The role of anxiety, social phobia and physiological arousal in prosocial behaviour

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Abstract

Research has traditionally been successful in the classification of situational factors that are predictive of prosocial behaviour. However less conclusive agreement has been reached in identifying internal traits associated with prosocial behaviour. A growing body of research has implicated the serotonin system in individual differences in prosociality, and as such has begun to associate anxiety and social phobia with propensity to behave prosocially. The present research, a quasi-experiment, is the first study outside of the field of behavioural neuroscience to directly explore the role of anxiety, specifically social phobia, and physiological arousal in prosocial behaviour. Undergraduate students (n = 32) were provided with an opportunity to engage in a prosocial act whilst their physiological arousal was measured using a BIOPAC MP36R. Self-report measures of trait anxiety/total phobia, including social phobia, were collected, in addition to positive and negative affectivity measures. A Kruskall-Wallace test found, as hypothesised, level of physiological arousal at the point of presentation of the opportunity to act prosocially, and furthermore mean level of physiological arousal, were significantly affected by total level of phobia/trait anxiety. Further regression analysis approached significance in assessing the power of total phobia/trait anxiety in predicting variance in physiological arousal to the behavioural experiment measure of prosocial behaviour.

KEY WORDS:	PROSOCIAL BEHAVIOUR	SOCIAL PHOBIA	TRAIT ANXIETY	PHYSIOLOGICAL AROUSAL

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2. Introduction

The present study aims to builds upon the seminal research conducted by Stoltenberg, Christ and Carlo (2013) to further assess the relationship between levels of prosocial behaviour and social anxiety. For the purposes of this research prosocial behaviour will be considered in light of the definition provided by Eisenberg, Fabes and Spinrad (2006); prosocial behaviour occurs when an individual commits voluntary behaviour with the intention of benefit to another. This study takes the definition from Kashdan (2007) that social anxiety refers to "the fear and avoidance of social situations in which a person might be exposed to negative evaluation by others" (Kashdan, 2007, p. 349).

2.1 Social Psychology Background

Social psychology has been successful in classifying a multitude of situational factors which modify propensity to prosocial behaviour. The bystander effect and ambiguity have been identified as two of the strongest factors which consistently predict incidences of prosocial behaviour (Latané & Darley, 1968; Latané & Darley, 1970). However the tradition has been less successful in identifying internal traits, with little consensus on factors associated with the prosocial personality. Latané & Darley (1970) found no significant relationship between prosociality and a number of traits including social responsibility and desirability. Conversely Oliner and Oliner (1988) reported a greater sense of social responsibility as well as perceived importance of observing a code of ethics and higher loci of control in rescuers of the Jewish community in Nazi Europe. Inconsistent findings such as these have led to the predictive power of personality variables on behaviour being considered generally weak by social psychology (Ross & Nisbett, 1991; Ross, 2001). A belief disparaged by Sabini, Siepmann and Stein (2001), who suggest that research previously taken as evidence for the exclusive influence of situational variables can actually be interpreted in light of the importance of additional internal factors. Sabini et al. (2001) cite the example of Latané and Darley's (1968) classic smoke filled room experiment in which participants were found to take longer to or neglect to act in the presence of a confederate omitting any action, a finding taken as substantiation of the bystander effect. Sabini et al. (2001) hypothesise embarrassment as an alternative additional explanation for the phenomenon, with the rationale that responding to smoke in an urgent manner whilst other persons present appear unaffected, is a potentially embarrassing act.

Zoccola, Green, Karoutsos, Katona and Sabini (2011) set out to test this hypothesis in a study methodologically similar to the present study. The researchers found that amongst those who notified the experimenter of a temporary and correctable facial flaw, participants who rated higher in embarrassability were slower to act, and replicating previous findings participants were twice as likely to act in the absence of a confederate. Furthermore, part two of the study concluded that participants high in embarrassability self-reported greater levels of inhibition in informing an interaction partner of a correctable temporary flaw such as an unzipped fly, whilst no association was found between levels of prosocial behaviour and empathy. This finding corroborates the suggestion that the research tradition may have overlooked the role of internal factors such as embarrassability. In assessing levels of embarrassability, Zoccola et al. (2011) measured "personality variables related to the

inhibition of social action" (p. 926). Research indicates that social anxiety manifests along a spectrum ranging from little to no social fear, to shyness and mild social anxiety, progressing to social inhibition so intense as to impair functioning (McNeil, 2001). Embarrassability as defined by Zoccola et al. (2011) would appear to lie at the lower end of the social anxiety continuum. As such, the findings of Zoccola et al. (2011) can be taken as support for the rationale behind the present study, to further assess the relationship between levels of social anxiety and propensity to behave prosocially.

The argument for the role of internal factors is supported by the assessment of the heritability of prosocial behaviour at 51 - 72% (Knafo & Plomin, 2006). In addition, longitudinal research indicates that prosocial tendencies are stable and persistent over time (Eisenberg et al., 1999). The notion that variance in prosocial behaviour is largely determined by situational factors cannot therefore explain prosocial behaviour as a stable, persistent and heritable phenomenon.

2.2 Role of Serotonin in Prosocial Behaviour

The field of biosocial science has increasingly been utilised to transcend the difficulties encountered by social psychology in identifying internal factors predictive of prosocial behaviour. The neurotransmitter 5-hydroxytryptamine (serotonin) has been linked to prosocial behaviour (Crockett, 2009). Individual differences in serotonin function would then serve as an explanation for stable and enduring individual differences in prosociality.

Crockett, Clark, Hauser and Robbins (2010) administered a high dose of the anti-depressant drug Citalopram, a selective serotonin uptake inhibitor (SSRI), to healthy participants, in doing so enhancing levels of serotonin. The increase in serotonin resulted in participants being more likely to judge emotionally salient harmful actions as forbidden. Furthermore during an economics game participants were more likely to accept unfair offers in order to avoid financially harming other players. Crockett et al. (2010) propose that the findings suggest serotonin increases prosocial behaviour through increasing aversion towards harming others. Siegel and Crockett (2013) went on to propose a model though which serotonin modifies social behaviour by creating a shift towards a more positive social disposition and through heightening concern for the outcome of other persons. This line of research carries implications for potential treatment of aggressive and antisocial behaviours, both of which have been associated with lower levels of serotonin (Miczek et al., 2007, Crockett, 2009).

2.3 Role of the Serotonin Transporter Gene in Prosocial Behaviour

The fields of behavioural genetics and cognitive neuroscience have informed the possible association between variations in SLC6A4 and emotional regulation, social behaviour and cognition (Canli & Lesch, 2007). For the present study, the relationship between a common polymorphism in the serotonin transporter gene and propensity to act prosocially is of relevance. The single serotonin transporter gene (5-HTT) can be compared to a recycling device, transporting serotonin from the synaptic cleft to the presynaptic neuron, and in doing so regulating the aggregation of serotonin in the synapse. This alters the concentration available to receiving receptors, and as such 5-HTT plays a key role in the action of serotonin in the brain (Lesch, 2007). 5-HTT is encoded by the single gene, SLC6A4, located on

chromosome 17q12 (Lesch et al., 1996). Variations in the polymorphism, 5-HTTLPR, in the regulatory region of SLC6A4, specifically the long (L') and short (S') variants, have been associated with anxiety related psychological and behavioural phenotypes (Murphy et al., 2008). Emphasising the impact of the polymorphism, variance in 5-HTTLPR may result in between five and twenty fold differences in 5-HTT expression and serotonin uptake capacity (Murphy et al., 2008). In light of the role of serotonin in prosocial behaviour proposed by Siegel and Crockett (2013), there is a strong argument for a relationship between prosocial behaviour and a polymorphism which results in such varied levels of serotonin in the brain. The 5-HTT gene has been extensively studied to further knowledge of the interaction between genetic variations, behaviour, personality and psychopathology (Lesch, 2007).

The ambiguity of a situation reliably predicts levels of prosocial behaviour (Latané & Darley, 1968). Blair et al. (2008) experimentally reduced serotonin levels through acute tryptophan depletion and documented 5-HTTLPR genotype, going on to assess decision making in situations of subtlety of choice. Reduced serotonin impacted upon decision making, with a greater affect on individuals homozygous for the L' allele. Whilst Stoltenberg, Lehmann, Anderson, Nag and Anagnopoulos (2011) found that decision making under ambiguity, was associated with homozygosity for the L' allele of the 5-HTTLPR; individuals homozygous for the L' allele made more risky decisions under ambiguity than carriers of the S' allele. Taken together the research suggests that individuals homozygous for the L' allele make more risky decisions under ambiguity. As individuals homozygous for the L' allele are also less likely to experience social phobia (Murphy et al., 2008), the argument can be posited that individuals who express less social phobia, are more likely to take risky decisions under ambiguity, a factor known to be important in propensity to prosocial behaviour.

2.4 Role of the Serotonin Transporter Gene in Physiological Reactivity

Gyurak et al. (2013) set out to explore the relationship between individual differences in emotional reactivity and the 5-HTT. Individuals homozygous for the S' allele of 5-HTTLPR expressed higher levels of emotional reactivity. They were found to visibly exhibit more emotional behaviours to watching oneself in an embarrassing situation as compared to participants homozygous for the L' allele. Furthermore, carriers of two S' alleles as compared to individuals homozygous for the L' allele presented with higher levels of empathic response and physiological reactivity to films of others in distress. Stoltenberg, Christ and Carlo (2013) concluded in light of their own findings and previous research that "individuals carrying one or two 5-HTTLPR S' alleles experience relatively greater levels of emotional arousal than L' homozygotes and may therefore be less likely to take actions that may carry risk." (p. 404)

2.5 Role of Serotonin and the Serotonin Transporter Gene in Social Anxiety

The above research provides the framework for the claim that serotonin and genetic variations in the 5-HTT may modulate propensity towards prosocial behaviour, and as such go some way towards explaining, and predicting individual differences in levels of prosocial behaviour.

However, serotonin and 5-HTT have far broader associations with cognitions, behaviour and psychopathology than the prosocial personality. Serotonin and 5-HTT have long been implicated in a variety of mood disorders including depression (Langer, Zarifian, Briley, Raisman & Sechter, 1981), susceptibility to depression (Canli & Lesch, 2007) and anxiety (Lesch et al., 1996). Furthermore, Serotonin and 5-HTT have been associated with complex traits in both humans and mice including but not limited to anxiety, aggression, cognition, reward and emotion. In addition the association has been extended to a variety of psychopathologies including obsessive-compulsive disorder, panic disorder and of particular importance to the present study, social phobia (Murphy et al., 2008).

SSRIs are one of the most widely prescribed drugs for mood disorders (Murphy et al., 2008). The use of SSRIs in mood disorders serves only to strengthen the evidence that serotonin plays an important role in the regulation of affect. Lesch and Gutknecht (2005) identified an association between the 5-HTTLPR polymorphism and overall response and response time to SSRI treatment for depression. Lesch et al., (1996) found that variation in the 5-HTT gene accounts for "3 to 4 percent of total variation and 7 to 9 per cent of inherited variance in anxiety-related personality traits in individuals as well as sibships" (Lesch et al., 1996, p. 1527.) Furthermore Lesch et al. (1996) found a significant relationship between individuals carrying one or two copies of the S' allele with Neuroticism, as compared to individuals homozygous for the L' allele. Rhesus macaque monkeys also carry the S' and L' expressions of the 5-HTT (Lesch et al., 1997). Barr et al. (2003) found that in rhesus macaque monkeys, variance in 5-HTT was moderated by type of rearing environment. S' allele carriers raised by peers showed lower incidences of social behaviour than L' variant carriers, however this effect was not seen in mother reared S' allele carriers (Barr et al., 2003). The implication drawn from this finding being that early life stress may exacerbate the effect of variance in 5-HTTLPR on social behaviours. This finding has been shown to generalise to the human population by Caspi et al. (2003) in a prospective longitudinal study of a birth cohort. Caspi et al. (2003) found carriers of one or two copies of the S' allele of the 5-HTTLPR were more likely to experience symptoms of depression as a result of stressful life events than individuals homozygous for the L' allele.

Schinka, Busch and Robichaux–Keene (2003) in a meta-analysis of 26 studies claimed to find no significant relationship between the 5-HTTLPR expression and anxiety. However when allowing for choice of measure, a small but reliable influence of trait anxiety was found when assessed using a Neuroticism scale (Schinka et al., 2003.) Conversely, Lesch (2007) argues that modest effect sizes are characteristic of non-Mendelian traits. Despite the conflicting findings of Schinka et al. (2003), the research is largely consistent in indicating a significant relationship between carriers of the S' allele and neurotic and anxious type traits, and susceptibility to psychopathology.

2.6 Prosocial Behaviour and Social Anxiety

These two lines of research of the influence of serotonin and 5-HTT in prosocial behaviour and anxiety converge in the seminal study conducted by Stoltenberg et al. (2013). Purporting to be the first study do so, the researchers set out to address the question of whether the association between the 5-HTTLPR polymorphism and propensity to behave prosocially is a pathway mediated by psychosocial traits,

specifically social anxiety. In developing the rationale for the study, Stoltenberg et al. (2013) noted that individual differences in factors associated with prosocial behaviour including cooperative behaviour, retaliation to perceived unfairness, avoidance of punishment, judgement of emotionally salient harmful actions, decision making under ambiguity, fear conditioning and moral judgement have been associated with serotonin and the 5-HTTLPR polymorphism. Stoltenberg et al. (2013) were the first to consider this research alongside the evidence implicating variance in the serotonin system with anxiety and anxiety-related traits (Hariri & Holmes, 2006; Leonard & Hen, 2006). Going on to note the negative correlation identified between prosocial behaviour and anxiety by Eisenberg et al. (2006), the researchers hypothesised that anxiety would mediate the association between 5-HTTLPR and prosocial behaviour. Students (n=398) were assessed for trait anxiety with Mark and Mathews' (1979) Fear Questionnaire, and self-report measures of prosocial behaviour and approach and avoidance were collected. Hierarchical multiple regression analyses supported the hypotheses, finding that homozygous 5-HTTLPR triallelic long (L') allele carriers reported lower levels of social anxiety and greater propensity to prosocial behaviour, as compared to carriers of one or two copies of the short (S') allele.

2.7 The Present Study

Whilst the work of Stoltenberg et al. (2013) is interdisciplinary, assessing genotype, prosocial behaviour and psychopathology, crossing the same level of analysis is beyond the remit of the present study. However the present study is informed by the research outlined above indicating that the serotonin system is associated with individual differences in prosocial behaviour (Crockett, 2009). In addition that variations in the 5-HTTLPR genotype lead individuals with one or more copies of the S' allele to display lower levels of prosociality (Stoltenberg et al., 2013), higher levels of social anxiety (Murphy et al., 2008), make fewer risky decisions under ambiguity (Stoltenberg et al., 2011), and display higher levels of empathy and physiological response in socially embedded scenarios (Gyurak et al., 2013). It is beyond the remit and practical limitations of the current study to assess genotype. Rather the present study aims to assess the expression of the behavioural phenotypes proposed by the two lines of research, considering these to be 1) higher levels of prosociality and lower levels of trait anxiety and 2) lower levels of prosociality and higher levels of trait anxiety.

The work of Zoccola et al. (2011), finding that participants higher in embarrassability take longer to act prosocially, can be considered in terms of embarrassability as a factor related to social anxiety. However to date no other research outside of the field of behavioural neuroscience has directly explored the relationship between prosocial behaviour and social anxiety. As such, the present study is the first to directly address the association between higher levels of social anxiety, lower levels of prosociality (which may be borne out of fewer risky decisions under ambiguity), and higher levels of empathy and physiological response.

The association between the S' allele and anxious and neurotic type traits is illustrated above in section 1.5. Stoltenberg et al. (2013) suggest that carriers of one or two copies of the S' allele may have an intense emotional reaction to uncertainty in social situations. Furthermore higher levels of emotional reactivity and physiological response in S' allele carriers was identified by Gyurak et al. (2013).

Taken together, this research provides the rationale for the present study that higher levels of physiological activity will be associated with trait and social anxiety.

Stoltenberg et al. (2013) noted that their findings must be taken in context of the limited construct validity of self-report measures, suggesting that future research ought to test the association between prosocial behaviour and social anxiety with a more ecologically valid approach. This study aims to address this limitation and fill the gap in the research through experimentally assessing propensity to behave prosocially.

2.7.1 Hypotheses

H^1: Higher levels of social anxiety will modulate propensity to behave prosocially.

H^2: Higher levels of trait anxiety will modulate propensity to behave prosocially.

H^3: Higher levels of social anxiety will be associated with greater physiological response to an opportunity to engage in and engagement in a prosocial act.

H^4: Higher levels of trait anxiety will be associated with greater physiological response to an opportunity to engage in and engagement in a prosocial act.

3. Method

3.1 Design

The current study, an unrelated design-quasi experiment, was conducted to examine the association between social anxiety, total phobia, prosocial behaviour and psychophysiology. The analyses were conducted in two distinct sections, the first of which focused on the relationship between social anxiety and prosocial behaviour. Two sets of 2 x 2 chi square analyses were conducted assessing the association between the dependant variable of engagement in prosocial behaviour (engagement in or omitting to act prosocially) and the two sets of independent variables; level of anxiety, with two levels, participants categorised as high or low social anxiety, and total phobia, with two levels, high and low total phobia. These analyses were followed up with two sets of 3 x 2 chi square analyses with the dependant variable of time taken to act or omit to action (slow, medium, fast), and the independent variables of level of social anxiety and level of total phobia, both of which with two levels ascertained by the median split of participants responses to the Fear Questionnaire. Participants who omitted to act prosocially were then excluded from the analyses, and a Kruskall-Wallace test was conducted assessing the relationship between the dependant variable of time taken to act, and two independent variables with three levels; social anxiety (low, medium and high), and total phobia (low, medium and high). Four multiple regressions were then conducted, two with the outcome variable of time taken to act or omit to action, and a further two with the outcome variable of time taken to act prosocially. For each outcome variable two regression analyses were conducted with the first set of predictor variables; social phobia, total phobia, positive affect and negative affect, and a second further set of predictor variables; social phobia, blood injury phobia, agoraphobia, positive and negative affect.

In turning to the second constellation of analyses the relationships between psychophysiology, social anxiety, total phobia and prosocial behaviour were explored, again using a variety of statistical tests. A number of Kruskall-Wallace tests were conducted on the data to assess the impact of two independent variables with three levels; social anxiety (low, medium, high) and total phobia (low, medium, high), on 3 separately assessed dependant variables consisting of amplitude of ER-SCR at two time points, point of opportunity to act prosocially and subsequent prosocial act, and finally a mean amplitude of ER-SCR. A further group of multiple regressions were then conducted using the same two groups of predictor variables as described above, for the outcome variable mean amplitude of ER-SCR. Finally a simple linear regression was conducted using total phobia as the predictor variable for the outcome variable mean ER-SCR.

3. 2 Participants

A total of 32 undergraduates were recruited from the psychology department at a London University. Students self-selected for those who wished to opt in to the research participation scheme, and were then able to select from the available pool of studies and timeslots. Students received research participation scheme credit for their participation. A total of 11 males and 21 females participated, aged between 18 and 52 years, with a mean age of 23.06 years (SD = 7.44).

3. 3 Materials and Instruments

3.3.1. Social Anxiety and Trait Anxiety

Levels of anxiety were assessed using the Fear Questionnaire, (Mark & Mathews, 1979) as adapted by Stoltenberg et al. (2013). The Fear Questionnaire was selected for consistency with past research on prosocial behaviour and social anxiety including Stoltenberg et al. (2013). The adapted fear questionnaire is a fifteen item self-report scale, made up of three five item subscales. The scale requires participants to rate how much they would avoid certain situations due to fear or other unpleasant feelings using a 9-point Likert scale (from 0 to represent "would not avoid" to 8 "would always avoid"). The three five-item subscales consist of Blood injury phobia (α = .80) with items such as "Injections or Minor Surgery"; Agoraphobia (α = .54) including items such as "Travelling alone or by bus"; and social phobia (α = .64) with items such as "Speaking or acting to an audience". Research has shown the social phobia subscale to be strongly related to social anxiety (Van Zuuren, 1988). A combined total phobia score (α = .79), has been found to be a reliable and valid measure of phobic avoidance (Mark & Mathews, 1979). The combined total phobia score is also considered a measure of trait anxiety (Stoltenberg et al., 2013) as such the terms total phobia and trait anxiety are used interchangeably throughout the report.

In order to achieve an acceptable Cronbach's Alpha for the social phobia subscale, question 2 "Eating or drinking with other people" was omitted from the analyses, giving an acceptable α = .70. As the Cronbach's alpha for Agoraphobia could not be improved above acceptable levels with the omission of any questions it was included but with results to be interpreted with caution.

3.3.2. Positive and Negative Affect

The Positive and Negative Affect schedule (PANAS) consists of two ten item mood scales that have been shown to have high internal consistency, respectable convergent and discriminant correlations with far lengthier scales, with temporal stability over 2 months (Watson, Clark & Tellegen, 1988). The construct validity of the PANAS has been further supported with factor analyses (Crawford & Henry, 2004). The negative affect scale consists of items such as "distressed", "irritable", and "afraid", whilst the positive affect scale includes emotions such as "interested", "alert" and "attentive". Respondents are asked to rate each emotion or feeling on a five point Likert scale ranging from 0, "very slightly or not at all", to 5, "extremely". Watson et al. (1988), suggest mean scores of 29.7 (SD = 7.9) for positive affect, and a mean of 14.8 (SD = 5.4) for negative affect in the normal population. The PANAS can be administered with a variety of instructions, ranging from asking participants to rate how they have felt in the past year, to how they feel at the present moment (Watson et al., 1988). In line with previous research on social anxiety and positive and negative affect, the instruction of "Indicate to what extent you have felt like this over the past few days" was selected for use.

Cronbach's alpha values in the current study indicated strong internal consistency with α = .887 for the schedule as a whole, with positive affect; α = .848*,* and negative affect; α = .899.

3.3.3 Big Five Inventory

The Big Five Inventory (BFI) (Donahue & Kentle, 1991; John, Naumann & Soto, 2008; Benet-Martinez & John, 1998) is a self-report measure of the big five personality traits. Each personality dimension is measured using between 8 and 10 items. Participants are asked to indicate the extent to which they agree with each characteristic in reference to themselves on a five point Likert scale ranging from 1, "Disagree Strongly" to 5, "Agree Strongly". The data from this measure was not included in the current study. The BFI was selected for use for its length (44 items) in order to create a period of time for participants to consider engaging in the prosocial act, in a manner which would not reveal the true nature of the study. Whilst this version of the BFI is subject to copyright, it was obtained with permission for use in an undergraduate research project from the Berkeley Personality Lab (https://www.ocf.berkeley.edu/~johnlab/bfi.php).

3.3.4 BIOPAC MP36R & AcqKnowledge 4.4 Software

The BIOPAC MP36R (BIOPAC) is a four channel data acquisition and analysis system which can be used to measure a variety of physiological signals. In the present study electrodermal activity was measured in the form of Skin Conductance Responses (SCRs) which indicate phasic changes in the electoral conductivity of skin (Braithwaite, Watson, Jones & Rowe, 2013). The EDA channel sampling rate was set at 1000Hz, with the SCR threshold set at 0.01μS as and a high-pass filter of 0.05Hz as endorsed by (Braithwaite et al., 2013). Changes in the readings that do not fulfil the threshold criteria will not be counted as SCRs.

SCRs were recorded for each participant for the duration of the study with SS3LA EDA finger transducers containing two Ag-AgCl electrodes mounted in polyurethane housings for improved contact and minimisation of noise interference. Isotonic Recording Electro Gel 101 was applied to both the SSLA electrode cavity and to the index and middle distal phalanges of the participant's non-dominant hand.

Analysis of the SCRs was conducted with the BIOPAC's accompanying Acqknowledge version 4.4 software. The analysis focused on identifying the amplitude of Event-Related SCRs (ER-SCRs), specifically the amplitude of the ER-SCR at the first point at which the ink on the experimenters face was presented to the participant and therefore the first point at which the opportunity to be prosocial was presented. For those participants who did engage in the prosocial act, the amplitude of the ER-SCR at the prosocial act was measured. It is usually recommended that a latency period of 1-3 seconds between stimulus onset and SCR is selected (Braithwaite et al., 2013). However given the current methodology, which involved the experimenter manually placing a marker on the data at the point of stimulus onset, this was increased to a 0-6 second window so as to account for human error in the placing of the marker.

As recommended by Braithwaite et al. (2013) SCR amplitude measurements were corrected using square root transformations to reduce the skew and kurtosis common to EDA data, thereby increasing the power of the parametric statistical tests selected.

3.4. Procedure

The University ethics board gave full approval to all methodology and measures, including the minor deception of participants.

The participant was handed a clipboard with an attached pen, containing the Participant Information Sheet, Consent Form and the Fear Questionnaire. Participants were initially asked to read and complete the Participant Information Sheet and Consent Form. A small amount of Isotonic Recording Electro Gel 101 was applied to the index and middle distal phalanges of the participant's non-dominant hand. Conventional protocol recommends the gel is allowed to set for a period of time (Braithwaite, et al., 2013), during which participants were asked to complete the Fear Questionnaire. Upon completion of the Fear Questionnaire the clipboard was removed from the participant. Pilot testing revealed that the clipboard with attached pen was a critical part of the methodology in allowing the researcher to seamlessly remove the non-leaking pen from the participant without arousing suspicion.

The SS3LA transducer was then attached to the participant and BIOPAC readings commenced. A 2 – 4 minute baseline measure is recommended to establish the participants' responder type (hypo or hyper-responder) at resting rate free from any stimulus (Braithwaite et al., 2013). Therefore in line with best practise participants were asked to watch a 3 minute 59 seconds video clip of trees blowing in the wind accompanied by the sound of bird song. Pilot testing revealed that it was necessary to emphasize to participants that they were going to watch a short relaxation video in which nothing unpleasant would occur; as 2/3 of pilot participants reported fearing a sudden unpleasant fright whilst watching the video.

Unbeknownst to the participant, the experimenter had previously set up a capped blue biro that appeared to be leaking ink. This was achieved through applying a small amount of liquid navy blue face paint inside the cap of a navy blue biro. When the cap was removed from the pen it then appeared to be leaking "ink". This mild deception of participants was unavoidable in attaining genuine responses from participants. The methodology of the current study was chosen over and above the use of a scale to measure levels of prosocial behaviour for its superior level of ecological validity.

The pilot testing of Zoccola et al. (2011) in their methodologically similar study revealed the intricate methodology involving the presentation of a "leaking" pen to be essential, as without the prime of the "leaking" pen no participants pointed out the ink.

Standardised instructions were issued to the participant regarding the PANAS, maintaining eye contact whilst doing so. The experimenter proceeded to uncap the pen for the participant to use, ensuring as much transfer of the "ink" as possible to her hands whilst doing so. The experimenter appeared surprised at the leak, whilst showing the participant that the "ink" had transferred to her hands. A new pen was provided and the participant was asked to inform the researcher upon completion of the questionnaire.

The experimenter then returned to her desk and audibly began cleaning up the "ink". A hidden mirror allowed the experimenter to standardise the placement of a clearly

visible smudge of “ink” between the left upper lip and nose. When the participant reported completion of the PANAS, the experimenter started a timer using a smart phone. A smart phone timer was selected over the use of a standard laboratory stop watch in order to avoid arousing suspicion.

The experimenter then gave standardised instructions regarding the completion of the BFI, again ensuring eye contact whilst doing so. Pilot testing revealed it to be critical that eye contact was established with the participant whenever verbal instructions were issued, so at the point at which the participant was presented with the opportunity to notice the ink they were accustomed to making eye contact with the researcher, thereby maximising the chance of participants noticing the ink smudge. Once again the participant was asked to inform the experimenter upon completion of the questionnaire. Standardised instructions were then issued for the completion of the demographics form. Finally participants were asked if they had any questions to offer one last opportunity to engage in the prosocial act. The window of time during which participants were able to act prosocially then closed, and the BIOPAC readings were stopped. The researcher recorded the time taken to act or omit to act prosocially.

Lastly participants received both a verbal explanation of the Debriefing Sheet and time to read the sheet itself. Given the mild deception of participants the dual nature of a verbal and written debrief helped to explain that it was necessary for the integrity of the research not to inform them of the research interest in prosocial behaviour at the outset of their participation. A full apology and explanation was given, with the opportunity to ask questions. It was made clear to the participants that now that they were fully informed that they had the right to withdraw from the study at any point and for any reason without penalty, and it was re-iterated that their data would be anonymised and would not in any way be identifiable to them. It was also emphasized that there was no right or wrong way to react during the experiment and that it was the full range of reactions that the study was interested in. This point was particularly elaborated upon for those participants who did not act prosocially. As part of the Debrief sheet participants were asked for their informed consent now that they were aware of the true nature of the study. Furthermore participants were questioned about suspicion as to the true nature of the study, and if they had in fact noticed the ink. None of the participants reported failing to notice the ink or aroused suspicion.

It was the initial intention of the study to counterbalance the presentation of the measures in order to minimise order effects. However pilot testing revealed that this confounded the recording of the time taken to act prosocially due to the vastly differing numbers of items between the measures and therefore the completion time. Furthermore it was methodologically desirable to present the PANAS first as a shorter 20 item scale, so as the longer BFI (44 items) was completed second giving the participant a longer window of time in which to consider whether or not to engage in the prosocial act. For the above reasons the standardised presentation of the items was deemed so critical to the methodology that the decision was taken not to counterbalance the order of presentation of the scales.

4. Results

Results are explored in two sections, the first of which focuses on the relationship between prosocial behaviour, social anxiety and total phobia. Chi square analyses were conducted to test for associations between levels of social anxiety and total phobia and engagement in prosocial behaviour. Those who omitted to act were then excluded from the analysis, and a Kruskall-Wallace test was performed to test for whether time taken to act prosocially was significantly affected by level of social anxiety or total phobia. Finally a hierarchical multiple regression using the enter method was conducted to assess whether social phobia, total phobia and positive and negative affect significantly predict the time taken to act or omit to act prosocially, or time taken to act prosocially (excluding those who omitted action).

Secondly the relationship between psychophysiology and the self-report domains, including social anxiety and total phobia, is explored. ER-SCR data collected using a BIOPAC was analysed using Acqknowledge version 4.4, and square root transformations were applied to the data to correct the distribution. A Kruskall-Wallace test was then conducted to explore whether the amplitude of ER-SCRs to the opportunity to engage in a prosocial act, and any subsequent prosocial act was significantly associated with level or social anxiety and total phobia. Finally a hierarchical multiple regression using the enter method was performed to assess if self-reported levels of social anxiety, total phobia and positive and negative affect were associated with the mean ER-SCR to the opportunity to engage and engagement in a prosocial act.

4.1 Social Anxiety, Total Phobia and Prosocial Behaviour

Participants who pointed out the ink to the experimenter were deemed to have acted prosocially, conversely those who did not point out the ink after the completion of the final questionnaire were considered not to have acted prosocially. Of the 32 participants 59.36% (n=19) acted prosocially, whilst 40.63% (n=13) omitted to act prosocially. Mean scores in all self-report domains as categorised by participants who acted or omitted to act prosocially can be seen below in table 1.

Table 1
Mean scores (SD) in all domains categorised by level of prosocial behaviour

	Mean Scores (SD)	
	Prosocial (n = 19)	Omitted to Act (n = 13)
Social Phobia	14.16 (6.71)	12.54 (7.13)
Blood Injury Phobia	13.58 (9.18)	12.92 (9.30)
Agoraphobia	6.89 (4.19)	6.08 (5.31)
Total Phobia	35.32 (16.18)	32.69 (16.07)
Positive Affect	32.58 (5.29)	32.00 (8.49)
Negative Affect	19.68 (6.40)	20.69 (10.33)

A median split was conducted on social anxiety scores as measured by the Fear questionnaire. Participants scoring below 15.5 were assigned to the "Low social anxiety" grouping, participants scoring above 15.5 were assigned to the "High social anxiety" grouping. SPSS was used to identify cut points for 3 equal groups within the total phobia scores, with scores of 0 – 26 being assigned a label of "Low total phobia"; scores of 26.1 – 44 were assigned a label of "Medium total phobia"; finally those who scored 44.1 - 120 were assigned a label of "High total phobia".

Table 2
Percentages (N) of participants who behaved prosocially as categorised by level of Social Anxiety and as separately categorised by level of Total Phobia as measured by the Fear Questionnaire

	Prosocial	Not Prosocial
Low Social Anxiety	28.1 (9)	21.9 (7)
High Social Anxiety	31.3 (10)	18.8 (6)
Low Total Phobia	21.9 (7)	15.6 (5)
Medium Total Phobia	18.8 (6)	15.6 (5)
High Total Phobia	18.8 (6)	3 (9.4)

Table 2 indicates that contrary to the hypotheses a slightly larger percentage of high social anxiety participants than low social anxiety participants behaved prosocially. However a slightly larger percentage of low total phobia participants behaved prosocially than medium or high total phobia participants. As suggested by the data presented in Table 2 no significant association was found between high and low levels of social anxiety and engagement in prosocial behaviour χ^2 (1) = 0.130 , p = .719. A Chi Square analysis could not be conducted using the above three way grouping for total phobia scores as this violated the minimum expected cell count (5). However an analysis conducted using a median (33.50) split of total phobia score revealed a non-significant association between high and low levels of total phobia and engagement in prosocial behaviour χ^2 (1) = 1.166, p = .280).

SPSS was used to split the time taken to act or omit to action into three equal groups. A Chi Square test found no significant association between levels of social anxiety and time taken χ^2 (2) = 3.49, p = .175 nor between total phobia score and time taken χ^2 (2) = 2.51, p = .285.

A Chi Square analysis excluding participants who omitted to act could not be conducted without violating the minimum expected cell count (5). Therefore a Kruskall-Wallace test was selected allowing the time taken to act to be rank ordered giving a stronger analyses than the arbitrary categorisation necessary for the Chi Square. Level of social anxiety in those who acted prosocially was split into three equal groups representing Low, Medium and High social anxiety. Amongst those who were prosocial (n=19), time taken to be prosocial was not significantly affected by level of social anxiety H (2) = .630, p = .730 nor by level of total phobia H (2) = 4.125, p = .127.

Finally in order to further test the hypotheses that levels of social anxiety will modulate propensity to behave prosocially, a hierarchical multiple regression was conducted. A stepwise regression was the intended method however SPSS was unable to produce a model using this method and as such a hierarchical multiple regression using the enter method was substituted. Descriptive statistics for the predictor variables and bivariate correlations can be found in Table 3. As would be expected total phobia correlated strongly ($p < .01$) with each of the subscales, however interestingly between the subscales a significant correlation was observed only between agoraphobia and blood injury phobia ($p < .01$). Indicating that the subscales are to some extent assessing distinct constructs, whilst agoraphobia and blood injury phobia may to some degree be measuring a common construct. A significant negative correlation between positive affect and social phobia ($p < .05$) indicates that social phobia may be associated with the extent to which a person feels enthusiastic, engaged and alert, as measured by the PANAS (Watson et al., 1988).

Four separate analyses were conducted using the hierarchical method, in the first two of which the time taken to act or omit to action was entered as the outcome variable, in the second two analyses participants who omitted action were excluded and as such the outcome variable was time taken to act prosocially. For each outcome variable two regression analyses were employed borne out of the research rationale. The first regression consisted of the following predictor variables; block 1: social phobia, block 2: total phobia, block 3: positive affect and negative affect (PANAS). The second regression was constructed so as to isolate any variance

from the components of total phobia; block 1: social phobia, block 2: blood injury phobia, block 3: agoraphobia, block 4: positive and negative affect (PANAS).

Table 3
Descriptive statistics and correlations for Social Phobia, Bloody/Injury Phobia, Agoraphobia, Total Phobia and Positive and Negative Affect variables

Correlations						
Variable	*M (SD)*	1	2	3	4	5
1. Social Phobia	13.50 (6.82)					
2.Blood/Injury Phobia	13.31 (9.08)	.204				
3. Agoraphobia	6.56 (4.61)	.318	**.450****			
4. Total Phobia	34.25 (15.93)	**.644****	**.826****	**.719****		
5. Positive Affect	32.34 (6.65)	**-.437***	-.249	-.040	-.342	
6. Negative Affect	20.09 (8.09)	.182	.036	.086	.137	.342

The results of the first regression analysis indicated that time taken to act or omit to act prosocially was not sig nificantly predicted by level of social phobia R^2 = .045, F(1,30) = 1.418, p = .243, B = -.212. On the addition of total phobia no significant variability was found R^2 = .048, F(2,29) = .724, p = .493, B = -.065. Finally the third model indicated that neither negative affect (B = -.147) or positive affect (B=.170) added any significant variance to the model, R^2 = .072, F(4,27) = .521, p = .721. In accordance with the non-significant findings of the first regression, a second analyses found that isolating the components of total phobia, as described above, did not significantly predict time taken to act or omit to act prosocially.

Furthermore when participants who omitted to act were excluded from the analysis, time taken to act prosocially was not significantly predicted by level of social phobia, R^2 = .058, F(1,17) = 1.046, p = .321, B = -.316. The second model did not through the addition of total phobia explain any significant variance in the model, R^2 = .122, F(2,16) = 1.116, p = .352, B = -.316. Finally the third model demonstrated that neither negative affect (B = -.029) or positive affect (B = -.173) added any significant prediction of time taken to act prosocially, R^2 =.143,F(4,14) = .583, p = .680. A further regression confirmed that no significance was observed through the separation of the components of total phobia. Table 4 below presents a summary of the beta values, unstandardized beta values and standard errors.

Table 4
Summary of Multiple Regression Statistics: Beta Values, Unstandardized Beta Values and Standard Error

	B	*SE B*	*β*
Regression 1[a] – Step 1			
Constant	228.417	70.249	
Social Phobia	-5.549	4.660	-.212
Step 2			
Constant	238.471	232.714	
Social Phobia	-4.462	6.189	-.171
Total Phobia	-.722	2.648	-.065
Step 3			
Constant	327.349	232.714	
Social Phobia	-6.590	6.935	-.252
Total Phobia	-.958	2.729	-.086
Negative Affect	3.737	4.737	.170
Positive Affect	-3.931	6.320	-.147
Regression 2[b] – Step 1			
Constant	10.471	6.403	
Social Phobia	.420	.411	.241
Step 2			
Constant	13.900	7.112	
Social Phobia	.748	.508	.429
Total Phobia	-.229	.211	-.316
Step 3			
Constant	20.008	25.577	
Social Phobia	.918	.640	.526
Total Phobia	-.235	.232	-.325
Positive Affect	-.063	.623	-.029
Negative Affect	-.317	.566	-.173

a = Dependant Variable: Time taken to act or omit to act prosocially. Note: R2 = .045$^{n.s.}$. For Step 2 ΔR^2 = .002$^{n.s.}$ For Step 3 = .024$^{n.s.}$

b = Dependant Variable: Time taken to act prosocially (prosocial participants only). Note: R2 = .058. For Step 2 ΔR^2 = .064$^{n.s.}$ For Step 3 = .020$^{n.s.}$

4.2 Social Anxiety, Total Phobia and Psychophysiology

Analysis of ER-SCRs were conducted with BIOPAC's accompanying software Acqknowledge version 4.4, further details of which can be found in section 3.3.4. No ER-SCR data was obtained from participants' number 17 (omitted action) and 26 (prosocial). Braithwaite et al. (2013) estimate 10% of participants to be non-responders, referring to participants deemed hypo-responsive and from whom high quality EDA measurements cannot be reliably obtained. This phenomenon may therefore be responsible for the lack of ER-SCRs obtained from participants' number 17 and 26. Alternatively the magnitude of the participants EDA response may not have been sufficient to meet the threshold criteria, indicating the participant did not experience a substantial emotional response. Furthermore ER-SCRs at the prosocial act were recorded for only 15 of the 19 participants who behaved prosocially, indicating that 4 of the prosocial participants may not have experienced an emotional response to acting prosocially of the magnitude necessary to meet the threshold criteria of an ER-SCR. Mean ER-SCR responses can be seen in table 5 below, with further details on the number of participants for whom ER-SCRs were ascertained at the two time points for each participant group. As endorsed by Tabachnick & Fidell (2007) and Howell (2007) all means and standard deviations are reported in their original (untransformed) units when being considered in an inherently meaningful manner. Furthermore all ER-SCRs are reported to 3 decimal places, as opposed to the conventional 2 decimal places, to allow for greater distinction between the often minute differences in ER-SCR amplitude values.

Table 5
Mean Skin Conductance Responses (SD) as categorised by level of Prosocial behaviour

	Mean SCRs (SD)	
	Prosocial (n = 18)	*Omitted to Act* (n = 12)
Amplitude of SCR at End of Q1	0.580 (0.639)[a]	0.480 (0.341)[d]
Amplitude of SCR at Prosocial Act	0.468 (0.545)[b]	N / A
Mean Amplitude of SCR	0.495(0.521)[c]	0.480 (0.341)[d]

[a] (n = 14); [b] (n=15); [c] (n=18); [d](n=12).

A Kruskall-Wallace test was computed to test the hypotheses that level of physiological arousal to an opportunity to engage and engagement in a prosocial act, would be significantly associated with levels of social anxiety and/or total phobia. Additionally analyses using mean ER-SCRs across both time points were conducted.

A visual inspection of histograms for the ER-SCR amplitude data (mean, opportunity to act, prosocial act) revealed the distribution of the data to be positively skewed. Further analysis revealed a leptokurtic distribution in the opportunity to act and prosocial act data, indicative of a higher and sharper central peak than would be expected in a normal distribution. Whereas the kurtosis value for the mean ER-SCR amplitude revealed a platykurtic distribution, suggestive of a lower and broader

central peak than would be expected in a normal distribution. As such square root transformations were applied to achieve more normal distributions. Square root transformations were selected for their recommendation for use with EDA data (Braithwaite et al., 2013) furthermore their recommendation for samples which are both positively skewed and suffering from missing datum's (Tabachnick & Fidell, 2007)

The Kruskall- Wallace test found that amplitude of ER-SCR at the point of opportunity to act prosocially was not significantly affected by level of social anxiety (low, medium and high) H (2) = .907, p = .635, additionally no significant affect was observed for mean amplitude of ER-SCR, H (2) = .012, p = .994. Amplitude of ER-SCR at the point of engaging in the prosocial act (excluding those who omitted to act) was also not significantly affected by social anxiety, H (2) = .073, p = 9.64.

However as hypothesized the level of physiological arousal (amplitude of ER-SCR) at the point of presentation of the ink was significantly affected by total level of phobia/trait anxiety (low, medium and high), H (2) = 7.075, p = .029. Though amplitude of ER-SCR at engagement in the prosocial act (n=19) yielded non-significant results H (2) = 2.327, p > .05 (p = .312). Furthermore significant results were obtained from the Kruskall-Wallace test showing that the mean amplitude of ER-SCR was significantly affected by total level of phobia/trait anxiety (low, medium and high) as measured by the Fear Questionnaire H (2) = 7.89, p = .019.

Table 6
Mean Skin Conductance Responses (SD) as categorised by total level of phobia, as measured by the Fear Questionnaire

	Mean ER-SCRs (SD)		
	Low Total Phobia	*Medium Total Phobia*	*High Total Phobia*
Amplitude of SCR at End of Q1	0.443 (0.254)[a]	0.820 (0.693)[c]	0.156 (0.123)[d]
Amplitude of SCR at Prosocial Act	0.409 (0.433)[b]	0.769 (0.755)[b]	0.228 (0.300)[d]
Mean Amplitude of SCR	0.438 (0.293)[a]	0.742 (0.573)[a]	0.211 (0.238)[e]

[a] (n = 11); [b] (n = 5); [c] (n = 10); [d] (n = 5), [e] (n = 8).

A visual inspection of the mean SCRs as depicted in table 6 indicates that participants characterised as having a medium level of total phobia appear to have the greatest SCR amplitudes across all three domains. Although it is worth noting that that the standard deviations are the greatest across all the phobia categories, indicating the greatest variance in SCR amplitudes amongst the medium total phobia group. The mean ER-SCR amplitudes insinuate a trend in ER-SCR amplitude from high total phobia with the lowest values, increasing again in the low total phobia group, and finally the largest mean ER-SCR amplitudes are depicted in the medium total phobia grouping.

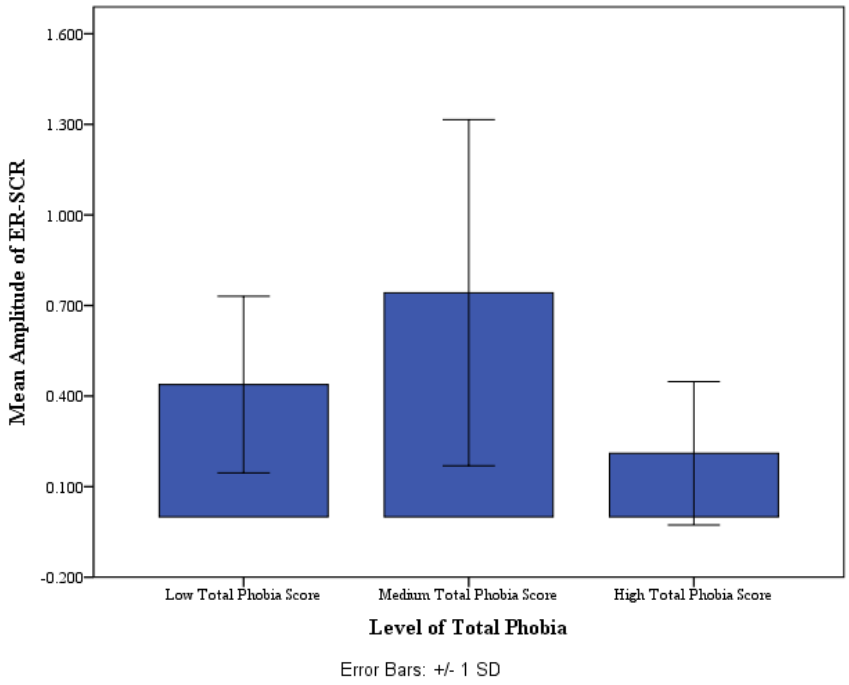

Figure 1: Mean scores for Mean Amplitude of ER-SCR measured by the BIOPAC for groups defined by level of total phobia as measured by the Fear Questionnaire

The results indicate that the high total phobia grouping had the smallest mean ER-SCR amplitude to being placed in an opportunity in which they could act prosocially and engagement in a prosocial act, whereas the medium total phobia group appear to have the greatest mean amplitude of ER-SCR. Given that the categorisation of levels of phobia was conducted using SPSS to arbitrarily split the data in to three groups, the inference can be made that having a higher level of total phobia results in a greater mean amplitude of ER-SCR, though this is a trend that does not continue in those with the very highest levels of total phobia.

A hierarchical multiple regression was conducted to test if levels of social anxiety, total phobia and positive and negative affect were associated with the amplitude of skin conductance response as measured by the BIOPAC. The mean ER-SCR was selected as the outcome variable for this analyses so as to include the greatest number of participants' data as possible given the relatively small sample size. Descriptive statistics for the predictor variables can be found above in Table 3, along with bivariate correlations. The regression models were constructed in the same way as above, with two regression analyses being conducted. The first regression was made up of the following predictor variables; block 1: social phobia, block 2: total phobia, block 3: positive affect and negative affect (PANAS). The second regression was generated so as to isolate any variance from the components of total phobia; block 1: social phobia, block 2: blood injury phobia, block 3: agoraphobia, block 4: positive and negative affect (PANAS).

Level of social phobia did not significantly predict mean ER-SCR (F(1,28) = .273, p = .605, B = -.098, R^2 = .098). However model 2, with the addition of total phobia approached significance in predicting 16.1% of the variance (F(2,27) = 2.595, p = .093, B = -.610, R^2 = .161). Finally model 3 found that neither negative affect (B = -.103) nor positive affect (B = .080) significantly predicted any further variance in mean ER-SCR (F(4,25) = 1.273, p = .307, R^2 =.169). Separating out the components of total phobia in a second regression analyses as described above did not significantly predict mean ER-SCR. However a simple linear regression was conducted to assess if total phobia significantly predicts mean ER-SCR. The results indicated that level of social phobia approached significance in predicting 10.5% of the variance in mean ER-SCR, F (1,28) = 3.285, p = .081, R^2 = .105. Table 7 below gives a summary of the beta values, unstandardized beta values and standard errors.

Table 7
Summary of Multiple Regression and Simple Linear Regression Statistics: Beta Values, Unstandardized Beta Values and Standard Error

	B	*SE B*	*β*
Regression 1[a] – Step 1			
Constant	.691	.132	
Social Phobia	-.005	.009	-.098
Step 2			
Constant	.796	.133	
Social Phobia	.017	.013	.372
Total Phobia	-.012	.005	-.610
Step 3			
Constant	.928	.398	
Social Phobia	.015	.015	.312
Total Phobia	-.012	.006	-.614
Positive Affect	-.005	.011	-.103
Negative Affect	.003	.008	.080
Regression 2[b] –			
Constant	.842	.130	
Social Phobia	-.006	.003	-.324

[a] = Dependant Variable: Mean ER-SCR. Note: R2 = .010[n.s.]. For Step 2 ΔR^2 = .152 (p = .036). For Step 3 ΔR^2 = .008[n.s.]

[b] = Simple Linear Regression. Dependant Variable: Mean ER-SCR. Note: R^2 = .105 (p = .081)

5. Discussion

The present study was the first outside of the field of behavioural neuroscience to assess the association between prosocial behaviour, anxiety/total phobia, specifically social phobia, and physiological arousal. The findings were not supportive of H^1 and H^2 as level of trait anxiety and level of social phobia did not significantly modulate propensity to behave prosocially, nor were they predictive of the time taken to act or omit action. The same pattern of results emerged when participants who omitted to act were excluded from the analyses. Furthermore, contradictory to H^3, level of physiological arousal was not significantly affected by social anxiety.

However, the results partially supported H^4, as level of physiological arousal at the point of presentation of the opportunity to behave prosocially, was significantly affected by total level of phobia/trait anxiety. A significant affect of total phobia on physiological arousal at the moment of engagement in the prosocial act was not observed. Nonetheless, in combining the data from the two time points to include the largest number of participants possible, a significant affect of total phobia/trait anxiety on level of physiological arousal emerged. This significant affect indicated that participants who self-reported a medium level of total phobia experienced the greatest levels of physiological arousal. Though, in contrast to H^4, the high total phobia/trait anxiety grouping had the smallest levels of physiological arousal. Yet given that the level of anxiety was split arbitrarily according to the self-report measure, the results insinuate that higher levels of total phobia result in greater levels of physiological arousal, though this is a trend that does not continue to those with the very highest levels of trait anxiety. It could be hypothesised that this finding may be explained in terms of those with the highest trait anxiety may immediately decide against intervening, effectively opting out of engaging with the dilemma of whether to act, and as such not experiencing skin conductance response above the threshold necessary to be considered a physiological response by the BIOPAC. However given that level of anxiety failed to significantly modulate propensity to prosocial behaviour, this hypothesised explanation should be interpreted with caution. In addition the analyses of the current study were framed in such a way that it was the participants' who responded and the amplitude of ER-SCRs that was assessed. Future research should aim to also explore any association between level of anxiety and the absence of experiencing a physiological response great enough to be considered an ER-SCR. Given that the current study identified a significant affect of trait anxiety on physiological response, anxiety may also be modulating the propensity not to respond physiologically at all.

Finally, regression analyses found that social phobia and positive and negative affectivity, did not predict mean level of physiological arousal across both time points. However, total phobia/trait anxiety approached significance in predicting mean physiological arousal. The sample size of the current study was too small to provide adequate power, which may explain the results approaching but not reaching significance at the .05 level. Given that total phobia approached significance in its predictive power despite such a small sample, it can be insinuated that this finding may be shown to reach significance in a more adequately sized sample.

5.1 Wider Context

The rejection of H^1 and H^2 contradicts the line of research implicating the role of anxiety in prosocial behaviour, including the findings of Stoltenberg et al. (2013). The findings of the present study directly oppose those of the seminal study in the area, Stoltenberg et al. (2013). Aside from the genetic component of their study, Stoltenberg et al (2013) found that lower mean phobia scores as measured by the Fear Questionnaire were associated with higher self-reported levels of prosocial behaviour. However, Stoltenberg et al. (2013) highlighted that their findings must be considered in light of the limitations of relying on a self-report measure of prosociality, going on to recommend that future work employed experimental behavioural measures. The present study differs from Stoltenberg et al. (2013) in endeavouring to meet this recommendation, in doing so filling a gap in the research. Stoltenberg et al. (2013) used a 14 item questionnaire measure, with questions such as "I have done volunteer work for charity" (Rushton, Chrisjohn, & Fekken, 1981). Whilst the small sample size of the present study is one candidate for explaining the difference in findings from Stoltenberg et al. (2013), the method of assessing prosociality may well also serve as explanation. The self-report method is open to critique of construct validity, and given the socially desirable nature of prosocial behaviour, may be subject to demand characteristics. Participants may wish to be perceived in a positive manner and as a consequence report fictitiously high levels of prosocial behaviour, confounding the results. However, a key strength of the current study was the use of a behavioural experiment measure instead of a self-report measure, and in addition participants' lack of knowledge of the studies interest in prosocial behaviour. Therefore prosociality as assessed by the behavioural experiment can be considered a more reliable and valid measure of genuine behaviour. In order to fully ascertain whether the divergent findings of the present study as compared to Stoltenberg et al. (2013) differed due to sample size or type of measure, future research should aim to repeat the current methodology with a more appropriately sized sample.

The present study was an adapted iteration of the methodology employed by Zoccola et al. (2011), a study assessing the predictive power of embarrassability on prosocial behaviour. Embarrassability can be considered in terms of a factor at the lower end of the social anxiety spectrum (see section 2.1). Zoccola et al. (2011) found that amongst those who acted prosocially, embarrassability was associated with time taken to act. However, in accordance with the findings of the present study, Zoccola et al. (2011) did not find that embarrassability successfully predicted propensity to act prosocially. These two findings together suggest that the influence of factors on the anxiety spectrum on prosocial behaviour are complex. Both studies found some affect of an internal trait related to anxiety on prosocial behaviour or physiological response to a prosocial situation. However the findings of neither study confirmed the effect of an internal trait related to anxiety modulating propensity to behave prosocially.

Culotta and Goldstein (2008) assessed proactive prosocial behaviour, which is distinct from altruistic prosocial behaviour in being motivated by a, usually self-serving, desired outcome. The study found social anxiety predicted higher levels of self-reported proactive prosocial behaviour in adolescents. Culotta and Goldstein

(2008) suggested that as socially anxious adolescents experience distress in social situations, they may engage in proactive prosocial behaviour motivated by the desire for others to see them in a positive light, thus gaining peer acceptance. This finding directly conflicts with the finding of Stoltenberg et al. (2013) that participants who self-reported higher levels of social phobia, reported lower levels of prosocial behaviour. The conflicting findings can be viewed in a number of ways. Firstly, it may be that social anxiety modulates different types of prosocial behaviour differently, given the focus on proactive prosocial behaviour in Culotta and Goldstein (2008). Alternatively social anxiety may predict levels of prosociality differently in adolescents as compared to an adult population. Finally, it may be that as discussed above the influence of biopsychosocial variables upon prosocial behaviour are so complex that internal traits cannot consistently and reliably predict levels of prosocial behaviour across different measures, samples and experimental methodologies. However, this final explanation would not explain the fact that situational variables such as the bystander effect and level of ambiguity have been shown to reliably and consistently predict levels of prosocial behaviour (Latané & Darley, 1968; Latané & Darley, 1970).

5.2 Limitations and Recommendations for Future Research

The results and conclusions drawn from this study must be considered in the context of a number of limitations, providing future research directions to be addressed. Firstly, as discussed above, the sample size in the current study was small, and this was reduced further given that not all participants' data yielded ER-SCRs. The repetition of the current methodology with a larger sample size would strengthen the preliminary findings of the current research, and allow for greater confidence in any significant association observed between prosociality, trait anxiety, social phobia and physiological arousal.

Secondly, Stoltenberg et al. (2013) considered total phobia as measured by the Fear Questionnaire a measure of trait anxiety, however it is not a traditional measure of trait anxiety. Given that the significant associations observed in the present study were largely related to the measure of total phobia, future research should endeavour to further assess these associations with instruments shown to be reliable measures of trait anxiety such as the State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983).

Furthermore, potential ceiling effects emerged in the present study, in that all participants who engaged in the prosocial act did so during or immediately after the completion of questionnaire 1. It was the initial intention of the study to assess time taken to act not only by the continuous measure of time, but according to an assigned score. For instance a participant intervening before or after questionnaire one would be assigned a score of 1, whereas participants who pointed out the ink before or after questionnaire 2 would be assigned a score of 2. This methodology would have eliminated the potentially confounding influence of individual differences in time taken to complete the questionnaires, as these individual differences impacted on the amount of time which passed until the next opportunity the participant had to engage with the experimenter. Therefore increasing the time taken until the next opportunity for the participant to act prosocially. The small sample size may also have exacerbated the presence of ceiling effects in the current study. A future research direction may lay in additionally manipulating the ambiguity

of the situation, a factor known to be associated with levels of prosocial behaviour (Latané & Darley, 1970). In the present study the situation was fairly unambiguous, it was clear that the researcher would benefit from the participant informing the experimenter of the ink smudge. A more ambiguous behavioural experiment may results in more variance in responses, reducing floor and ceiling effects.

In addition, the current study utilised only one measure of physiological arousal, electrodermal activity (EDA) in the form of skin conductance responses. EDA was selected for use as it has been considered "arguably the most useful index of changes in sympathetic arousal that are tractable to emotional and cognitive states as it is the only autonomic psychophysiological variable that is not contaminated by parasympathetic activity" (Braithwaite et al., 2013, p. 3). Future research would however benefit from multiple measures of physiological arousal, such as heart and breathing rate. Finally the sole researcher in the experimenter was female, and as such gender norms may have confounded the results (Eagley & Crowley 1986).

Although the results of the current study must be interpreted with caution, they go some way to supporting a role of anxiety in prosocial behaviour. In accordance with the recommendations of Ratner and Way (2014), a future line of research lies in further assessing whether anxiety interfaces with other possible internal traits that may influence propensity to prosociality, such as empathy, compassionate goals and specific moral values (Ratner & Way, 2013).

5.3 Conclusion

Advances in behavioural neuroscience have allowed associations to be drawn between the serotonin system and prosocial behaviour, thus implicating anxiety as an internal trait that may modify propensity to behave prosocially. Despite this furthered knowledge of the biological processes underpinning individual differences in propensity to behave prosocially, the behavioural manifestations of such processes remain inconclusive. The evidence implicating social responsibility as an internal trait related to prosocial behaviour has been conflicting (Latané & Darley, 1970; Oliner and Oliner, 1988). Continuing this trend the evidence implicating the role of anxiety, social phobia and physiological arousal on prosocial behaviour remains inconclusive. In sum, the interplay between situational, biological and psychological variables on prosocial behaviour are complex, and the exact pathways between the factors and the manifestation of prosocial behaviour remain elusive.

6. References

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