who offer free anonymous support. You are neither expected nor required to make use of them, but they may be helpful.

Website: http://www.leedstrinity.ac.uk/student-life/student-support/counselling

Email: studentsupport@leedstrinity.ac.uk

Remember that even having completed this study, you retain the right to withdraw for the next ten working days. Make note of your participant code and if you wish to withdraw, simply email Rebecca Clarke at: 1606718@leedstrinity.ac.uk and state your participant code. If ten working days have not passed (at which point, data will be anonymised and entered into the data set), your data will be destroyed/deleted at first opportunity.

Any person with concerns or complaints about the conduct of this study should immediately contact Professor Mark Russell, Chair of the School of Social and Health Sciences Ethics Committee, Leeds Trinity University, Brownberrie Lane, Leeds, LS18 5HD. Email: M.Russell@leedstrinity.ac.uk

For your information:

Date of Participation: _____

Unique Participant code (What is the first letter of your first name? What is the last letter of your first name? What is the date of your birth? What is the last digit in your year of birth?):_____

Thank you for your valuable time

Appendix N

Interview guide

The following schedule will act as a guide for the researcher who is conducting the interview.

Start of the interview:

- Participants thanked for consenting to take part in the interview.
- Researcher will explain that the purpose of the research is to examine the relationship between shyness, anxiety and Type D personality and find out more about how people experience shyness and anxiety
- Collect their unique identifier code (What is the first letter of your first name? What is the last letter of your first name? What is the date of your birth? What is the last digit in your year of birth?)

Participants will be reminded that:

- Everything they say in the interview is confidential and they will not be identified from any reports arising from the research
- They are free to withdraw or pause the interview at any time, without reason, by informing the researcher
- Participants will be asked if they have any further questions at this stage
- The interview will be audio recorded and will be asked if they still consent to this

Appendix O

Interview questions

The interview questions listed below will act as prompts for the interviewer due to semi-structured design of this interview. The exact order and number of questions may vary depending on the participant and ongoing analyses.

Section 1: Time

- Thinking about the presentation you have completed in the past 24 hours –
    - How did you feel before completing the presentation?
    - How are you feeling after completing this?
    - Did you feel anxious at any point during the presentation? At which point did you feel most anxious?
    - Can you think of a time when you have felt equally anxious?

PROMPTS: please tell me more about this? Please give me an example?

Section 2: Influences on anxiety

- What were you most anxious about with the presentations?
- Have you ever felt anxious in a social situation? – Tell me more about this

PROMPTS: please tell me more about this? Please give me an example?

Section 3: Perceptions

- Thinking about the topic areas of shyness and anxiety –
    - Tell me about shyness - what is your perception of shyness?
    - Tell me about anxiety - What is your perception of anxiety?

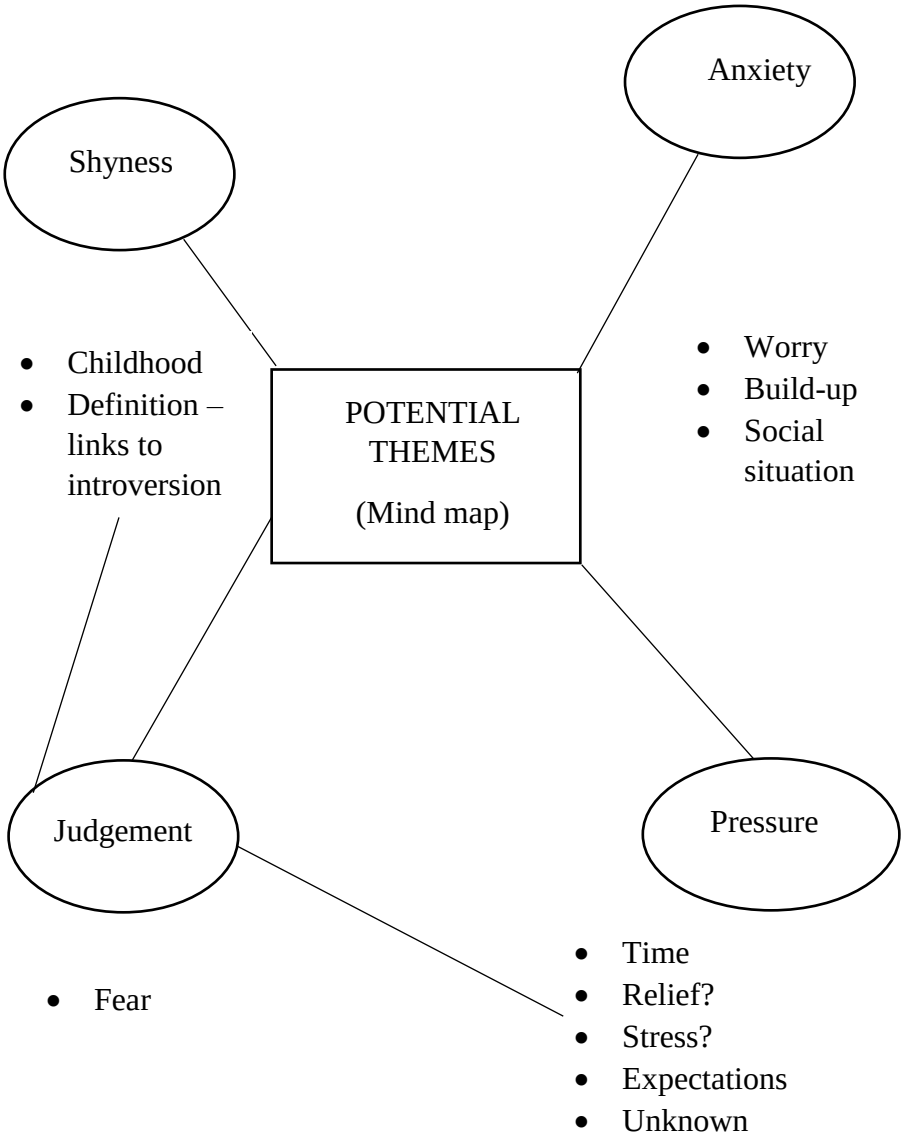
PROMPTS: please tell me more about this? Please give me an example?

After the interview:

- Participants will be thanked again for taking part in the interview and the study as a whole
- Ask if they would like to receive a summary of general findings from the study (Take an email address if so)

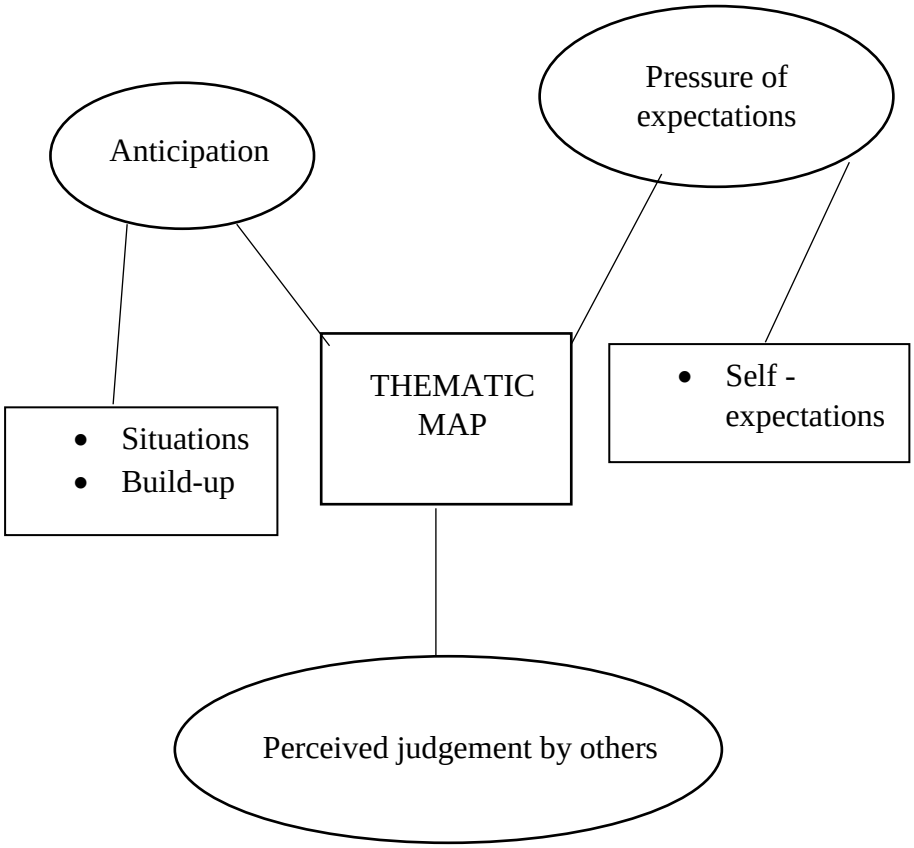
Appendix P

Mind Map



Appendix Q

Thematic Map



Appendix R

Table 1.

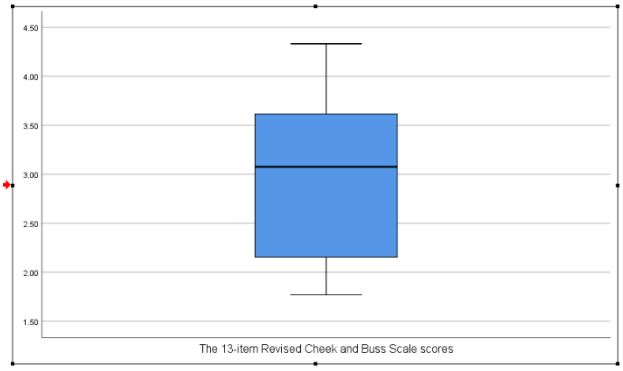
Shapiro-Wilk results for all 25 Participants on the Questionnaire Data

	Statistic	P value
Shyness	0.928	0.077
NA	0.932	0.095
SI	0.971	0.678
DS14	0.960	0.406
STAI-T	0.964	0.509
BFNE	0.885	0.009*

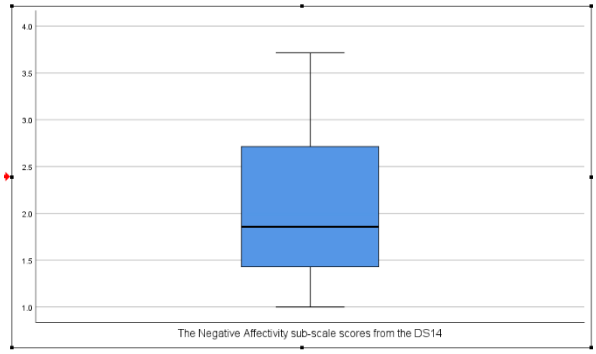
* Data not normally distributed

Figure 1: Box plots showing normal distribution of the questionnaire data for 25 participants

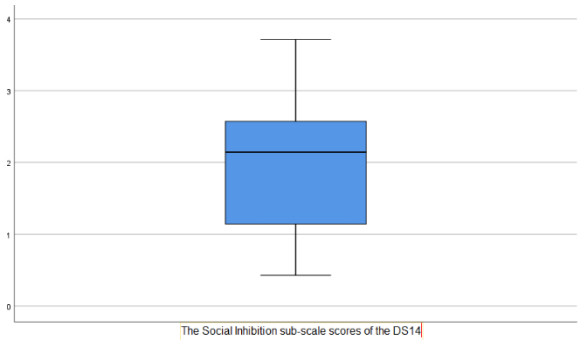
1.1 - Shyness



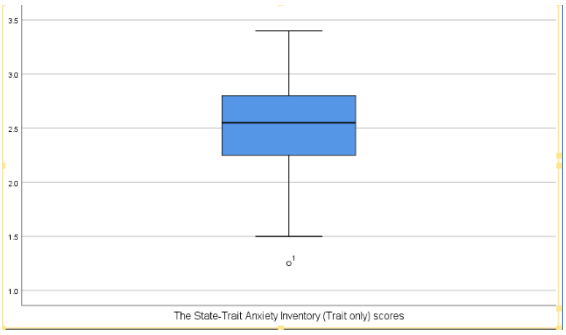
1.2 – Negative Affectivity



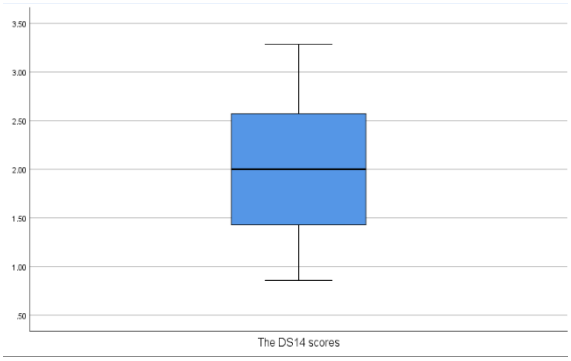
1.3 – Social Inhibition



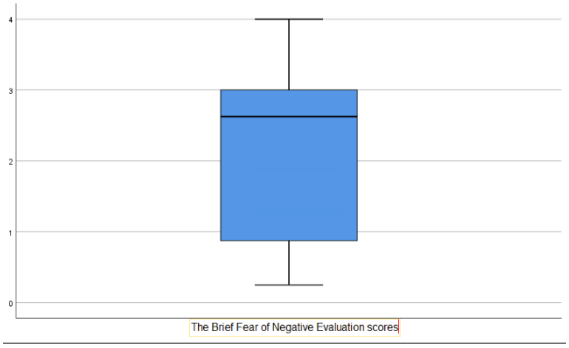
1.4 – STAI-T



1.5 - DS14



1.6 - BFNE



Appendix S

Table 1.

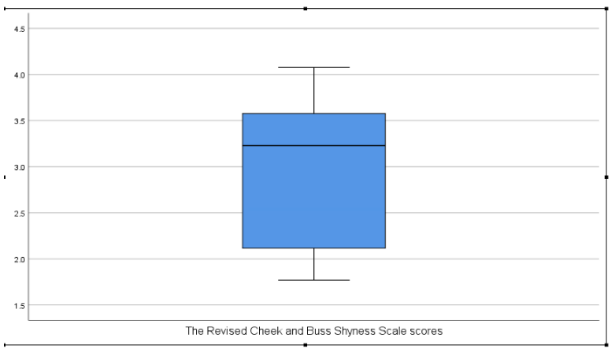
Shapiro-Wilk results for 19 Participants on the Questionnaire Data who had complete data in the study

	Statistic	P value
Shyness	0.895	0.039*
NA	0.911	0.076
SI	0.961	0.592
DS14	0.956	0.490
STAI-T	0.949	0.382
BFNE	0.895	0.039*
HR baseline	0.917	0.100
HR before	0.929	0.165
HR after	0.940	0.260
HR pre ROCF task	0.945	0.326
HR post ROCF task	0.953	0.440
ROCF /30 score	0.948	0.360
ROCF /20 score	0.928	0.157

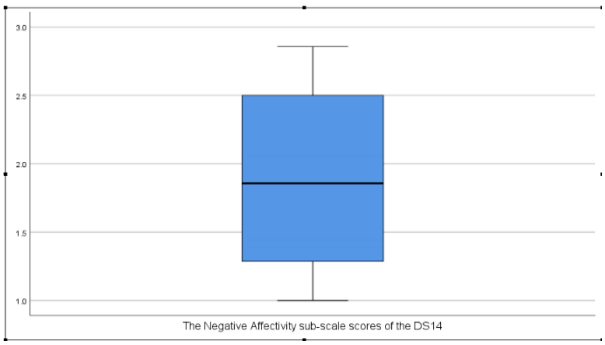
* Data not normally distributed

Figure 1: Box plots showing normal distribution of the questionnaire data for 19 participants

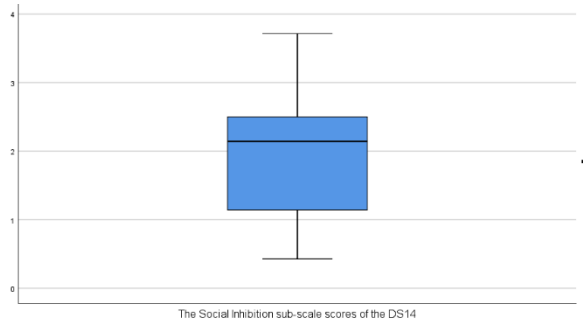
1.1 – Shyness



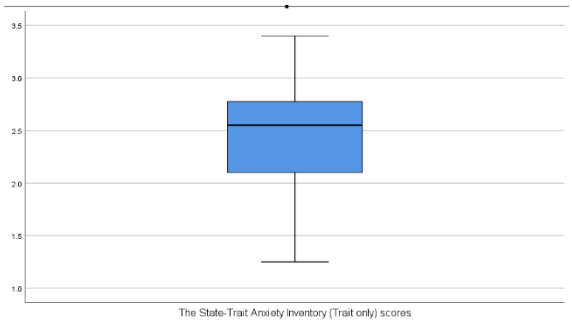
1.2 – Negative Affectivity



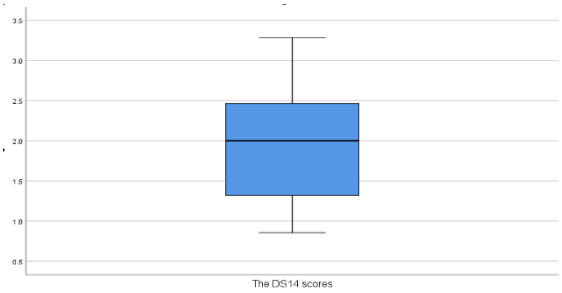
1.3 – Social Inhibition



1.4 – STAI-T



1.5 – DS14



1.6 - BFNE

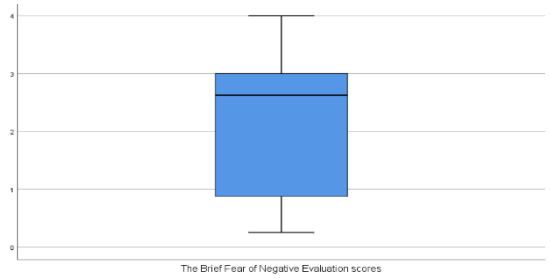
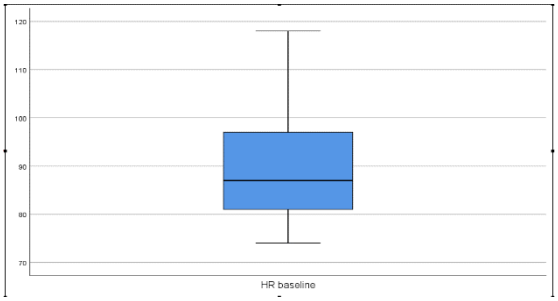
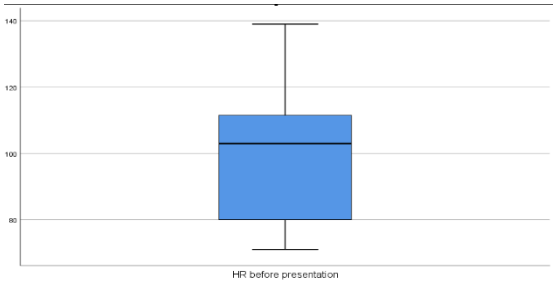


Figure 2: Box plots showing normal distribution of the heart rate data for 19 participants

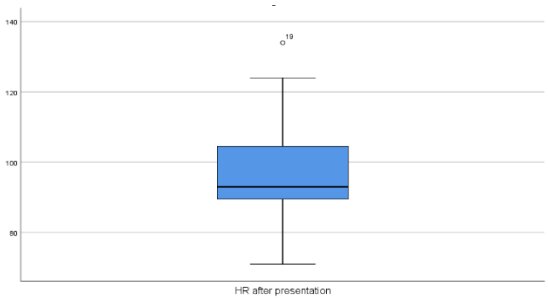
2.1 – HR baseline



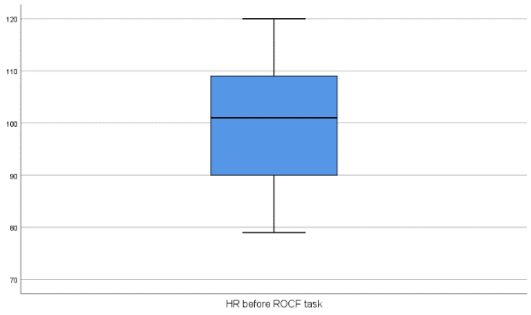
2.2 - HR before presentation



2.3 – HR after presentation



2.4 – HR before ROCF task



2.5 – HR after ROCF task

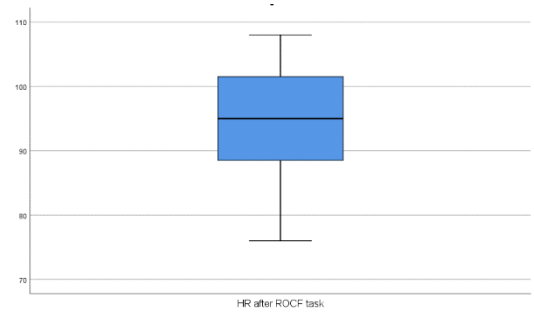
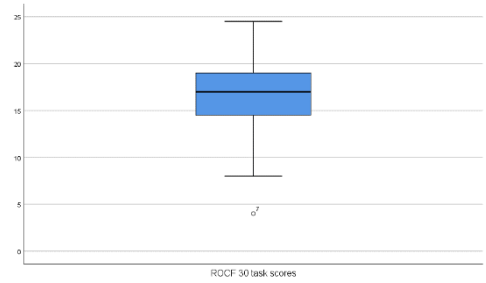
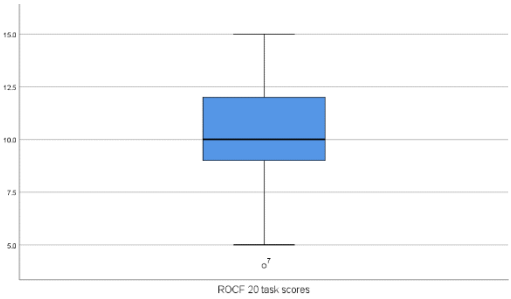


Figure 3: Box plots showing normal distribution of the ROCF data for 19 participants

3.1 – ROCF 30 task scores



3.2 – ROCF 20 task scores



Appendix T

Table 1.

Pearson Correlation Co-Efficients between the IVs and the DVs of HR and ROCF

	HR baseline	HR before presentation	HR after presentation	HR before ROCF task	HR after ROCF task
RCBS	-0.18 0.469	-0.09 0.730	0.05 0.848	-0.22 0.365	0.02 0.922
NA	0.16 0.527	0.02 0.947	0.12 0.622	0.01 0.974	-0.04 0.865
SI	-0.15 0.537	-0.03 0.918	0.17 0.495	-0.11 0.648	0.07 0.766
DS14	-0.03 0.912	-0.01 0.971	0.16 0.504	-0.07 0.779	0.03 0.909
STAI	-0.25 0.297	-0.12 0.629	0.06 0.820	0.02 0.925	-0.09 0.716
BFNE	-0.43 0.066	-0.15 0.545	0.03 0.893	-0.06 0.810	0.21 0.395
ROCF score /30	-0.14 0.579	0.06 0.803	-0.11 0.669	0.38 0.111	-0.9 0.706
ROCF score /20	0.00 0.996	0.17 0.477	-0.19 0.443	0.26 0.275	-0.09 0.718

Appendix U

Table 1.

Spearman's rho for the RCBS and BFNE scales alongside the 5 HR time points

	HR baseline	HR before presentation	HR after presentation	HR before ROCF task	HR after ROCF task
RCBS	-0.24 0.328	-0.08 0.753	0.13 0.586	-0.20 0.407	-0.01 0.954
BFNE	-0.46 0.050	-0.05 0.827	0.03 0.909	0.01 0.959	0.16 0.504