Anxiety and Perception of Pain:

The Role of Personality and Distractor Type

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Abstract

The present research concerns personality type (extraversion and neuroticism), distraction type (relaxation and attentionally demanding), anxiety and pain tolerance. Previous studies have examined these variables individually; however no previous research has examined the interaction between personality and distraction type, and their effects on pain and anxiety. The study used an independent groups design. Participants were exposed to a cold pressor, with their personality, anxiety levels (before and after) and pain ratings measured, as well as the time they spent in the cold pressor (pain tolerance). The distractions used were a maths quiz (which was designed to be attentionally demanding) and a piece of relaxing music. A control group was also used as a baseline, in which participants did nothing while their hand was in the cold pressor. Results showed no significant moderating effect of between personality upon the effect of distraction type, however there were several relationships between anxiety and other variables (namely time and pain rating); these were evident throughout all conditions. Anxiety also significantly increased from before the task to after the task, and there was a significant relationship between pain tolerance and pain rating, specifically in the music task. The maths task prevented anxiety from increasing to a greater degree than that seen in both the control and music conditions. There were some significant relationships between personality and other variables identified in the findings; pain tolerance and extraversion and anxiety (before) and neuroticism. To conclude, it would appear that anxiety has more of an effect upon the experience of pain than personality; however the current study has some limitations, such as the small sample size, which could have affected the results. Limitations and possibilities for further research are discussed.

Copyright Statement

Contents Page

Figure List

Tables List

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Introduction

"Until the 1960s pain was considered an inevitable response to tissue damage. There was little room for the affective dimension of this ubiquitous experience, and none whatsoever for the effects of genetic differences, past experience, anxiety, or expectation" (Loeser & Melzack, 1999, p.1607). This experiment will investigate the relationships between personality, anxiety and pain.

Clinical procedures, such as burn wound dressings, stitches and blood tests, can be very painful. Previous research has also shown that psychological distress caused by these procedures can impair the healing process after an invasive procedure (Broadbent, Petrie, Alley & Booth, 2003) and also increase postoperative pain (Kain, Sevarino, Alexander, Pincus & Mayes, 2000; Vaughn, Wichowski & Bosworth, 2007). Therefore, it is vitally important that an effective non-pharmacological method of reducing pain is discovered. Arntz, Dreessen and Merckelback (1991) stated that attention distracted away from the pain reduces participants' pain ratings; therefore it makes sense that something that would accomplish this, and do it as effectively as possible, would be a valuable technique to help patients cope with these painful clinical procedures.

Pain is subjective; everyone experiences it differently, and it varies between people for many different reasons, including past experiences and expectations (Loeser & Melzack, 1999; Koyama, McHaffie, Laurienti & Coghill, 2005). For example; research has found that, on average, peoples' pain tolerance decreases with age and men tolerate more pain than women (Woodrow, Friedman, Siegelaub & Collen, 1972). Previous research has also suggested that apprehension of pain increases the intensity of the pain experience (Beecher, 1959; Koyama et al, 2005). This has been confirmed by using not only self-report measures but also physiological measures; Koyama et al (2005) manipulated pain expectation and found that a reduced expectation of pain significantly decreased the participants' subjective experience of pain as well as activation of pain related brain areas.

The following literature review will discuss previous research relating to the effects of anxiety on pain, and how anxiety can be effectively reduced in order to lessen the amount of pain experienced. The different methods of reducing anxiety using relaxation techniques will be examined; along with whether using relaxation as a distraction from pain is more or less effective than attentionally demanding distractors. Personality and its relationship with pain will then be discussed. Throughout the literature review, the different psychometric measures available will also be assessed.

Literature Review

Anxiety and Pain

Many studies have investigated the link between anxiety and pain; some research suggests that no relationship exists (Arntz et al, 1991; Arntz & De Jong, 1993; Arntz, Dreesson & De Jong, 1994); however there is much research that suggests otherwise (Al Absi & Rokke, 1991; Rhudy & Meagher, 2000; Vaughn et al, 2007).

Al Absi and Rokke (1991) investigated whether anxiety related to the pain would decrease participants' pain tolerance levels, whereas anxiety unrelated to the pain would actually increase their tolerance levels. One hundred female participants were given high or low anxiety triggering information about one of two conditions; either a cold pressor or an electric shock. Information relating to the shock triggered unrelated anxiety and information relating to the cold pressor triggered related anxiety, as all participants were administered the cold pressor. The results of their experiment revealed that those participants who were highly anxious about the related pain (the cold pressor) did in fact demonstrate a lower pain threshold and tolerance level than those who were highly anxious about the unrelated pain (the shock). This demonstrates that anxiety may have an effect on the pain experience, however, this study failed to measure this effect against a baseline or control which would have indicated whether the anxiety of any pain (related or unrelated) increased or decreased the participants' pain tolerance levels.

Contradictions in the literature surrounding the negative effect of anxiety on pain were found by Rhudy and Meagher (2000). They found that many studies discovered that anxiety did reduce pain tolerance; however some also found the opposite. They suggested that this discrepancy was likely to have been caused by the methods chosen by the researchers to induce anxiety in their participants, potentially unintentionally inducing fear. Rhudy and Meagher stated that there is a clear distinction between fear and anxiety, and, while one reduces pain tolerance (anxiety) the other actually increases it (fear). They hypothesised that fear is an alarm response to an immediate threat, which invokes the fight or flight response and pumps adrenaline through the body, a well proven natural analgesic (Yamashima, 2005). This would therefore increase pain tolerance, whereas anxiety is characterised by the anticipation of a future threat. In order to test this they induced fear or anxiety into their participants and measured the participants' pain thresholds before and after, as well as skin conductance level and heart rate. Fear was induced into the participants by three brief shocks, while anxiety was induced by the threat of the shock. They discovered that the differing effects of fear and anxiety that are demonstrated in animal studies do in fact generalise to human participants; the participants who were in the fear condition experienced an increase in their pain threshold, while those in the anxiety condition experienced a decrease in pain threshold. These results indicate a strong relationship between anxiety and pain, as well as a clear differentiation between anxiety and fear; they clearly suggest that anxiety does significantly increase pain.

In a review that focuses on the relationship between preoperative anxiety and postoperative pain conducted by Vaughn et al (2007), the authors concluded that there was a strong relationship between the two variables. The studies that Vaughn et al (2007) reviewed did however highlight some inconsistencies in the literature. Some improvements were suggested by the authors; amongst the studies reviewed, only two measured preoperative pain to establish a baseline, something that the authors felt would enhance the correlation between anxiety and pain. Literature in this area was difficult to compare because of variations between types of patient populations, surgical procedures and postoperative measures used.

The research reviewed by Vaughn et al (2007), highlights the fact that clinical and laboratory populations may differ considerably when investigating pain and anxiety. For example, those studies that take place in a laboratory, or experimental setting, have to induce pain into participants which can be quite difficult. When these studies are also measuring anxiety, it is possible that participants will experience less anxiety because they know it is unlikely they will experience any real or long-lasting pain, whereas clinical pain can be more real and threatening. As mentioned before with the research conducted by Al Absi and Rokke (1991) and Rhudy and Meagher (2000) it is possible to attempt to induce anxiety into the participants, however this is also rife with problems; Rhudy and Meagher (2000) unintentionally induced fear.

When measuring anxiety for the purpose of research, it is important to use a measure that is valid and reliable. In order to measure state anxiety in the present study the State-Trait Anxiety Inventory – Short Form (STAI-SF; Marteau & Bekker, 1992) will be used. This scale measures trait anxiety (how the participant usually feels) as well as state anxiety (how the participant feels at the moment). For the purposes of this study, only participants' state anxiety will be measured, this does make the STAI-SF more suitable for the current research than other scales, such as the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983), as the participants' anxiety levels need to be measured before as well as after the experiment has taken place, thus measuring two different levels of anxiety. The HADS, on the other hand, while being a valid and reliable measure of anxiety and depression (Bjelland, Dahl, Haug & Neckelmann, 2002), is more suited to a hospital environment. The HADS also measures depression, which is a variable unrelated to the current research.

If anxiety does in fact increase the amount of pain experienced, as is suggested by the research above, then attempting to reduce it is something very important to consider. If a patient is about to undergo a potentially painful procedure then it is likely they will experience some anxiety caused by this, possibly worsening the pain they are about to experience. If medical professionals are attempting to reduce the pain felt by the patient by distraction then it may be beneficial to consider a distraction that also reduces the patient's anxiety. The aim of using a relaxation technique to distract participants (or patients) from pain stems from McCaul and Malott's (1984) first principle of distraction, which states that a distractor will reduce distress when compared to control conditions; in order to distract a participant from their pain, their anxiety must be reduced, which can be done by relaxing the participant.

Many studies have investigated the relationship between relaxation and anxiety, the majority of which have lead to the conclusion that a form of relaxation does decrease anxiety (Field et al, 1996; Salmore & Nelson, 2000; Ikonomidou, Rehnström & Naesh, 2004). Field et al (1996) tested the effects of massage relaxation over simply just relaxing in a chair. They found that, although both groups demonstrated effects of relaxation, the treatment group's anxiety levels were significantly lower than those who had simply been told to relax. Similarly, Salmore and Nelson (2000) discovered that relaxation music significantly lowered blood pressure in their participants, when compared to a control group. However, some research indicates that the theory of being able to reduce anxiety by relaxation is not as clear as suggested, and that the use of relaxation techniques can in fact just annoy the patient, which could have the opposite effect and increase anxiety, or even have no effect on anxiety levels whatsoever (Aitken, Wilson, Coury & Moursi, 2002; Kwekkeboom, 2003).

When testing methods of anxiety reduction on 60 cancer patients, Kwekkeboom (2003) found that music had no benefit over simple distraction (the participants' choice of audio book, chosen to reduce the similarity between conditions), nor did it appear to have any benefit over no intervention at all; some patients reported finding the distraction methods irritating during medical procedures. Kwekkeboom suggests that patients would benefit from being asked if they would prefer to have a distraction during the procedure, in order to cater to their personal preference. Aitken et al (2002) tested the effects of music on anxiety in 45 children undergoing dental treatments, they also found that music did not have an effect on anxiety, heart rate or pain levels during a painful dental procedure, but they did find that the patients enjoyed listening to the music and would like to have it played during their next visit. Although the results of this study were not significant, and did not increase their pain tolerance levels, this would suggest that the music may have decreased the patients' anxiety levels slightly during the procedure.

Although some of this research does appear to suggest music has an anxiety reducing effect, Labbé, Schmidt, Babin and Pharr (2007) discovered that this can also depend on what sort of music is played to participants during the experiment. A significant difference was found between the type of music participants listened to, and its effect on their anxiety. Labbé et al (2007) made a comparison between silence, heavy metal, classical and a self-selected piece of music. They found that, of these four options, the most effective was self-selection, which was closely followed by classical. Both of these types of music significantly reduced participants' feelings of anxiety as well as increased their levels of relaxation.

In a review conducted by Evans (2002), it was revealed that the music played to participants reduced their anxiety, but did not reduce their pain. This contradicts much of the research within anxiety and pain, which suggests that by reducing the anxiety of the participant, their pain will also be reduced (Field et al, 1996; Salmore & Nelson, 2000; Ikonomidou et al, 2004). Another review, conducted by Nilsson (2008), did find a pain reducing effect of music as well as the same anxiety reducing effects of music found by Evans (2002). In half of the 24 studies reviewed, music significantly reduced the participants' anxiety levels and, in 13 of the 22 studies that measured pain, music was shown to have a significant pain reducing effect. Of these 13, five had a self-selection music choice for their participants.

Other relaxation methods, not just music, have been shown to reduce anxiety; Salmore and Nelson (2000) examined the effects of three interventions (pre-procedure teaching, relaxation instruction and music) on anxiety levels during an outpatient endoscopy on 63 participants. First of all they ascertained that patients' blood pressure did increase during admission to the hospital. Secondly, participants were assigned to one of two conditions; either the treatment group (in which patients were given instructions on relaxation techniques as well as a tape containing relaxation music) or the control, in which no treatment was provided. The results showed that those patients in the treatment group had significantly lower blood pressure throughout the procedure when compared to those who were in the control group, this is indicative of relaxation and music being effective at reducing anxiety. These results are in contrast to Good et al (1999), who found that relaxation and music were effective only when combined with analgesics. The results of Salmore and Nelson's (2000) study suggested that there was no difference in effectiveness of the treatment with regards to the amount of medication used. It is possible that those patients taking part in Good et al's (1999) research were experiencing a greater amount of pain than those in Salmore and Nelson's (2000) study, in which case this finding suggests that the less intense the pain, the more effective the distraction.

A study conducted by Roykulcharoen and Good (2004) aimed to test the effect of a relaxation method called Systematic Relaxation on anxiety levels. This investigation highlighted that, although the groups of patients given the relaxation therapy experienced less post-operative pain than the control group, this did not lead to a significant decrease in anxiety or opoid intake. The results of this research combined with those of Kewkkeboom (2003) and Aitken et al (2002) suggest that, while relaxation does decrease the pain sensation, it does not decrease the anxiety felt by the participant. However, this contradicts the majority of the research mentioned previously and overall it would appear evident that anxiety does increase the pain experience and is also decreased by relaxation methods (Al Absi & Rokke, 1991; Good, 1999/2005; Rhudy & Meagher, 2000; Salmore & Nelson, 2000). If this is the case, before attempting to reduce participants' anxiety levels using relaxation, it is essential to uncover which relaxation method is the most effective.

The Analgesic Effect of Relaxation on Pain

As already discussed, research has shown anxiety can have a negative effect on the pain experience (Al Absi & Rokke, 1991; Rhudy & Meagher, 2000; Kain et al, 2000; Vaughn et al, 2007). This research also suggests that if this anxiety is reduced then participants' pain is also reduced; the question is, which method is best at reducing anxiety? Relaxation techniques have frequently been used to investigate this (Field et al, 1996; Salmore & Nelson, 2000; Ikonomidou et al, 2004) however, they all use varying methods of relaxation. Many studies have attempted to find the most relaxing technique that distracts their participants from pain (Good, 1996; Good et al, 1999/2001/2005/2010; Aitken et al, 2002; Kwekkeboom, 2003; Roykulcharoen et al, 2004). The relaxation techniques examined in these pieces of research vary greatly, including; systematic relaxation, jaw relaxation and music, as well as the complex technique of mindfulness (Jain, Shapiro, Swanick, Roesch, Mills & Schwartz, 2007; Giluk, 2009; Zeidan et al, 2011).

One researcher in particular has investigated the use of relaxation techniques to reduce pain in depth; Good has conducted many studies doing just that. Her first examination into the subject was a review in 1996, investigating the effects of relaxation and music on postoperative pain. The relaxation methods used by the studies she examined included jaw relaxation methods, breathing techniques and relaxation imagery. She found that relaxation and music did significantly decrease affective measures of pain in the majority of studies, however they did not reduce the amount of pain-killers taken by the participants. Another study conducted by Good et al (1999) directly examined the effects of jaw relaxation, music and the combined effect of relaxation techniques and music on postoperative pain. The results indicated that the combined effect of both techniques (jaw relaxation and music) was much more effective than that of a singular technique; however the individual methods did reduce pain during resting periods following the patients' operations. The results from both studies suggest that the combination of nonpharmacological pain reduction (relaxation/music), as well as oral analgesics, can be effective in reduction of pain post-surgically.

Further studies conducted by Good et al (2001 & 2005), with similar methodology, resulted in similar findings. In all of these studies Good et al have compared the effectiveness of jaw relaxation techniques, music and a combination of the two in reducing post-operative pain. Their results have consistently found that all three interventions successfully reduce post-operative pain, especially when used in conjunction with analgesics. However, these results do not carry over during ambulatory periods, when the patients are in greater pain than when resting. This suggests that, although these distraction techniques may be effective when in periods of lower pain, they may not be useful during periods of greater pain. One final study by Good et al (2010) considers the possibility of pre-operatively teaching the patient pain management as a more effective and reliable way of reducing pain than relaxation and music. However, the researchers again concluded from the results that the method of relaxation and music was significantly more effective than the patient teaching method, which did not reduce pain at all.

Although having conducted much research in the area, in none of their studies do Good et al find any significant differentiation between relaxation techniques and listening to music. Plenty of other research, however, has investigated the effectiveness of music and relaxation therapies separately (Syrjala, Donaldson, Davis, Kippes & Carr, 1995; Phumdoung and Good, 2003; Ikonomidou et al, 2004; Roykulcharoen & Good, 2004; Park, Oh & Kim, 2013).

Syrjala et al (1995) investigated the difference in effectiveness of several different pain relieving techniques during cancer treatment on 94 patients; firstly, therapist support, secondly, relaxation and imagery training (which consisted of patients being pretreatment trained in relaxation, including deep-breathing and progressive muscle relaxation), and thirdly, cognitive-behavioural coping skills, in which patients received training in relaxation techniques and coping strategies. These interventions were compared against a treatment as usual control group. Results of the study confirmed that those patients in either the relaxation and imagery or cognitive-behavioural training groups reported less pain than those patients in the other two groups. The conclusions drawn from this research are that relaxation and imagery techniques are very effective at reducing pain in patients receiving treatment for cancer. This research, however, uses techniques that, like those of Good's research, need training beforehand. This is not ideal for the reduction of acute pain as it is not always forewarned.

On the other hand, Seers and Carroll (1998) conducted a review investigating the use of relaxation techniques to reduce acute pain, post-surgically as well as during procedures. Three of the seven studies reviewed by Seers and Carroll reported significantly decreased pain in the patients who experienced the relaxation condition. However, the four other studies reported no difference at all. They found no significant difference between methods, however, the techniques used in the three studies that reported a significant finding were; a three step relaxation technique (tongue and jaw relaxation, rhythmic breathing and lack of attention to thoughts, words and speech; Ceccio, 1984), progressive muscle relaxation and cognitive relaxation (Mandle et al, 1990) and relaxation training (Wilson, 1981). All of this research suggests that relaxation or a relaxation technique may be more effective than simply listening to music. Mandle et al's (1990) research specifically indicates this as, unlike Good et al (1996/2001/2005), they found a significant difference between relaxation and music, with relaxation being the most favourable. However, this may be due to the type of music patients are given to listen to; research has shown that different types of music have different effects on participants (Labbé et al, 2007).

In contrast to these results, there is research that has found a significant effect of music on pain. During an investigation into the analgesic effect of music, Phumdoung and Good (2003) found similar results to that of Good et al (1996/2001/2005) in that music did in fact relieve participants' pain, however this was during labour, not postoperatively. Those in the experimental group listened to soft music with no lyrics for three hours at the start of their labour; results indicated that those in this condition experienced significantly less distress and less pain than those in the control group, which had no intervention at all. This decrease in pain also continued decreasing throughout the three hours of the intervention. Another study that found music was very effective at distracting patients was conducted by Tse, Chan and Benzie (2005) who found that music was very effective at distracting patients. Music was played intermittently to an experimental group of participants who were experiencing post-operative pain during the first 24 hours after their operations. Subjective pain experiences were significantly less in the experimental group when compared to the control, as well as this the experimental group also demonstrated lower blood pressure and the need for less analgesic medication. Likewise, Ikonomidou et al (2004) found that those participants who listened to music (peaceful pan flute music) had a significant decrease in pain after the music had been played; they also took significantly less pain medication than those in the control group. All this research appears to use peaceful, soft music as the music style of choice, indicating that perhaps it is the type of music used that makes it either effective or ineffective, and that the style of music that seems to be the most effective is classical.

There is some dispute over whether music induces emotion in listeners (emotivist) or whether music simply expresses emotion which listeners recognise (cognitivist) (Hunter & Schellenberg, 2010). However there is biological evidence to support the former; several researchers have found that physiological and neurological responses to music are the same as those associated with an emotional response (Krumhansl, 1997; Mitterschiffthaler, Fu, Dalton, Andrew & Williams, 2007; Witvliet & Vrana, 2007). This research suggests that music evokes a physiological response in listeners, actively changing the emotions they are experiencing, and their mood. However, it is important to recognise that multiple emotions can evoke similar physiological responses.

Further research supports this theory; a study conducted by Knight and Rickard (2001) examined the effect of relaxing music on stress (induced by preparation for an oral presentation). Knight and Rickard measured participants' subjective and physiological responses to the music and compared them to a control group who listened to silence. In the control group both the participants' subjective stress levels, and their physiological responses increased from before to after the stressor – indicating an increase in anxiety. The levels of stress and anxiety (subjective and physiological) that increased during the control condition never increased in the condition where participants listened to the relaxing music. This indicates that the music was effective in preventing an increase in stress and anxiety.

Cognitively Demanding Distractors

Significant research has been conducted in another area of pain distraction; attentionally demanding distractors. McCaul and Malott (1984) stated in their four principles of distraction that the second most important principle is "distraction techniques that require more attentional capacity will be more effective" (McCaul & Malott, 1984, pg.516). A lot of research suggests that an active distraction is more effective than a passive distraction (Dahlquist et al, 2007/2009; Jameson et al, 2011). Jameson et al (2011) found that playing a Nintendo Wii game significantly increased pain tolerance when compared to a more passive distraction (watching a TV program) or a control. Jameson also found that the passive distraction did not significantly differ from the baseline in terms of reducing pain tolerance. This contradicts much of the research surrounding passive relaxation as an effective distraction as many of the studies in that area find relaxation, or passively listening to relaxing music, to be very effective at distracting participants from pain (Syrjala et al, 1995; Good et al, 1996/1999/2001; Phumdoung & Good, 2003; Ikonomidou et al, 2004; Good et al, 2005/2010).

Arntz et al (1991/1993/1994) conducted three studies investigating the relationship between anxiety, attention [to pain] and pain. Their first experiment in 1991 revealed no impact of anxiety on pain; however they did discover that what seemed to be the crucial factor was the amount of attention that was paid to the pain. This was directly related to an increase in the amount of pain experienced. Their second study, conducted in 1993, suggested again that when attention was directed away from the pain, participants' pain ratings decreased, and that anxiety had no effect. However, in this particular study the method chosen to induce anxiety into participants was spider exposure (the participants were all spider-phobic). This method was completely unrelated to the pain, which was a mild electrical shock. Arntz et al's third study in 1994 addressed this very issue; does the source of the anxiety (related or unrelated to the pain) make a difference to its effects on the pain experience? They again examined the effect of attention on pain and anxiety, however this time they accounted for the difference between related and unrelated anxiety and pain. In this study they also found that it was attention, not anxiety, which had the significant effect on pain, regardless of whether the anxiety was relevant or irrelevant. This research suggests that redirecting the participants' attention from the pain would be more effective than attempting to reduce their anxiety.

Knowles (1963) described the persons' attention capacity as a "pool" of processing resources which had a limited capacity. When one task requires more of the "pool's" resources then there are fewer resources available for another task. This then results in a lesser performance on this second task, and any tasks after. The majority of psychologists who have theorised around this area tend to agree with the notion of attention as a limited resource. Kahneman (1973) suggested that it is possible to either focus attention onto one particular task or to split attention between several different tasks. However the amount of attentional capacity varies according to several factors, including motivation as well as arousal levels.

Many studies that compare passive to active distractions use video games as the active distractor. One problem with this however is the issue of how to induce the pain in participants; if a cold pressor is used then one of the participants' hands needs to be in the cold pressor, giving the participant only one hand with which to play the game. Jameson et al (2011) found an excellent way to combat this problem; using a Nintendo Wii games console means the participant can play the game using the Wii remote which requires only one hand. This method worked in distracting 60 participants from pain induced via a cold pressor. Other research overcomes this problem using a head-mounted display helmet (Dahlquist et al, 2007/2009).

Dahlquist et al (2007) interestingly found that participants in both the active and passive distraction conditions demonstrated significant decreases in pain tolerance and pain threshold when compared to their control scores. Although both conditions were effective in distracting the participants (children undergoing a cold pressor task), the interactive distraction, administered using a virtual reality head-mounted display helmet, appeared to be slightly more effective than the passive condition. Dahlquist et al (2009) furthered this research, aiming to discover whether the head-mounted display helmet actually assisted with the effectiveness of the distractor, or whether it was a hindrance. All of their participants played the same video game twice, once with the helmet and once without. While both conditions resulted in an increased pain tolerance level, there was a difference in effects between ages of the participants. Dahlquist et al noted that, while older children appeared to gain benefits from the helmet, the younger children seemed to have no specific preference for one or the other.

There is some research, however, that suggests active distractions are less effective than passive (Vasterling, Jenkins, Tope & Burish, 1993). This experiment compares the effectiveness of playing a video game to relaxation training methods, in order to distract patients from painful chemotherapy treatment. The results show no significant difference between these two methods. Vasterling et al (1993) also found that this did not differ between patients with high anxiety levels and patients with low anxiety levels. However, the distractors were successful in reducing nausea before, and blood pressure after, the sessions.

Another study that makes a comparison between active distraction and passive distraction is that conducted by Bellieni et al (2006) who found that, when distracting sixty-nine young children from having their blood taken, watching a cartoon on TV worked better at distracting the children than a more active distraction of their mothers playing with them. The issue with using a sample such as young children in an experiment like this one is that children are likely to be distracted more easily by things they are interested in, for example, the children's age may mean they were more fascinated by the cartoon, or that the mothers' emotional familiarity meant that the children were not as interested in them as the novelty of the cartoon. This doesn't mean that the cartoon would be a good distractor for someone older, therefore the results found in studies using young children should not be generalised to a wider population, and different distractors should be used depending on the age of the person being distracted.

Regardless of both these pieces of research (Vasterling et al, 1993; Bellieni et al, 2006), the majority appear to suggest that active distractors are more effective at increasing pain tolerance than passive distractors, especially in adults (Jameson et al, 2011; Dahlquist et al, 2007/2009). McCaul and Malott (1984) also suggest that a distraction that is attentionally demanding will be more effective than one that needs no active attention. Johnson (2005) supports this theory by stating that distraction works by competing for attention with the pain, and that directing the participant's focus onto another attentionally demanding activity leaves less attention available for the pain, thus reducing the pain experienced. In his 2005 review, Johnson also described the essential factors that he found make the most effective distraction from pain. Johnson stated that, to be effective, a distractor should have the following properties; behavioural activity, problem solving, cognitive activity and imagery. These factors all lead to a more cognitively demanding distraction, and, as the results of his review suggests, if attention is directed away from pain then this has the ability to reduce the pain experience.

If what Johnson (2005) stated is true, then this indicates that the more attention demanded by the task, the more effective it should be. Veldhuijzen, Kenemans, de Bruin, Olivier and Volkerts (2006) found this result by experimenting with high and low cognitive load tasks as distractors. The task used was a visual search task in which participants had to identify previously given letters amongst a group of non-relevant letters, during administration of a cold pressor. The task load was manipulated by increasing the number of non-relevant letters to make the high load condition. They found that, while task performance was not affected in either high or low load conditions, pain intensity scores given by the participants in the high load condition were significantly lower than those given by the participants in the low load condition. These results support the theory mentioned above; the more attention used for the distraction, the less intense the pain felt by the participant. This, however, does depend on intensity of the pain. Eccleston (1995) found that participants in his study who were experiencing high intensity pain were unable to focus their attention on the task and thus continued their experience of the pain, one of McCaul and Malott's (1984) principles of distraction was "Distraction will have stronger effects on pain stimuli of low intensity" (McCaul and Malott, 1984, p.516).

A similar study to this, conducted by Buhle and Wager (2010), substantiates the theory. Buhle and Wager also made a comparison between the level of cognitive load of a task and level of intensity of pain, and examined the effects of these on both pain tolerance levels and task performance. The method of pain induction was thermal stimulation and participants' pain tolerance levels were calibrated; that is, they were tested so that the researchers knew at what temperature each participant would give a low pain rating, a medium pain rating and a high pain rating. Participants' perception of task difficulty level was also calibrated in a similar way. They found that, similarly to Eccleston's (1995) findings, pain intensity was negatively correlated to task performance, i.e. task performance worsened as pain level increased. The researchers also discovered, however, that participants reported less pain during the most difficult task. This suggests that just attempting a difficult task can be more effective at distracting participants from pain, even if task performance is reduced.

Much research in the area of distracting patients from procedural pain uses burn wound dressings as the pain and Virtual Reality (VR) as the distraction (Hoffman, Patterson & Carrougher, 2000; Hoffman et al, 2000/2004). In their 2000 study, Hoffman et al found that VR successfully distracted the patients from the pain of moving their injured body part during physical therapy, the distraction also reduced the amount of time patients thought about the pain. Similarly, in 2004, Hoffman et al discovered that, again, VR decreased the patient's pain during physical therapy. However, in a study conducted by Miller, Hickman and Lemasters (1992), it was discovered that a distraction method comprising of a video clip showing beautiful scenic images and relaxing music also worked just as well as the VR treatment used in Hoffman et al's (2004) study to reduce the amount of pain felt by a patient receiving burn treatment. These findings emphasise the point that it is not necessarily an attentionally demanding task that is the most effective, and there are clearly other factors involved that make a distractor more or less effective that need to be considered.

When conducting research in the area of pain, it is important to carefully consider the way the pain experienced by participants will be measured. There are several methods of measuring pain; the McGill Pain Questionnaire (MPQ) and Visual Analogue Scale (VAS) are just two. There is also the Numerical Rating Scale (NRS) as well as other scales, more suited to use with children, such as the Faces Pain Scale, and all of these measures have been tested thoroughly for reliability and validity. The MPQ, while it has been shown to be both a reliable and valid measure, will not be assessed, due to the fact that it gives a very descriptive quality of data, which is not suitable for the purposes of the current study (Hawker et al, 2011). The MPQ will also not be used because of the amount of time it takes for participants to complete the questionnaire – it will be preferable for participants to be able to complete a questionnaire with which their pain can be immediately assessed, especially since the pain being measured is a type of pain that may ebb fairly quickly after they take their hand out of the water.

When making a comparison between the NRS and the VAS, there is no shortage of research to assess. Many researchers have compared both these measures in different situations (Downie et al, 1978; Ferraz et al, 1990; Bijur, Latimer & Gallagher, 2003; von Baeyer et al, 2009; Hawker et al, 2011). The VAS consists of a ten centimetre line labelled "no pain" at one end and "worst possible pain" at the other, the participant is asked to mark a cross on the line wherever they feel their pain falls. Similarly, the NRS also consists of a ten centimetre line, however each centimetre is marked with a number, so the participants know exactly where their rating is going. While both these measures sound very similar, research shows that participants respond to them very differently.

Studies have shown that both measures have good reliability; Bijur et al (2001) conducted an investigation into the reliability of the VAS when measuring pain. They discovered that the VAS is highly reliable and can reproduce ninety percent of pain ratings within a margin of nine millimetres. However, they did discover that the VAS was more reliable at times of intense pain than during times of moderate pain. On the other hand, von Baeyer et al (2009) found the NRS to be excellent at measuring children's self-reports of pain intensity.

Downie et al (1978) discovered that, while both measures correlated well with each other, their results pointed to the NRS performing slightly better than the VAS. This means that the two measures produce results that are very similar to each other, making the decision to use one over the other much more difficult. Overall however, research appears to indicate that the better measure is the NRS; Ferraz et al (1990) found that the NRS has the highest reliability (over the VAS) in both literate and illiterate participants when measuring pain.

Personality Differences and Pain

In his book *The Biological Basis of Personality* (1970), Eysenck refers to the important roles individual differences play within every hypothesis or experiment. Many studies have found no significant differences between their variables, but when measured in terms of extraversion and introversion the differences are vast. For example, Eysenck (1970) refers to Hovland's (1939) study which found no difference in the effects of massed and spaced practice on paired-associate learning; however, when looked at in more detail, some participants responded more to massed practice, and some more to spaced practice; this effect, Eysenck hypothesised, was due to individual differences. The bearing of personality goes even further as Eysenck expanded upon in another book; *Readings in Extraversion-Introversion: 3 Bearings on Basic Psychological Processes* (1971). Personality's effects stretch to cognitive function, brain function and even perception of stimuli; for example, one study discovered that introverts perform tasks much better during the early morning, whereas extraverts perform better during the afternoon (Blake, 1967).

It is also commonly assumed that different personality types also have a strong relationship with general affect (Larsen & Ketelaar, 1991; Canli et al, 2001). Larsen and Ketelaar (1991) manipulated the induction of positive and negative affect and found that neurotic participants reacted more emotionally to negative mood induction, whereas extraverted participants reacted more emotionally to positive mood induction. Canli et al (2001) found the same, they used functional Magnetic Resonance Imaging (fMRI) to investigate whether differences in brain reactivity to positive and negative emotional stimuli are correlated with personality. They discovered that positive emotional stimuli evoked brain reactivity in extraverted participants, whereas negative stimuli evoked brain reactivity in neurotic participants.

When investigating the differences in personality with regards to pain on a physiological level, Paine et al (2009) reported personality effects in participants' psycho-physiological responses to pain. Paine et al conducted an experiment to investigate the difference in brainstem autonomic responses to pain in different personality types. Nineteen participants were subjected to electrocardiographic recordings (ECG's) whilst resting, and during ten oesophageal balloon expansions. They found that participants whose Cardiac Vagal Control (CVC; heart rate variability) increased during pain were more neurotic in personality, more anxious and more sensitive to sensory stimuli than those participants whose CVC decreased during the balloon expansions. These results suggest that neurotics' and extraverts' responses to pain are very different on a physiological level, and that neurotics respond worse to pain than extraverts.

Lynn and Eysenck (1961) hypothesised that extraverts would have a much higher pain tolerance than neurotics. To test this they exposed participants to heat stimulation; participants were instructed to state when they first felt pain and then tolerate the pain for as long as possible. Out of the ten participants who were highly extraverted, eight successfully reached the twenty second limit, whereas none in the introverted group managed this. The results regarding the neurotic participants were not significant, however there was a near significant negative correlation; meaning neurotics do have a tendency to have slightly poorer pain tolerance levels than extraverts.

These findings have been supported by a number of other researchers. Shiomi (1978) also discovered a significant negative correlation between pain tolerance and neuroticism and a significant positive correlation between pain tolerance and extraversion; the more neurotic a participant was the lower their pain tolerance and the more extraverted, the higher their pain tolerance. Fekracuti and de Carolis (2005) reported similar results in their experiment with extraversion and pain tolerance; using the cold pressor task to induce pain into their participants, they measured how long participants were able to tolerate the cold water. Again they found that those who scored higher in extraversion on the Eysenck Personality Inventory (EPI) were able to tolerate the pain for longer. However they also noted that personality did not affect how the participants qualitatively described the pain experience.

On the other hand there is some research that does not find any difference between personality types at all; Miró and Raich (1992) studied the effects of personality on experimental pain and found that extraverts did not differ from introverts on the following; pain threshold and tolerance, sensitivity range and sensory and affective ratings. They also found no difference between low scoring neurotics and high scoring neurotics on pain ratings, the only difference between these two groups was on their use of coping strategies. However the study does not compare neuroticism to extraversion, only the two poles of each personality dimension – extraversion to introversion and high neuroticism to low neuroticism (stable). So although no differences were found between high and low neurotics, and high and low extraverts, there still may be a difference between neurotics and extraverts themselves.

As mentioned above, one of the strongest differences between personality types with regards to the pain experience is not necessarily how much pain they feel, but how they cope with it. Several studies have found that neurotics and extraverts have very different methods of coping with stress and pain (Vollrath & Torgersen, 2000; Ramírez-Maestre, Martínez & Zarazaga, 2004; Connor-Smith & Flachsbart, 2007; Homayouni et al, 2009).

Vollrath and Torgersen (2000) examined how different combinations of personality types affected coping strategies, particularly neuroticism, extraversion and conscientiousness. Those participants who had personalities combining high conscientiousness and low neuroticism had the best approach to coping with stress whereas those who had a personality type of low neuroticism and low conscientiousness had poor coping strategies. Interestingly this study revealed that extraversion had little effect on the coping strategies of the participants, and this was more determined by the levels of conscientiousness and neuroticism, whereas in the studies concerning pain, conscientiousness is a trait that has not been previously accounted for.

Supporting the research above are the results found by Ramírez-Maestre et al (2004) who correctly predicted that neuroticism would be positively correlated with more passive coping strategies, i.e. giving the control of the pain over to another person. This type of coping strategy has been linked with slow recovery and psychological distress and depression (Snow-Turek, Norris & Tan, 1996; Carroll, Cassidy & Côté, 2006). Ramírez-Maestre et al (2004) also found a link between extraversion and active coping strategies such as handling the pain or carrying on despite the pain. These coping strategies, as opposed to the much more negative passive strategies, are thought to increase positive mood activity levels (Snow-Turek et al, 1996).

As previously discussed, anxiety is known to increase the amount of pain experienced by a participant or patient during or after a procedure. However not everyone will become equally anxious under the same conditions (Bolger, 1990). The state-trait theory of anxiety suggests that subjects with higher trait anxiety will demonstrate higher increases in anxiety when in a stressful situation. Bolger (1990) proposed that neurotics (a personality trait associated with high anxiety) would therefore experience more anxiety during stress. Bolger (1990) found that neuroticism predicted the following coping strategies; distancing, wishful thinking and self-blame. He also found that neuroticism did predict an increase in anxiety as suggested and that the coping strategies used by neurotics also increased distress and anxiety. Although the use of a small sample size in this study reduces the generalisability of the results, it does highlight the important interaction between neuroticism, anxiety and coping methods.

One interesting question to further the above research would be whether the anxiety related to the personality trait of neuroticism is to blame for the negative coping strategies? If the anxiety experienced by the participants was to be reduced before the experiment, would the participant decide upon a different coping strategy?

If this research regarding personality, coping strategies and the effect on anxiety is correct, then it is even more important to find a distraction that will reduce neurotics' anxiety levels; to do this the personality traits of extraversion and neuroticism must be more closely examined. For example, part of Eysenck's theory of personality is based upon his assumptions concerning individuals' states of arousal; extraverts prefer a state of higher arousal and so will actively seek arousal. Extraverts and introverts become aroused at any incoming stimuli, whereas neurotics become more aroused when faced with emotion-inducing stimuli (Matthews & Gilliland, 1999). Optimal Stimulation Level

(OSL) is a term that describes individuals in relation to their responses to environmental stimuli. It is suggested that all organisms prefer a particular level of environmental stimuli (when this refers to factors such as ambiguity, novelty and complexity etc.) and that when this environmental stimulation is below the organism's optimal level they will seek to increase it somehow. This theory was first suggested by Leuba (1955); he observed that during lab experiments on animals, in which the animals were food deprived or given electric shocks, the animal in question would learn an action that would reduce this stimulation. He then went on to apply this to human behaviour and pointed out that when children are bored at school, or at home, they will actively engage in stimulation-increasing behaviour in order to reach their Optimal Stimulation Level. Eysenck also suggested that humans have a defensive 'transmarginal inhibition' (TMI) which is activated after optimal stimulation is reached in order to reduce the chance of over-stimulation (Matthews & Gilliland, 1999).

Raju (1980) then linked this concept to some personality traits; a person with a high OSL will have a stronger need to seek new situations, and will be more likely to take part in risk-taking behaviours – a trait most commonly associated with the personality type of extraversion. Likewise, a person with a low OSL will seek to reduce the stimulation they are experiencing. Raju's study found negative correlations between OSL and personality traits such as rigidity and arousal seeking tendencies. The experiment focused on the relationship between OSL and personality traits; however, it would have been interesting to see if there was a relationship between OSL and specific personality types, as this would have given a more broad indication of individuals' OSLs.

Several studies have investigated the link between OSL (or similar) and personality types. Geen (1984) conducted an experiment in which extraverted and introverted individuals were asked to choose the level of intensity of noise to be played to them. Extraverts chose higher levels of intensity noise than introverts, and introverts were found to be more aroused than extraverts when subjective to the same intensity noise. This suggests that extraverts seek higher arousing activities than introverts, and also that introverts need less stimulation in order to become aroused, and reach their OSL. Although an interesting concept, there has been little research conducted on the relationship between the theory of OSL and personality – this theory can be used to hypothesise about what type of distraction task would be preferred by either personality type.

Like Kahneman (1973), who suggested that the amount of attentional capacity can vary because of arousal levels, Revelle (1993) also connected attentional capacity to levels of arousal and personality. These factors were the only two assessed in his review of non-cognitive factors that affect people's ability to perform attentionally demanding tasks. The studies regarding cognitively demanding distraction tasks could then be responded to differently by different personality traits. For example, the theory is that, as arousal increases and decreases, so does attentional capacity. Therefore, neurotics (with a generally lower state of arousal) may have a lower attentional capacity and therefore not have as much attentional resource to distribute between the cold pressor and the task than extraverts who have a generally higher state of arousal, and therefore have more resources to split between the cold pressor and the task.

Considering the research that indicates neurotics prefer passive strategies of coping with pain, over extraverts' preferred active strategies, leads to the question; will neurotics also prefer passive distraction from pain and extraverts a more active distraction from pain? Not only the difference in coping strategies, but also the OSL theory of stimulation can also be applied to this question. McCaul and Malott (1984) suggested that a task that is cognitively demanding will be more distracting than one that isn't. This could be considered as arousing or stimulating for the participants. That being said, since the theory of OSL suggests that personality types have specific optimum arousal levels, if a cognitively demanding task is too arousing for a specific personality type then it may activate the transmarginal inhibition (TMI) and become less distracting for the participant. If this who to happen, it would likely occur with a neurotic or introverted participant, as they are the personality types which require less stimulation to become aroused. Therefore, it may be more beneficial for these personality types to use a less arousing task such as a relaxation task, i.e. listening to relaxing music. The two distractors being used in the current research, therefore, will be a maths quiz (designed to be cognitively demanding) and a piece of relaxing music.

When it comes to measuring personality for the purposes of the current study, the choices of measure are limited, particularly since the personality theory of the current study comes from Eysenck's theory of personality, and thus must measure extraversion and neuroticism. This narrows the choices of psychometric measure down to Eysenck's Personality Questionnaire (EPQ; Eysenck, 1968) and the Big Five Model (Costa & McCrae, 1985). Both models measure extraversion and neuroticism; however the Big Five Model also includes agreeableness, conscientiousness and openness to experience (Eysenck, 1992).

Eysenck (1992) responded to Costa and McCrae's Big Five Model of personality, in which he stated that Costa and McCrae had neglected to take into consideration much of the research which is key in the area of personality. Eysenck stated that the agreeableness and conscientiousness factors included in the Big Five Model are not major dimensions of personality, but part of what Eysenck terms psychoticism. Due to this, and because of the aims of the current research, the only option is to use Eysenck's EPQ.

Rationale

The present study will build upon the research conducted in this area to further investigate the relationship between personality and pain.

The study will investigate the effect of anxiety on participants' pain tolerance; research has shown that anxiety plays a huge role in the experience of pain (Al Absi & Rokke, 1991; Rhudy & Meagher, 2000; Vaughn, 2007), and therefore it is essential to consider this factor when investigating pain. These researchers, among others, have discovered that anxiety can make the experience of pain much worse, and can even inhibit the healing process (Broadbent et al, 2003). Research has also shown that relaxation can reduce anxiety and even reduce pain (Good et al, 1996/1999/2001; Aitken et al, 2002; Good et al, 2005/2010), this and research conducted by Good et al (1996/2001/2005) and Labbé et al (2007) leads to the decision that a relaxing piece of music will be the first distraction. Further research into distraction from pain has shown that a task that demands attention can be very effective (McCaul & Malott, 1984).

In the current study, music will be used as one of the distraction methods. Music has been shown to be an invaluable method of non-pharmalogical pain relief in clinical settings (Good et al, 1996/2001/2005; Gallagher, Lagman, Walsh, Davis & LeGrand, 2006; Allred, Byers & Sole, 2010), as well as an effective way of reducing anxiety (Salmore & Nelson, 2000; Evans, 2002; Labbé et al, 2007). This research highlights the importance of music in reducing pain. The second distraction will be a maths quiz; this task is intended to be attentionally demanding, based upon the capacity theory of attention which suggests that the more attention a task demands, the less attention is available for the pain caused by the cold pressor (Knowles, 1963; Kahnman, 1973).

The research conducted by Lynn and Eysenck (1961) which suggests that neuroticism is related to a decrease in pain tolerance, whereas extraversion is related to an increase in pain tolerance, as well as the theory of Optimal Stimulation Levels, leads to the theory that the differences between these two personality types will result in a personality type having an effect on the response to the distractor types used in the study.

Bolger's (1990) research into the interaction between coping and personality highlighted the way in which the participants' level of neuroticism can affect not only how much anxiety they experience, but also how they cope with it. From this research it is predicted that those who score higher on the neuroticism scale will have a higher level of anxiety before the experiment and also that this level of anxiety will increase more from before the experiment to after.

The current study aims to find an interaction between personality type and distractor used with regards to pain tolerance, pain rating and anxiety levels. While previous research has considered these factors individually, none has investigated the interaction between them.

Hypotheses

1. Personality type (extraversion, neuroticism and psychoticism) will interact with distraction condition to have an effect on pain tolerance.

2. Personality type (extraversion, neuroticism and psychoticism) will interact with distraction condition to have an effect on the pain rating participants will give after the task.

3. Personality type (extraversion, neuroticism and psychoticism) will interact with distraction condition to have an effect on the anxiety score participants give after the task has been completed.

4. There will be an effect within distraction condition on anxiety before and anxiety after the task.

5. There will be an effect within distraction condition on the relationship between anxiety and pain tolerance.

6. There will be an effect within distraction condition on the relationship between anxiety and pain rating given after the task.

7. There will be an effect within distraction condition on the relationship between pain tolerance and pain rating given after the task.

Method

Design

The design used was an independent measures design; each participant only took part in one condition. This was to try to reduce the risk of desensitisation from the cold pressor; if participants completed all three conditions during the same day it was possible that during the second and third condition their hands may become used to the cold temperature of the cold pressor (Field & Hole, 2010). An independent measures design also reduced the risk of order effects where the participants may become bored after completing several conditions and "give up" fairly quickly on the second or third task by taking their hand out of the water before they were ready.

The independent variables were the conditions – control or experimental, either the maths task or the music condition, and personality traits measured with the EPQ-R, using the traits extraversion, neuroticism and psychoticism. The dependent variables were pain tolerance, pain intensity, and anxiety levels before and after the participants completed the cold pressor task.

This design also helped decrease the risk of participants dropping out. One way to combat the risks of desensitisation and order effects would have been to require the participants to complete one condition per week (using a repeated measures design), but this would have increased the chance that participants may have dropped out before finishing all three conditions.

Participants

Forty-two participants were recruited using an opportunity sample method. All participants were students from the University of Huddersfield and all gave their consent to take part and for their data to be used in this research. Participants were recruited on a voluntary basis. The mean age of the participants was 32.81 (SD=10.26), with a range of 18 to 55, and there were 18 males and 24 females. There were 14 participants in each condition.

Participants were asked to sign a form confirming that they did not suffer from any skin conditions worsened by the cold, poor circulation, Reynaud's disease or any heart conditions.

Apparatus/Materials/Measures

Distractors

The first distractor was a maths quiz; this task consisted of a series of maths questions of increasing difficulty. This task was administered as a flash game on a computer and was designed to be completed using a mouse. The maths task was designed to last longer than the maximum of five minutes and had 51 questions. The task was stopped once participants withdrew their hand from the water.

The second distractor was five minutes of relaxing music, specifically a piece called 'Spiegel Im Spiegel' composed by Arvo Pärt (1978). The music was stopped when the participant withdrew their hand from the water.

Measures

Before beginning the experiment participants' personality was measured using the Eysenck Personality Questionnaire Revised Version (EPQ-R; Eysenck and Eysenck, 1975). This questionnaire consisted of 48 questions which the participants were required to answer by circling "Yes" or "No" depending on whether they felt the statement applied to them or not. Previous reliability tests on the EPQ-R Short form have provided evidence of good reliability. In a study conducted by Francis, Brown and Philipchalk (1992) the extraversion scale recorded an alpha coefficient of 0.85, the neuroticism scale a coefficient of 0.82, the lie scale 0.65 and the psychoticism scale was the lowest with a coefficient of 0.51. Cronbach's alpha conducted on the data from the current study revealed the following; extraversion had a coefficient of 0.76, neuroticism had a coefficient of 0.81 and psychoticism had a coefficient of 0.6. The lie scale had the lowest coefficient of 0.52. This could not be significantly increased by removing any items. Overall however, the Cronbach's alpha coefficients of the current study appear very similar to that of Francis et al (1992). This study does acknowledge the low reliability of the psychoticism scale and attribute this to the fact that it is the most recent addition to the questionnaires.

Participants were required to fill in a Numerical Rating Scale (NRS) after they had completed the cold pressor task to determine the intensity of the pain they had experienced. This scale consisted of one question (what was the intensity of the pain you felt during the task) and was answered on a scale of 0 to 10; 0 being no pain at all and 10 being the worst pain possible. Since the participants only completed the NRS once, no reliability tests could be conducted for this particular study, however Farrar, Troxel, Stott, Duncombe and Jensen (2008) found that, after conducting test-retest reliability analysis on two measures of the NRS recorded over a 7-10 day period, the NRS had a coefficient of 0.83.

Participants were also asked to complete the State-Trait Anxiety Inventory – Short Form (STAI-SF; Marteau & Bekker, 1992) which consists of six statements regarding mood which are scored on a four-point scale from "Not at all" to "Very Much". The STAI-SF has also previously shown good reliability scores; the state's Cronbach's alpha was 0.93 and the trait's was 0.92. The Cronbach's alpha scores for the current study were; before (0.74) and after (0.80).

Cold Pressor

The cold pressor consisted of a bucket of water kept at 2^0C by packing ice around the sides of the bucket, kept in place by chicken wire. The temperature was measured before and after every time it was used using a laser thermometer to ensure it stayed at the same temperature; if the water was increasing in temperature, ice was added to the water and allowed to melt before participants submerged their hand. The chicken wire was kept away from their hand using a plastic bag, to ensure participants did not catch themselves on the wire.

Procedure

Ethical approval was gained from the School of Human and Health Science's ethics board before recruiting any participants (Appendices 1-3; pp.70-76).

Before Task/Control

Participants were assigned condition in an alternating pattern – the first participant took part in the control condition, the second in the maths condition, the third in the music and then the fourth in the control condition again etc.

Upon entering the room the participants were given the participant information sheet to consult. This thanked them for agreeing to take part and provided them with information regarding what was going to happen during the experiment. The participant information sheet also contained information on how to contact the researcher should they have any questions after completing the experiment, or wish to withdraw their results from the study. The participant's individual participant number was written on the top of the information sheet to provide to the researcher should they wish to withdraw their results. There were two participant information sheets; one for the participants taking part in the experimental conditions (maths and music) and another for those taking part in the control condition [Appendices 4 & 5; pp.77-78].

Participants were then asked if they had any questions regarding what was going to happen during the experiment and if they were still willing to take part. If they answered yes then they were given a consent form [Appendix 6; p.79] and an inclusion sheet [Appendix 7; p.80] to complete and sign to determine whether they were eligible to take part or not. If there was no reason for the participants to not take part they were given the EPQ to measure their personality. Participants were also given the STAI to measure their anxiety levels before the task began.

Before beginning the experiment participants were asked which hand was their dominant hand, this was to ensure the cold pressor could be placed on the side of their non-dominant hand as participants needed to be able to use their dominant hand to complete the task. In order to be consistent, all participants completed the cold pressor task with their non-dominant hand.

MATHS DISTRACTOR

The participants were asked to sit in front of a computer with the maths quiz ready to be played, and given the standardised instructions [Appendix 8; p.81] written specifically for the maths quiz. The participants were presented with a maths question and four possible answers from which to choose, participants were given five seconds and then were given an option to pass the question. Having chosen the answer they wanted to give, participants were then told whether their answer was correct or incorrect and the game moved on to the next question. Participants' scores were totalled in the top right hand corner of the game. A button was provided in game for the participants to click should they want to quit, the participants were then instructed to remove their hand from the cold pressor if they click it.

The participants were reminded that it was important they remove their hand from the water when it became too uncomfortable to stand; they were not told there was a time limit of five minutes. They were also given assurance that their performance or completion of the task was not being measured and had no bearing on the results of the study. Participants were asked to submerge their hand whenever they were ready and begin the task. The time participants kept their hand in the water was recorded using a stopwatch.

Relaxation Distractor

The participants taking part in this condition were asked to sit next to the cold pressor and relax. Participants were asked to concentrate on the music and not on the sensations in their hand. Participants were reminded that it was important they remove their hand from the water once it became too uncomfortable to stand. The music was started and participants were asked to submerge their hand whenever they were ready.

Control

Participants who took part in this condition did not complete any type of distraction task. They sat with their non-dominant hand in the cold pressor for no more than five minutes. This condition was to establish a baseline, to know how long participants can keep their hand in the cold water for without a distractor, in order to compare the results with the distraction conditions.

After Task/Control

A time limit of five minutes was used (Mitchell, MacDonald & Brodie, 2004); after that time, if they hadn't already, participants were requested to remove their hand from the water. After completion of the task (or finishing the control) participants were given the NRS to record the intensity of the pain they had felt during the task and the STAI again to measure their anxiety levels after the task. Before leaving the participants were debriefed. They were given more information on the purpose of the experiment, asked if they had any questions and reminded that they could contact the researcher at any point to ask any further questions or withdraw their results from the study and given instructions on how to do so.

Results

The alpha level was set at p = 0.05.

After collecting the data from participants, the results from the EPQ were interpreted using a personality scale key and input into an SPSS database, along with the results from the STAI-SF (before and after), NRS, times recorded during the experiment, participants' age and sex and which condition the participant took part in. Statements one, four and five of the STAI-SF were reversed and both the before scores and the after scores were totalled separately to form two new variables – total STAI-SF score before, and total STAI-SF score after. In order to conduct the moderated regression analyses the three personality types (extraversion, neuroticism and psychoticism) were centred by subtracting the value from the mean. The conditions were converted into dummy variables in order to create interaction variables for the analysis; these were created by multiplying the value of each personality (extraversion, neuroticism and psychoticism) by dummy condition (maths or music).

In order to analyse the data, moderated regression analyses were chosen rather than ANCOVAs as the aim was to find an interaction between condition and personality. This is something that moderation takes into account, whereas ANCOVAs only control for the effect of the variable.

Table 1: The means and standard deviations for the four dependent variables by condition and the mean scores for each personality type measured, in each condition

Condition	Control		Music		Maths	
	Mean	SD	Mean	SD	Mean	SD
Pain Rating	7.02	0.89	5.81	2.80	6.64	1.74
Time	103.0	97.12	161.64	121.04	161.14	125.07
STAI before	8.57	2.24	8.14	1.70	10.0	3.30
STAI after	10.93	2.30	10.50	3.92	11.21	2.89
Extraversion	9.57	2.77	8.29	3.45	7.64	2.47
Neuroticism	2.79	2.42	4.14	2.38	6.36	4.13
Psychoticism	2.71	1.54	3.86	2.89	3.21	2.61

Table 2: The results of a Shapiro-Wilk test of normality

Condition	Control	Music	Maths
Pain Rating	0.08	0.11	0.15
Time	0.00*	0.01*	0.01*
STAI before	0.22	0.11	0.04*
STAI after	0.97	0.01/*	0.23
Extraversion	0.01*	0.11	0.19
Neuroticism	0.10	0.24	0.17
Psychoticism	0.36	0.49	0.57

*significant to 0.05

In order to establish that anxiety is equivalent in the three conditions before the cold pressor task, a one-way ANOVA was conducted on the STAI before between the conditions. The ANOVA showed that there was no significant difference in anxiety before the task between the three conditions ($F(2, 39) = 2.12$, $p = 0.14$).

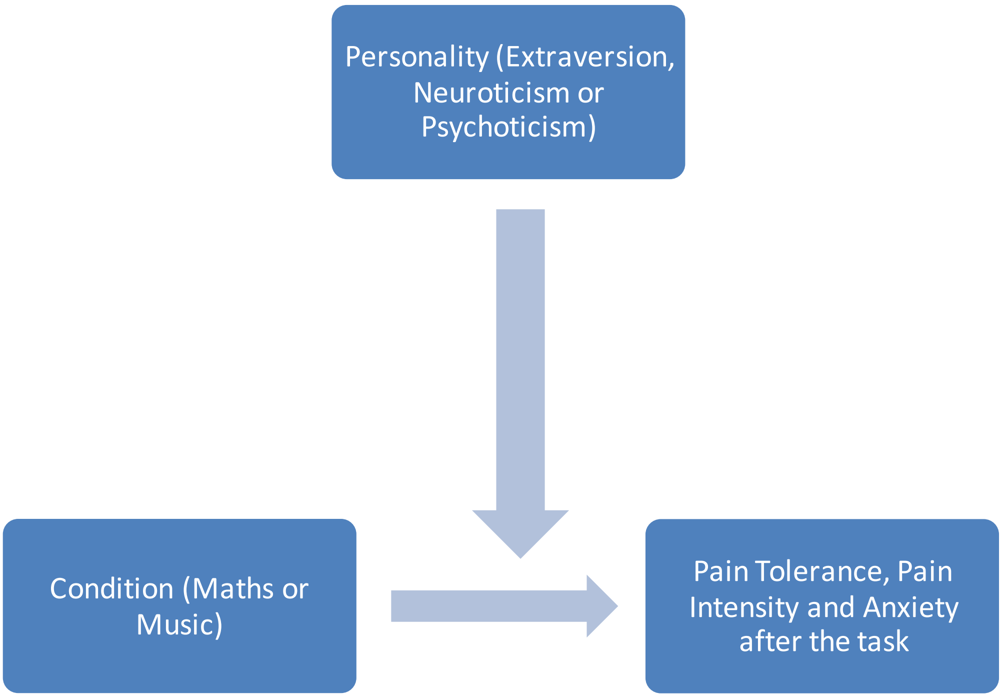

Figure 1: A diagram demonstrating the predicted interaction between personality and condition on the dependent variables

Hypothesis One

Personality type (extraversion, neuroticism and psychoticism) will interact with distraction condition to have an effect on participants' pain tolerance.

It can be seen that the mean times for both the maths quiz condition (161.14, SD = 125.07) and the music condition (161.64, SD = 121.04) are very similar, they are also higher than that of the control (103.00, SD = 97.11). To identify if there is a difference between these values, a one-way independent Analysis of Variance (ANOVA) was needed, however since pain tolerance was not normally distributed across all conditions a non-parametric Kruskal-Wallis test was used instead. The difference was found to be non-significant ($H(2) = 1.15$, $p = 0.56$).

These results indicate that there was no significant difference in pain tolerance between the three conditions.

The hypothesis, however, predicts that there will be an effect on time by combining the condition and personality (demonstrated in Figure 1). To test this, a moderated regression analysis was conducted on the data. In these analyses the effect of condition on pain tolerance was tested, with each personality type as a moderating variable. The results of the moderated regression analysis can be found in Table 3; R Square shows the percentage of the variance explained by condition alone, R Square with moderating variable shows the percentage of variance explained by condition and personality, R Square change describes the increase in percentage of variance explained by the addition of personality, Sig. F Change demonstrates whether this change is significant, and Model significance shows the significance of the model as a whole.

EXTRAVERSION

The results showed that the model as a whole was not significant ($F(4, 37) = 0.87$, $p = 0.49$). This means that extraversion had no significant interaction with condition, and no effect on time spent in the cold pressor. Looking more closely it can be seen how small the effect was; before the addition of extraversion, condition explained 5.8% of the variance in time, when combining this with extraversion, the model as a whole explained 8.6% of the variance – an increase of 2.8% which was a non-significant contribution ($p = 0.57$).

NEUROTICISM

The results from the moderated regression analysis for neuroticism also showed that the model was not significant (F (4, 37) = 0.80, p = 0.53). This means that neuroticism had no significant interaction with condition with regards to time. Neuroticism also only explained an extra 2.2% of the variance of time, another non-significant contribution (p = 0.44).

PSYCHOTICISM

The results showed that when the model included psychoticism as the moderating variable, it was also non-significant (F (4, 37) = 0.63, p = 0.65). Psychoticism provided the smallest contribution to variance in time out of all three personality types measured, contributing only 0.5% to variance, a significance value of (p = 0.90).

Table 3: The results of the moderated regression analysis for Hypothesis 1

	R Square (%)	R Square with moderating variable (%)	R Square Change (%)	Sig. F Change	Model significance
Extraversion	5.8	8.6	2.8	0.57	0.49
Neuroticism	5.8	8.0	2.2	0.65	0.53
Psychoticism	5.8	6.3	0.5	0.90	0.65

Hypothesis Two

Personality type (extraversion, neuroticism and psychoticism) will interact with distraction condition to have an effect on the pain rating participants will give after the task.

The mean pain ratings for each condition show that the control condition produced the highest pain rating (7.02, SD = 0.89), maths the second highest (6.64, SD = 1.74) with music producing the lowest mean pain rating (5.81, SD = 2.80). After conducting an ANOVA on these means, however, this difference can be seen to be non-significant (F (2, 39) = 1.39, p = 0.26).

This result indicates no significant difference in the pain rating given between conditions.

Again, however, the hypothesis predicts that condition will have an influence on pain rating when combined with personality (demonstrated in Figure 1). To test this three moderated regression analyses were run. In these analyses the effect of condition on pain intensity was tested, with each personality type as a moderating variable. The results of the moderated regression analysis can be found in Table 4; R Square shows the percentage of the variance explained by condition alone, R Square with moderating variable shows the percentage of variance explained by condition and personality, R Square change describes the increase in percentage of variance explained by the addition of personality, Sig. F Change demonstrates whether this change is significant, and Model significance shows the significance of the model as a whole.

EXTRAVERSION

The results of the moderated regression analysis with extraversion as the moderating variable show that the model is non-significant (F (4, 37) = 1.43, p = 0.25). Condition on its own explains 6.7% of the variance in pain rating, when extraversion is added, the model as a whole explains 13.3% of the variance, with extraversion contributing an additional 6.7% of the variance, this is a non-significant contribution (p = 0.25).

NEUROTICISM

These results also show the model as non-significant with neuroticism as a moderating factor (F (4, 37) = 1.33, p = 0.28). With neuroticism only contributing an extra 5.9% of the variance, again, a non-significant contribution (p = 0.30).

PSYCHOTICISM

The results of the analysis with psychoticism also show the model as non-significant (F (4, 37) = 0.79, p = 0.54). Again, psychoticism contributes the smallest percentage to the variance out of all three personality types – 1.2%, a non-significant contribution (p = 0.79).

Table 4: The results of the moderated regression analysis for Hypothesis 2

	R Square (%)	R Square with moderating variable (%)	R Square Change (%)	Sig. F Change	Model significance
Extraversion	6.7	13.3	6.7	0.25	0.25
Neuroticism	6.7	12.6	5.9	0.30	0.28
Psychoticism	6.7	7.8	1.2	0.79	0.54

Hypothesis Three

Personality type (extraversion, neuroticism and psychoticism) will interact with distraction condition to have an effect on the anxiety score participants give after the task has been completed.

The means for anxiety levels after the task for each condition appear very similar; control (10.93, SD = 2.30), music (10.50, SD = 3.92) and maths (11.21, SD = 2.89). An ANOVA formalises this assumption (F (2, 39) = 0.19, p = 0.83). The non-significant result of this ANOVA indicates that there is no significant difference in anxiety between conditions.

The hypothesis predicts an interaction between personality and condition on anxiety (demonstrated in Figure 1). To test this three moderated regression analyses were conducted. In these analyses the effect of condition on anxiety score given after the task was tested, with each personality type as a moderating variable. The results of the moderated regression analysis can be found in Table 5; R Square shows the percentage of the variance explained by condition alone, R Square with moderating variable shows the percentage of variance explained by condition and personality, R Square change describes the increase in percentage of variance explained by the addition of personality, Sig. F Change demonstrates whether this change is significant, and Model significance shows the significance of the model as a whole.

Extraversion

The results of the analysis show that the model is non-significant (F (4, 37) = 0.10, p = 0.98). In this model, condition on its own provides 1% of the variance in anxiety after the task, after combing this with extraversion, the variance explained increases only to 1.1%, with extraversion adding 0.1% of the variance. This is a non-significant contribution (p = 0.98).

Neuroticism

The results of the moderated regression analysis with neuroticism as the moderating variable show the model to be non-significant (F (4, 37) = 0.54, p = 0.70). Neuroticism provides a larger contribution to the variance than extraversion (4.6%), however this contribution is still non-significant (p = 0.41).

Psychoticism

The results of the analysis with psychoticism again show the model to be non-significant (F (4, 37) = 1.02, p = 0.41). Psychoticism provides a larger contribution than both extraversion and neuroticism (9%), however this is still non-significant (p = 0.17).

Table 5: The results of the moderated regression analysis for Hypothesis 3

	R Square (%)	R Square with moderating variable (%)	R Square Change (%)	Sig. F Change	Model significance
Extraversion	1.0	1.1	0.1	0.98	0.98
Neuroticism	1.0	5.5	4.6	0.42	0.71
Psychoticism	1.0	9.9	9.0	0.17	0.41

Hypothesis Four

There will be an effect within distraction condition on anxiety before and anxiety after the task.

The means for anxiety before the task (8.90, SD = 2.57) and anxiety after the task (10.88, SD = 3.05) indicate that participants' anxiety appears to increase from before the task to after. A paired samples t-test was conducted on these two means and the difference was found to be significant ($t(41) = -3.49$, $p < 0.01$). Therefore, overall, there was a significant increase in anxiety from before the task to after the task.

To assess the difference between conditions three more paired sample t-tests were conducted, each with a different condition selected.

Control

With only the control condition selected, the means for anxiety before the task (8.57, SD = 2.24) and anxiety after the task (10.93, SD = 2.30) also appear to increase from before to after. The result of the t-test affirms this assumption ($t(13) = -3.45$, $p < 0.01$).

Music

With only the music condition selected, again the means for anxiety before the task (8.14, SD = 1.70) and anxiety after the task (10.50, SD = 3.92) appear to increase from before to after. The result of the paired samples t-test conclude that this difference is not significant ($t(13) = -2.03$, $p = 0.06$).

Maths

With only the maths condition selected, the means for anxiety before the task (10.00, SD = 3.30) and anxiety after the task (11.21, SD = 2.89) appear to have a slight increase but not as much as the other two conditions. The results of a t-test find this difference to be non-significant ($t(13) = -1.13$, $p = 0.28$).

Hypothesis Five

There will be an effect within distraction condition on the relationship between anxiety and pain tolerance.

Since time was non-normally distributed across all conditions, rather than conducting two Pearson's correlations, Spearman's correlations were used instead; one on anxiety before the task against time and another on anxiety after the task against time. The first correlation (anxiety before) was non-significant (rho = -.04, p = 0.81), however a strong, significant negative correlation was found between anxiety recorded after the task and time (rho = -.53, p < 0.01). These results indicate that as anxiety increases, time spent in the cold pressor decreases, and vice versa. This relationship can be seen in Figure 2 below.

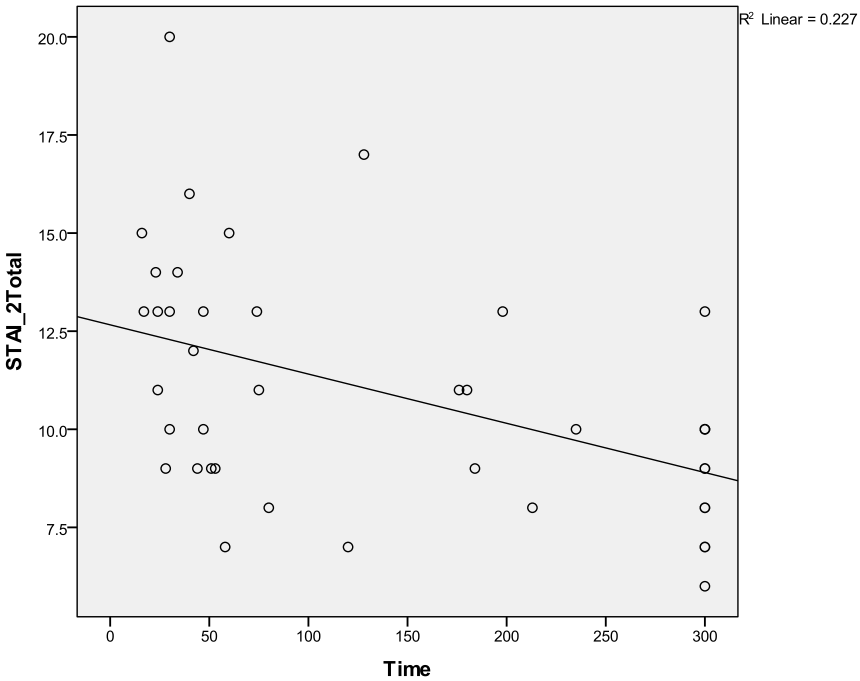

Figure 2 – The relationship between anxiety measured after the task and pain tolerance in all conditions.

Three more Spearman's correlations were conducted to attempt to see if this relationship between anxiety after the task and time extended to each condition individually.

CONTROL

With only the control condition selected, the correlation between anxiety after the task and time was found to be non-significant (rho = -.42, p = 0.13). However, the correlation is negative and moderate; the correlation is demonstrated in Figure 3.

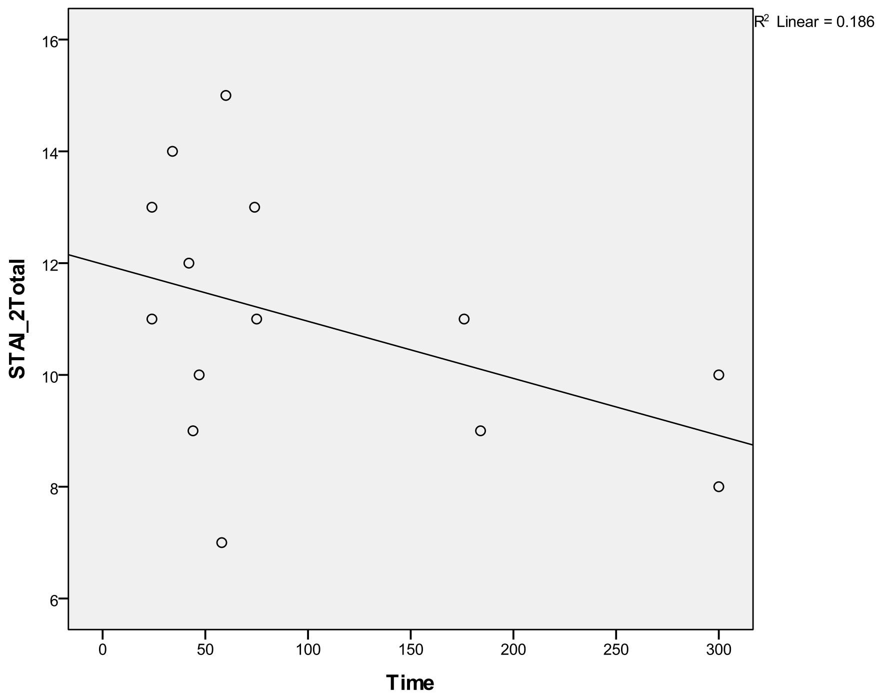

Figure 3 – The relationship between anxiety measured after the task and pain tolerance in the control condition.

MUSIC

With only the music condition selected, although the correlation was moderate in strength, it was non-significant (rho = -.50, p = 0.07). This correlation can be seen in Figure 4.

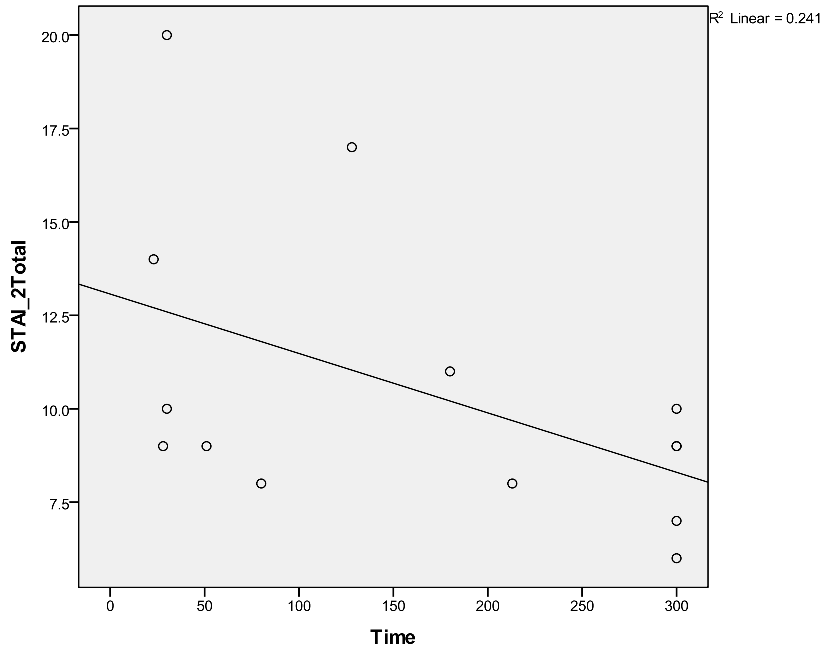

Figure 4 – The relationship between anxiety measured after the task and pain tolerance in the music condition.

MATHS

A significant negative correlation was found between anxiety after the task and time when only the maths condition was selected (rho = -.61, $p < 0.05$). This means that the longer the participants' keep their hand in the water, the lower their anxiety levels after the task has finished. This relationship is shown in Figure 5.

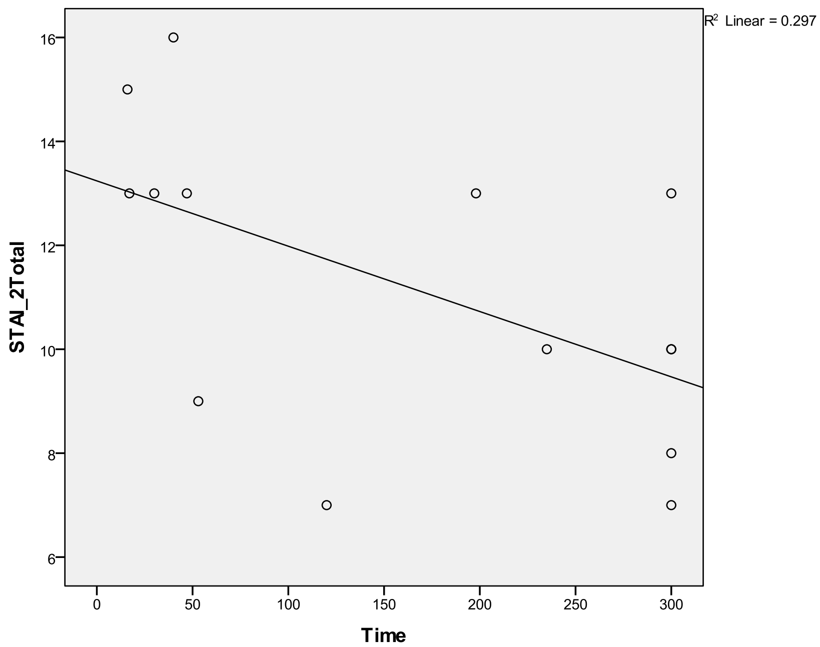

Figure 5 – The relationship between anxiety measured after the task and pain tolerance in the maths condition.

Hypothesis Six

There will be an effect within distraction condition on the relationship between anxiety and pain rating given after the task.

Two Pearson's correlations were conducted, one on anxiety before the task and pain rating and the other on anxiety after the task and pain rating. The first correlation (anxiety before) was non-significant ($r = -.20$, $p = 0.19$). However, the second correlation produced a significant positive correlation ($r = .38$, $p = 0.01$). These results indicate that the higher the participant's anxiety during the task, the higher their pain rating will be.

Three more Pearson's correlations were conducted to attempt to see if this relationship between anxiety after the task and pain rating extended to each condition individually.

CONTROL

With only the control condition selected, no significant correlation was found ($r = -.12$, $p = 0.69$).

MUSIC

With only the music condition selected, the correlation was significant ($r = .38$, $p < 0.05$). This indicates that the higher the participants' anxiety was after the task, the higher their pain rating was. This is demonstrated in Figure 6.

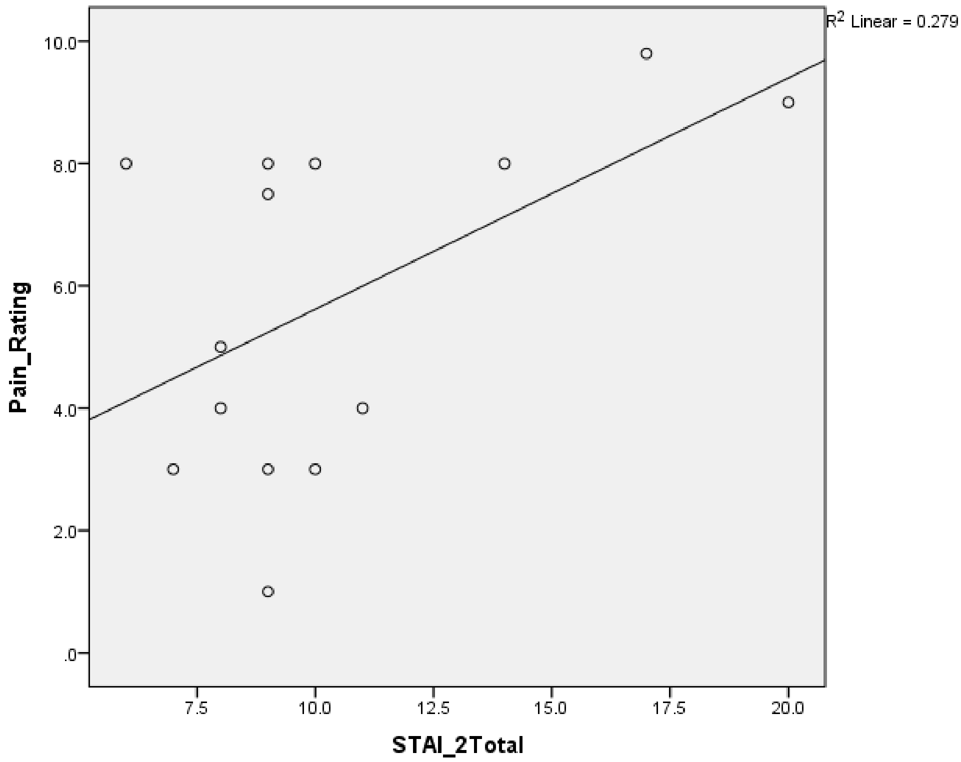

Figure 6 – The relationship between pain rating and anxiety scores after the task in the music condition.

Maths

With only the maths condition selected, no significant correlation was found ($r = .28$, $p = 0.34$).

Hypothesis Seven

There will be an effect within distraction condition on the relationship between pain tolerance and pain rating given after the task.

Again, since pain tolerance is non-normally distributed Spearman's correlations were used instead of Pearson's correlations. These were conducted between pain tolerance and pain rating, on all participants. A strong, negative, significant correlation was found (rho = -.50, $p < 0.01$). This suggests that the longer a participant kept his or hers hand in the water, the lower the pain rating would be, and vice versa. The relationship can be seen in Figure 7.

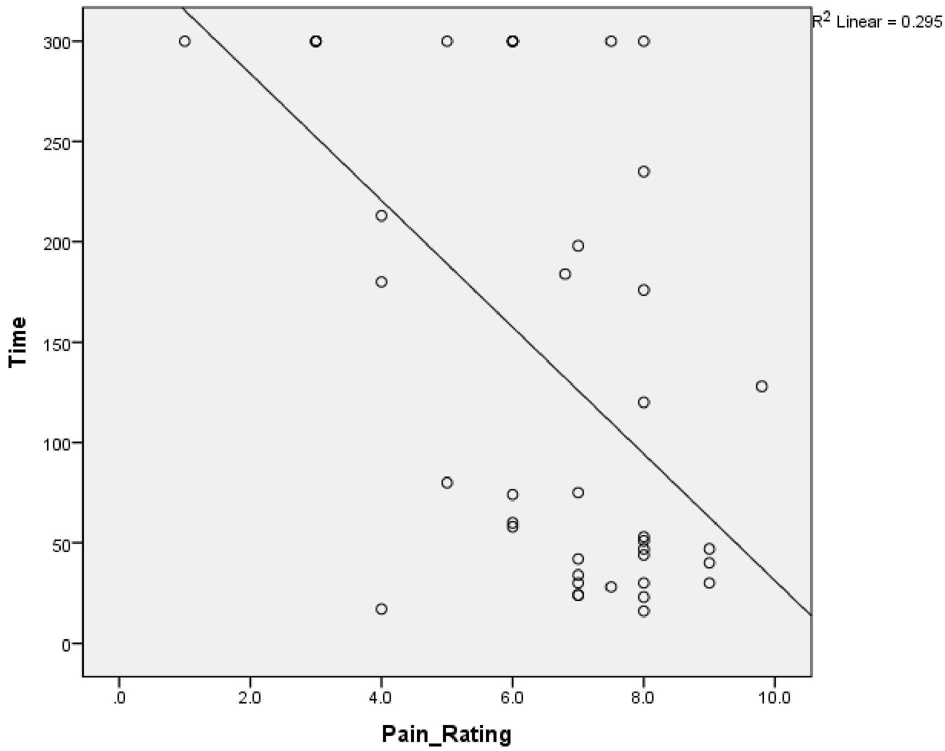

Figure 7 – The relationship between pain tolerance and pain ratings given after the task in all conditions.

Correlations were then conducted with each individual condition selected to identify any effect of condition on the relationship between pain tolerance and pain rating.

CONTROL

The correlation between pain tolerance and pain rating in only the control condition showed no correlation (rho = -.19, p = 0.52).

MUSIC

With only music selected, the correlation was strongly negative (rho = -.67, p < 0.01). This suggests that, in the music condition, participants who kept their hand in the water for longer gave a lower pain rating. This relationship can be seen in Figure 8.

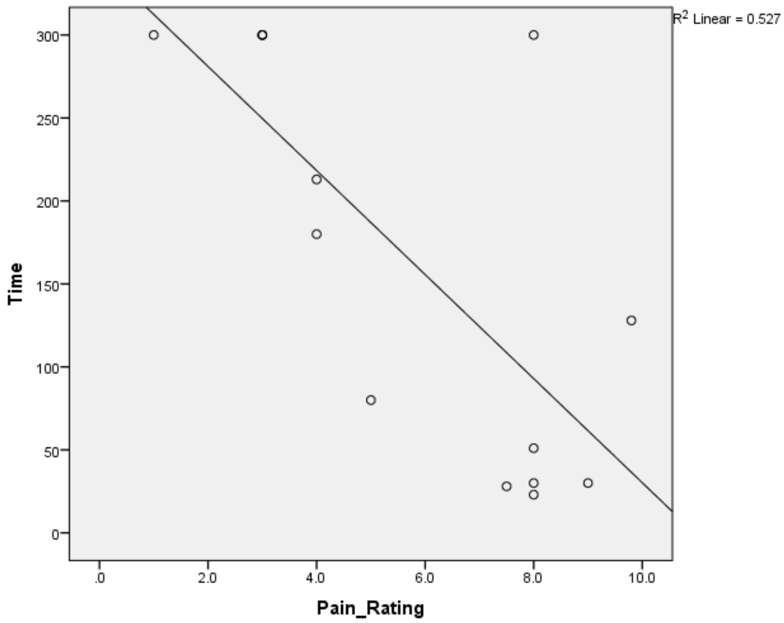

Figure 8 – The relationship between pain tolerance and pain rating in the music condition.

MATHS

The correlation between pain tolerance and pain rating with only the maths condition selected did not produce a significant correlation (rho = -.50, p = 0.07). This relationship is demonstrated in Figure 9.

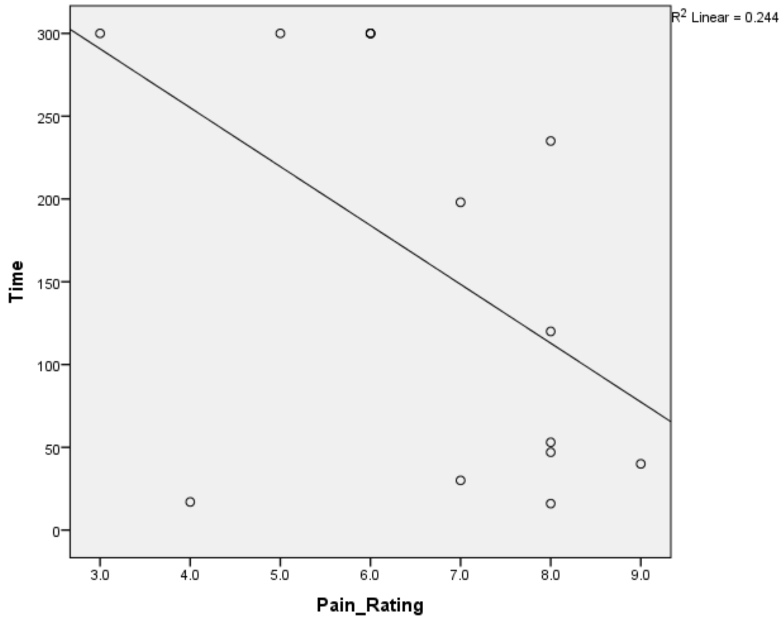

Figure 9 – The relationship between pain tolerance and pain rating in the maths condition.

Discussion

The first hypothesis is – personality type (extraversion, neuroticism and psychoticism) will interact with distraction condition to have an effect on pain tolerance. The first step in testing this hypothesis was to measure the mean time participants left their hand in the cold pressor for, for each of the conditions. Both experimental conditions are very similar, both around 161 seconds, however the mean time for the control condition is a lot lower – 103 seconds. This difference would appear to be quite a large difference, suggesting the experimental conditions in which the distractors were used were effective at increasing participants' pain tolerance, which is what was expected. However, after a Kruskal-Wallis test was conducted, this difference was found to be non-significant. This means that it cannot be safely said that the two distractors used were successful in their purpose; however, this non-significant result could possibly be due to the small sample size as each condition only had 14 participants, a limitation which will be discussed later. This non-significant result does not support the research conducted by Labbé et al (2007) and Nilsson (2008) who both found that music did have a pain reducing effect, nor does it support the research of McCaul and Malott (1984) and Johnson (2005) who also found that attentionally demanding tasks were effective at distracting participants from pain, and while the direction of the means do indicate support for this research, the non-significant results do not.

In order to find whether this non-significant result is affected by the addition of personality, moderated regression analyses were conducted on time and condition, with personality as the moderating variable. However, none of the three personality types tested were found to have any significant effect, meaning that personality does not have an impact upon the participants' pain tolerance in any condition. Although the moderated regression analysis revealed no effect of personality and condition on pain tolerance, when looking closer at the amount of variance explained by personality it can be seen how small the effect actually was. Extraversion provided only 2.8% of variance, where neuroticism provided only 2.2% of variance – demonstrating how small the effect of personality on time is. Psychoticism provided the least with only 0.5% contribution to variance.

Lynn and Eysenck (1961) found that extraversion was related to an increase in pain tolerance and neuroticism was related to a decrease in pain tolerance and therefore it was predicted that a more extraverted personality would leave their hand in the cold pressor for longer (have an increased pain tolerance) than neurotic participants. It was also predicted that extraverts would stay in the cold pressor longer specifically during the maths condition when compared to the control condition; and that a more neurotic personality would have an increased pain tolerance during the music condition when compared to the control condition. This was predicted mainly because of the theory of OSL; this theory states that when environmental stimulation is below the optimum level for the person, they will attempt to increase it (Raju, 1980). However, these results from the present study do not appear to provide any support for this theory.

In the article by Matthews and Gilliland (1999), it is described how Eysenck stated that extraverts' optimum stimulation level is much higher than that of neurotics, thus explaining extraverts' characteristic of sensation seeking. Eysenck also suggested that extraverts (and introverts) become aroused at any incoming stimuli, whereas neurotics will become aroused at more emotional stimuli (Matthews & Gilliland, 1999). Therefore, it was predicted that a mentally stimulating task (maths quiz) would engage the extraverted personalities, and a calming piece of music would relax the neurotic personalities. The non-significant results from the first hypothesis do not support these findings as it was found that personality and condition did not interact to have an effect on the time participants' spent in the cold pressor.

Harkins, Price and Braith (1989) found that extraverts and introverts did not differ in their sensory processing of pain, nor did high and low neurotics. Harkins et al (1989) instead found that where their processing did seem to differ is in the way they process the implications of the pain. This would explain why studies have found extraverts to be more likely to keep their hand in the water for longer as they experience little of the implications related to pain, whereas neurotics tend to catastrophize the experience of pain (Ramírez-Maestre et al, 2004). This correlation does not provide any support for this previous research; however it does call into question why these researchers have found these results.

No significant interaction between personality and distraction condition was found and therefore the first hypothesis must be rejected.

The second hypothesis is – personality type (extraversion, neuroticism and psychoticism) will interact with distraction condition to have an effect on the pain ratings participants will give after the task. The first step in testing the third hypothesis was to observe the mean pain ratings throughout the conditions; the control condition was the highest out of the three conditions, with maths being the second highest and music being the lowest. This is what was expected as it was assumed that the experimental conditions where distractors were used would decrease participants' pain and draw attention away from it, while the control condition (with no distractor) would cause the highest pain rating as participant's attention was directed to the pain. However after an ANOVA was conducted, this difference was found to be non-significant. This non-significant result does not provide any support to those studies that found distractors to reduce pain (McCaul & Malott, 1984; Johnson, 2005; Labbé et al, 2007; Nilsson, 2008), however, similar to the first hypothesis, the means do indicate support for this research.

Again, in order to identify if this effect changes with the addition of personality, moderated regression analyses were conducted with personality as the moderating variable. All personality types were found to have no significant interaction with condition when it comes to the pain rating given by participants. When looking at the amount of variance explained by each personality type individually it appears that personality contributes more of the variance to pain rating than to time. Extraversion contributes the most with 6.7%, whereas neuroticism contributes 5.9% of the variance.

Although a lot of research covered in the literature review of the present study identifies that distraction tasks do reduce pain (McCaul & Malott, 1984; Johnson, 2005; Labbé et al, 2007; Nilsson, 2008), there is also a lot of research that states that, while distractors increase pain tolerance, they do not change how different personality types qualitatively describe, or experience, pain (Harkins et al, 1989; Miró & Raich, 1992; Fekracuti & de Carolis, 2005). The findings from the current research do support the findings of these previous studies.

No interaction between personality and pain ratings was found and therefore the second hypothesis must be rejected.

The third hypothesis is – personality type (extraversion, neuroticism and psychoticism) will interact with distraction condition to have an effect on the anxiety score participants will give after the task has been completed. The first step in testing the fifth hypothesis was to observe the mean anxiety scores taken after the task in each condition. The means appear to be very similar, with only slight differences; with music being the lowest, and maths being the highest. An ANOVA confirmed that there was no significant difference between the conditions. Although this result suggests that neither experimental condition had an effect on participants' levels of anxiety, the direction of the means does indicate that participants who took part in the music condition had slightly lower levels of anxiety than those participants who took part in the maths or control conditions. This is as was expected; the premise behind the music condition was to reduce pain by reducing anxiety levels, as previous research has shown to do just this (Salmore & Nelson, 2000; Evans, 2002; Labbé et al, 2007; Nilsson, 2008).

Moderated regression analyses were again conducted for each personality type with personality as the moderating variable. As before, none of the three models tested were significant, indicating that personality had no significant effect on anxiety scores given after the task. However this time extraversion contributed much less of the variance (1.1%) than neuroticism (4.6%), suggesting that neuroticism effects anxiety more than extraversion. This result fits in with theories of neuroticism that describe one major characteristic of the personality type as anxious (Eysenck, 1968). The analysis of the data also indicates that psychoticism provides 9% of the variance in anxiety scores, even more than neuroticism, however, there is no significance to the models.

In Eysenck's writings, neuroticism is often referred to as simply "anxiety"; clearly quite an important trait in the personality type named 'neuroticism' (Eysenck, 1968). Therefore it would be expected that participants with a higher level of neuroticism would also display more anxiety. Many researchers have concluded that anxiety can be decreased with a form of relaxation (Field et al, 1996; Salmore & Nelson, 2000; Ikonomidou et al, 2004), therefore it was expected that neurotics' anxiety levels will be lower after the music task. Although not significant, the means do indicate support for those studies that found music to be an effective relaxation technique. The non-significant findings, however, support those researchers who found that music did not have any effect; such as Aitken et al, 2002 who found no pain reducing effect of music. Kwekkeboom (2003), however, found music to actually irritate the participants, which could suggest an increase in anxiety when listening to music; a finding which was not replicated in the present study.

No significant interaction between personality and condition was found and therefore the third hypothesis must be rejected.

The fourth hypothesis is – there will be an effect within distraction condition on anxiety before and anxiety after the task. From observing the means for anxiety before and anxiety after, there appears to be an increase from before to after. This difference was found to be significant after a t-test was conducted. This difference indicates that something was increasing participants' anxiety levels during the task, either the cold pressor (which appears most likely) or the tasks themselves. This result also indicates that participants were not experiencing much anticipatory anxiety, and that, rather than being nervous about completing the experiment, they were likely to become more anxious during the task. As Rhudy and Meagher (2000) found, participants who are anxious before the task begins are more likely to experience increased pain.

In the control condition there was a significant increase from anxiety before to anxiety after, however the difference was not significant in the music and maths conditions. This suggests that the experimental conditions did prevent participants' anxiety from increasing to a significant degree, indicating the effectiveness of the distractors as good methods of anxiety reduction. It can be noted however, that the t-test conducted on the music task is very nearly significant; this indicates that the maths task was the distractor that appeared to stop participants' anxiety levels increasing during the task the most. As previous research has stated – a distraction will be most effective if it reduces the distress of the patient (McCaul & Malott, 1984). Although the maths quiz did not reduce participants' anxiety, it did appear to stop it increasing as much as during the control and music tasks. There has been no research that has investigated the effects of attentionally demanding tasks on levels of anxiety, and therefore this finding is new and cannot be compared to any previous research. This finding, however, suggests that attentionally demanding tasks do have some sort of effect upon anxiety levels; it is possible that, because participants were concentrating on the task, they were not becoming significantly more anxious from the pain caused by the cold pressor. It should be noted that the anxiety level taken before the task started appears to be much higher in the maths task than in the control or music conditions, it is also possible that this could have had something to do with the non-significant result of the t-test.

It was expected that the music condition would reduce levels of anxiety from before to after, therefore the music used in the task was chosen to be relaxing and calming and, as previous research suggests, was chosen to attempt to reduce participants' anxiety in the hope of reducing their pain levels. Salmore and Nelson (2000) found that relaxation music significantly reduced participants' blood pressure, indicative of an anxiety reducing effect. However, Aitken et al (2002) and Kwekkeboom (2003) both found music to either have no effect or even to irritate and annoy the participant or patient. This could be an effect experienced in the present study; the music used may not be to the participants' specific tastes. Labbé et al (2007) found that a self-selected piece of music was the most effective at reducing anxiety and increasing relaxation out of several other genres. Perhaps in further research it would be beneficial to allow the participants to select a preferred piece of music from a selection given.

From looking at the mean anxiety level measured after the task for each condition, it can be seen that anxiety is highest after the experimental conditions. Although this may be expected in the maths condition, it is not expected in the music condition. Previous research suggests that music is an effective relaxation technique (Field et al, 1996; Salmore & Nelson, 2000; Ikonomidou et al, 2004), and although some research has found no relaxing effect of music (Aitken et al, 2002; Kwekkeboom, 2003), it was expected that music would lead to lower anxiety levels. While it cannot be said that it was the music task that increased anxiety, it can be said that this distraction did not reduce anxiety as it was intended.

These differences indicate an effect within condition on anxiety before and anxiety after the task and therefore the fourth hypothesis can be accepted.

The fifth hypothesis is – there will be an effect within distraction condition on the relationship between anxiety and pain tolerance. No significant correlation was found between anxiety measured before the task and time; Al Absi and Rokke (1991) found that participants who were made highly anxious about the pain they were about to experience had a much lower pain tolerance than those who were given reassurance about the task. The results of the current study do not support this as there was no relationship between the levels of anxiety before and time spent in the cold pressor. This could be due to the participants not being completely aware of how cold the water was, or perhaps being in a secure environment meant they felt nothing too painful would happen to them.

A significant negative correlation was found between anxiety recorded after the task and pain tolerance over all conditions, however no significant correlations were found between anxiety measured after the task and pain tolerance in any of the conditions separately. The correlations that were found in each condition, while non-significant, were of moderate strength, and all were negative, as demonstrated in Figures 4 – 6 (pp.44-45). The significant correlation found over all conditions can be seen in Figure 3 (p.43). The direction of the correlations suggests that the more anxious a participant became during the task, the quicker they were likely to take their hand out of the cold pressor, which supports research of both Al Absi and Rokke (1991) and Rhudy and Meagher (2000) who found results that indicate anxiety worsens the experience of pain. The correlation could also indicate that the more time the participant spent in the cold pressor, the less anxious they were; suggesting that they became used to the sensation of the cold water, and therefore were desensitised.

From examining the correlation in Figure 2 (p.x), it can be seen that there is not an even spread of data over the time scale – i.e. there are a lot of participants who took their hand out quite quickly, and a lot who kept their hand in for the full length of time, while the participants at the low end of the time scale appear to have given quite a varied response with regards to anxiety scores, the participants who stayed in the water longest appear to have consistently given low anxiety scores. This suggests that the second interpretation of the correlation is true; that participants became desensitised the longer they stayed in the water for.

These findings mean that the fifth hypothesis can be partially accepted; no relationship was found between anxiety before the task and time, however a relationship was found between anxiety measured after the task and time over all participants.

The sixth hypothesis is – there will be an effect within distraction condition on the relationship between anxiety and pain rating given after the task. The correlation between anxiety before the task and pain rating was not significant. There was, however, a significant positive correlation between anxiety measured after the task and pain rating. This finding suggests either one of two things; either that the more anxious the participant became, the more the cold pressor hurt, or the more the cold pressor hurt the participant, the more anxious they became. This second explanation seems most likely, especially when combined with the previous finding that participants spent less time in the cold pressor if they felt more anxious – this would suggest that they were also feeling more pain. The disadvantage with testing data using correlations is that causality cannot be established; i.e. it cannot be said which variable influenced the other, however, the findings can be compared to other research to attempt to find an explanation. The following studies have all found that when anxiety is induced into participants, it increases the amount of pain they experience; Al Absi and Rokke (1991), Rhudy and Meagher (2000) and Vaughn et al (2007).

There was no relationship found between personality and pain ratings, whereas, upon testing this hypothesis, a relationship between anxiety and pain ratings has been found. This suggests that anxiety has much more of an effect on the qualitative experience of pain than personality does. When compared between conditions, no significant correlation was found – however in the music condition the correlation was positive and fairly strong, suggesting that this effect was strongest in that condition. When looking at Figure 6 (p.x) it can be seen that there are a higher number of data points with a low anxiety score and a low pain rating, suggesting that the majority of participants were less anxious in the music condition. Although it cannot be said that this correlation provides support for previous research such as Field et al (1996), Salmore and Nelson (2000) and Ikonomidou et al (2004) who all found that relaxation does decrease anxiety, it does indicate in this direction.

The sixth hypothesis can be accepted as, not only is there a relationship between anxiety after and pain ratings over all participants, there also appears to be an effect within condition on these two variables.

The seventh hypothesis is – there will be an effect within distraction condition on the relationship between pain tolerance and pain rating given after the task. A significant negative correlation was found between time spent in the cold pressor and pain rating, meaning that the longer a participant kept their hand in the water, the lower their pain rating would be. This contradicts what would generally be expected as it would be assumed that the longer the participant is exposed to a painful stimulus, the more pain they would experience, however, there is a reasonable explanation for these results. Desensitisation could have occurred, meaning that the longer the participants kept their hand in the water for, the less sensation they felt, and therefore the less pain. Those participants, who kept their hand in the water for less time and felt more pain, just may have had less willing to stick with the pain and taken their hand out more or less straight away. This theory is supported by the significant negative correlation found between anxiety and pain tolerance in which it was assumed (due to the spread of data in Figure 2; p.x) that participants who kept their hand in the water for longer gave low anxiety scores due to desensitisation.

This correlation could also indicate that the less pain the participant was feeling, the longer they would keep their hand in the water for, or the more pain they were feeling, the quicker they took their hand out of the water; this explanation appears more reasonable and logical than desensitisation, however both are likely possibilities. Unfortunately, the disadvantage with using correlations to test these results is that causality cannot be established.

Significant negative correlations were found between time and pain ratings in the music task, but not in the control or maths tasks, however the correlation in the maths task was of moderate strength. This indicates that it is possible that both the experimental distraction conditions distracted the participants for long enough to force them to become desensitised to the pain from the cold pressor, and thus keep their hand in the water for much longer than in the control condition. The correlation between time and pain ratings in the music task can be seen in Figure 10 (p.x), this scatter graph shows a clear cluster of data points at a high pain rating, and low time, thus suggesting that the majority of participants who completed the music task felt a lot of pain and therefore took their hand out of the water very quickly. The correlation found in the maths task is very similar (see Figure 9; p.x), as well as the correlation between the two variables over all conditions (Figure 7; p.x). This clearly suggests that the more painful the participants find the cold pressor, the quicker they will take their hand out of the water. While no correlation whatsoever was found in the control condition, when observing the scatter graph (Figure 8; p.x) it appears that the majority of data points lie in the area of low pain ratings. While it was expected that participants would take their hand out the water quicker if experiencing more pain, it was also assumed that the experimental conditions would result in lower pain ratings than in the control condition, due to the participants being distracted from the pain, which did not occur.

These correlations indicate that there was an effect within condition on the relationship between time spent in the cold pressor and pain rating; therefore the seventh hypothesis can also be accepted.

Limitations

When comparing the methodology of the current study to that of other studies that test a similar theory, it differs considerably. The majority of research that focuses on the effectiveness of distraction tasks tends to focus on one particular type of distractor; either comparing different methods of relaxation (Good et al, 1996/1999/2001/2005/2010; Aitken et al, 2002; Kwekkeboom, 2003; Roykulcharoen et al, 2004), or attempting to find the best attentionally demanding distractor (Bellieni et al, 2006; Dahlquist et al, 2007/2009; Jameson et al, 2011). None, however, focus on a comparison between the two. However, the problem faced with this methodology is that it is difficult to tell whether either task actually works to its purpose and distracts the participant from the pain they are experiencing. To attempt to combat this issue, the current study included a baseline, or control, condition. This was used to compare the two experimental conditions to a condition in which no distractor was used. Although the two distractors appeared to produce a higher pain tolerance than the control in their means, the difference was not significant.

Amongst the limitations mentioned already in this discussion, the biggest issue with the present study is the small sample size. The addition of a baseline condition also added to the study's issue of small sample size. The use of three different conditions affected this as it meant what few participants were used were spread across three conditions. There is a possibility that this small sample size caused Type I errors, i.e. caused non-significant results to be found and the hypothesis to be rejected when in fact the hypothesis was true. This was especially likely to occur in the correlations where each distraction condition was correlated separately as only 14 participants were in each condition. Some correlations were strong enough to expect a significant result, however no significant result was found, due to this small sample size. Therefore further research should take this into consideration and use a much larger sample size. The small sample size in the current study is due to a reluctance of volunteers to take part in a study involving pain

The measures used in research can be a big issue; the Eysenck Personality Questionnaire (EPQ) was used to measure participants' personalities. This was an easy decision as the theory was based around Eysenck's theory of personality. However, in order to measure participants' pain ratings, a few more choices had to be assessed, in the end a Numerical Rating Scale (NRS) was used. This measure was chosen over measures such as the McGill Pain Questionnaire (MPQ) as it measures more quantity of pain over quality, which is what was desired for the purposes of the current study. It was also chosen over similar measures such as the Visual Analogue Scale (VAS) as some research has shown that some participants have difficulties completing the scale. However, in retrospect it may have been more useful to have used the VAS as this would have given a broader range of results as it is measured on a scale of 1 to 100, whereas the NRS is only measured between 1 and 10.

The method of the current study allowed for a comparison to be made across many different variables – something that previous research has omitted. In his book *The Biological Basis of Personality* (1967), Eysenck stresses the importance of not just making comparisons between extraverts and introverts, and neurotics and stable personalities, but also between extraverts and neurotics. The current study has enabled this comparison by taking measures of not just the extraversion and neuroticism scales, but also the psychoticism scale. This would have benefitted, however, by having participants who measured at the extreme of each scale as well as in between, and knowing the participants' personality scores before the experiment began. This would have enabled the even distribution of personalities between conditions and would have allowed for a fairer examination of the hypotheses.

Further Research

The present study examined the effect personality has on the experience of pain, and while there appears to be no significant effect, further research could be conducted with attention to the limitations mentioned above. However, there is some research surrounding distractions that focuses upon the use of Virtual Reality (VR). Similarly to Hoffman et al (2000/2004) (as mentioned in the literature review of the present research), Gold, Kim, Kant, Joseph and Rizzo (2006) found that a control condition during a paediatric Intravenous (IV) placement increased participant's pain by four, compared to a condition using a VR distraction, in which no increase of pain was found. Other research has found the same (Gershon, Zimand, Pickering, Rothbaum & Hodges, 2004; Furman et al, 2009). Malloy and Milling (2010) conducted a review on the subject which found VR to be an effective distractor in both experimentally induced pain and burn injury care. The majority of this research, however, uses very small sample sizes due to the equipment necessary to test the distraction, as well as using children for the sample population. More research should be conducted into the area of VR distraction, but with larger and more generalisable samples, as it has been shown to be more immersive and effective than other, passive distractions.

An interesting addition to research around VR would be the measurement of anxiety; the present research has shown anxiety to be an important contributing factor to the area of distraction research, and to test whether the VR distraction decreases participants' anxiety levels more or less than a 'regular' distraction. At present it appears that not much research has been conducted with a VR distraction and accounting for the presence of anxiety in participants. Morris, Louw and Grimmer-Somers (2009) conducted a systematic review into the effectiveness of VR in reducing pain and anxiety in burn injury patients; they found that out of the nine studies reviewed, only three accounted for anxiety. They specifically state that further research should assess the effect of VR on anxiety.

Conclusion

The present study combined several concepts in the area of pain research. It is difficult to make a comparison between the overall findings of the current study and that of previous research as not only have no other researchers investigated the difference between distraction type (relaxation or cognitively demanding), but there has been no research conducted into the interaction between this and personality type. This was the main aim of the study; to attempt to find an interaction between distraction type and personality type, and to examine whether they had a combining effect on various variables – pain tolerance, pain rating and anxiety.

From the data gathered, however, it would appear that personality does not have that much, if any, interaction with the type of distraction used, nor does it appear to have much of an effect on tolerance levels. What does seem to have the most impact on the variables tested is anxiety. Anxiety had significant correlations with personality; time spent in the cold pressor and participants' pain ratings. Although the effect of personality on pain was the main focus of the present study, these findings are still very interesting. The findings, with relation to anxiety, are in support of some of the research previously discussed, for example; Al Absi and Rokke (1991) and Rhudy and Meagher (2000) who found that anxiety increases the amount of pain experienced. The findings are also contradictory to some others; Field et al (1996), Salmore and Nelson (2000) and Ikonomidou et al (2004) who found music to be an effective form of relaxation. However in this respect the results replicate those of Aitken et al (2002) and Kwekkeboom (2003) who found that patients felt music to be irritating and annoying.

The most important findings gained from the present study are as follows;

1. Extraverts spent significantly less time in the cold pressor in only the control condition, suggesting that extraverts may become bored and therefore do need stimulation in order to distract them from pain.

2. Anxiety significantly increased from before the task began to after, suggesting that something made participants more anxious during the task – most likely the pain experienced from the cold pressor.

3. The maths task prevented this anxiety from increasing to a greater degree than the music or control conditions. It was expected that if any task should do this it would be the music task, and therefore this result was unexpected; however this

is possibly because participants were too engrossed in the task to become anxious.

4. The more anxious the participants were, the less time they spent in the cold pressor, supporting research that found anxiety decreases pain tolerance.

5. A significant, positive, correlation was found between anxiety after and pain ratings, suggesting that anxiety also increases the subjective rating of pain.

6. A significant, negative, correlation was found between pain rating and time, suggesting both that the more pain a participant was feeling, the less time the spent in the cold pressor, and that the more time they spent in the cold pressor, the less pain they felt – possibly an indication of desensitisation.

Therefore, although unsuccessful at finding a relationship between personality and type of distraction, the present study has highlighted key areas for further research with some specific areas for improvement. To conclude, the main focus for future research should be upon the effects of anxiety on pain. In a medical setting anxiety levels of patients can be high and therefore the focus should be on reducing these levels of anxiety so the patient feels more relaxed and can cope better with the pain of certain medical procedures.

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Appendices

Appendix One – SREP Application Form

THE UNIVERSITY OF HUDDERSFIELD

School of Human and Health Sciences – School Research Ethics Panel

Kirsty Thomson SREP Administrator: hhs_srep@hud.ac.uk

Name of applicant: Emily Brown

Title of study: The Reaction of Specific Personality Types to Different Types of Distraction Tasks

Department: Psychology Date sent:

Issue	Please provide sufficient detail for SREP to assess strategies used to address ethical issues in the research proposal
Researcher(s) details	Emily Brown (student)
Supervisor details	Dr Peter Moxon Dr David Peebles
Aim / objectives	Much research has been conducted into discovering the most effective distraction task to distract from pain; however this research often finds different results. Some research suggests that the most effective distractor is an active task (Jameson, 2011), whereas some find relaxation to be the most effective (Good et al, 1999). Research has found that extraverts have a significantly higher pain tolerance level than neurotic personalities (Lynn and Eysenck, 1961; Shiomi, 1978; Fekracuti and de Carolis, 2005). The aim of this study is to determine whether different types of distraction tasks have a different effect on different personality types.
Brief overview of research methodology	The Eysenck Personality Questionnaire (EPQ) will be used to determine participants' personalities as research shows that extraverted and neurotic personality types respond to pain differently (Lynn and Eysenck, 1961; Shiomi, 1978; Fekracuti and de Carolis, 2005; Paine et al, 2009). To induce the experimental pain in my participants I will use a commonly use method of pain induction; a Cold Pressor, where participants submerge their hand or forearm in cold water (Shiomi, 1978; Fekracuti and de Cardis, 2005; von Baeyer et al, 2005; Dahlquist et al, 2007). This has been used safely with a ceiling time of five minutes (Mitchell, MacDonald and Brodie, 2004). Research has found that an active distraction task is more effective than a passive task (Landolt et al, 2002; Dahlquist et al, 2007; Jameson, 2011). McCaul and Malott (1984) discovered that a distraction task that was cognitively demanding was more effective.

	Therefore one of the distractions used in the current study will be an active, cognitively demanding maths quiz. Pain increases stress levels (Terkelson et al, 2004) therefore it makes sense that a distraction task that reduces stress will be more effective (McCaul and Malott, 1984). Relaxation distraction methods have been found to be very effective, especially at reducing post-operative pain (Good et al, 1999; Good et al, 2001; Good et al, 2004; Good et al, 2005; Brunner and Suddarth, 2009). Therefore the second distractor will be a six minute piece of relaxing music. Cornwall and Donderi (1988) discovered that anxiety increases pain, therefore participants will complete a short version of the Spielberger State-Trait Anxiety Inventory (Marteau and Bekker, 1992) both before and after completing the Cold Pressor Task in order to determine participants' change in anxiety levels during the experiment. The purpose of this measure is to determine whether decreasing participants' anxiety levels makes a distraction task more effective. Participants will also complete a simple Numerical Rating Scale (NRS) – a scale from 0-10 (0 being no pain, 10 being the worst pain), this has been found to be a valid measure by many researchers, including; Paice and Cohen (1997) and Hawker et al (2011).
Study Start & End Date	Start Date: 01/10/12 End Date: 31/09/13
Permissions for study	N/A
Access to participants	Participants will be recruited using the University's SONA system as well as emails sent to University students (please see "Letters" section of form).
Confidentiality	Participants' consent forms (which will contain personal details, including their name and age) will be stored securely and away from the study data. Any data stored electronically will be password protected in order to ensure security.
Anonymity	Participants' consent forms will be marked with their participant number. This will allow me to remove their data from the results, should they request this.
Psychological support for participants	N/A
Researcher safety / support (attach complete University Risk Analysis and Management form)	Risk Assessment Form attached.
Identify any potential conflicts of interest	N/A
Please supply copies of all relevant supporting documentation electronically. If this is not available electronically, please provide explanation and supply hard copy	
Information sheet	

	Information sheet is attached (one for participants in experimental condition, one for participants in control condition)
Consent form	Consent form is attached, including an inclusion form which contains questions regarding participants' health status to determine whether they will be able to take part.
Letters	Hi everyone, My name is Emily and I am a Psychology Masters student looking to recruit participants for an experiment. The purpose of this project is to attempt to investigate the relationship between personality and how they experience pain. During the experiment your personality will be measured and you will complete a simple task whilst your hand is submerged in cold water. The experiment will only take about 15 minutes of your time, however you will not be able to take part if you have any skin conditions on your hand that are worsened by the cold, or Raynaud's disease. First years will receive 1 credit for taking part via SONA. For more information or time slots please email me on u0956630@hud.ac.uk Thank you!
Questionnaire	Eysenck Personality Questionnaire (EPQ), Numerical Rating Scale (NRS) and a short-form of the Spielberger State-Trait Anxiety Inventory (STAI)
Interview guide	N/A
Dissemination of results	Master's thesis, and may be presented at a conference and/or published in a psychology journal.
Other issues	N/A
Where application is to be made to NHS Research Ethics Committee / External Agencies	N/A
All documentation has been read by supervisor (where applicable)	Please confirm. This proposal will not be considered unless the supervisor has submitted a report confirming that (s)he has read all documents and supports their submission to SREP

All documentation must be submitted to the SREP administrator. All proposals will be reviewed by two members of SREP. If you have any queries relating to the completion of this form or any other queries relating to SREP's consideration of this proposal, please contact the SREP administrator (Kirsty Thomson) in the first instance – hhs_srep@hud.ac.uk

Approved: P. Moxon & D. Peebles (Supervisors).

Appendix Two – SREP Amendments Application

THE UNIVERSITY OF HUDDERSFIELD

School of Human and Health Sciences – School Research Ethics Panel

AMENDMENTS TO PROPOSAL

Proposal received from: Emily Brown
Title of study: The Reaction of Specific Personality Types to Different Types of Distraction Tasks

Issue	**Please clearly identify below revisions made to SREP application in light of requested amendments.**
Researcher(s) details	
Supervisor details	
Aim / objectives	The objective of this study is to understand whether different personality types (extravert/introvert, neurotic/stable) respond better to a relaxing distractor or a cognitively demanding distractor, as well as to attempt to determine whether decreasing participants' anxiety levels has an effect on their pain experience.
Methodology	
Permissions for study	An application has been made to SREP to undertake this study.
Access to participants	
Confidentiality	The data collected from the experiment will be kept for a period of five years and then destroyed. It will be destroyed by formatting the memory stick it will be stored on.
Anonymity	

Psychological support for participants	Participants' will be asked to complete a form to confirm they eligible to take part in the experiment (i.e. have no skin condition worsened by the cold, no poor circulation or Raynaud's disease and no heart conditions or a history of heart disease – please see attached form entitled "Inclusion Form"). If participants answer 'Yes' to any of these questions they will not be able to take part in the experiment. In case of any participants being unaware they have any of the above mentioned health problems, such as Raynaud's disease, and experiences distress or pain because of this, a separate bucket of slightly warm water will be kept to the side for the participants to place their hand in to slowly warm their fingers back up.
Researcher safety / support (attach complete University Risk Analysis and Management form)	
Information sheet	
Consent form	
Letters	
Questionnaire	
Interview schedule	
Dissemination of results	
Other issues	
Where application is to be made to NHS Research Ethics	

Committee	
All documentation has been read by supervisor (where applicable)	

Signed: ___________E.Brown_______________________________________

(SREP Applicant – electronic signature acceptable)

Date: __________15/01/13____

Appendix Three – Risk Assessment Form

ACTIVITY: Experiment			Name: Emily Brown	
LOCATION: University of Huddersfield			Date:	Review Date:

Hazard(s) Identified	Details of Risk(s)	People at Risk	Risk management measures	Other comments
Cold Pressor Task	Cold burns or frostbite	Participants	Temperature of the water will be monitored, and participants will be told to take their hand out of the water after 5 minutes. Participants will be given a bucket of warm water with which to warm their hands after they take them out of the cold water	
Water next to electrical equipment	Water could spill onto equipment and shock participant and damage equipment	Participants	The water will be in a tall bucket (to avoid splashes) and will be placed carefully on a towel on a flat chair as far away from the computer as possible. Precautions will be taken to ensure that no water spills from the bucket	

Appendix Four – Participant Information Sheet (Control)

Thank you for expressing interest in taking part in this experiment. This information sheet will provide you with information about the purpose of the study, and what will take place during the study. Please feel free to ask any questions regarding the study after reading the information sheet. You do not have any obligation to consent to take part in the study by reading this; you can decline to take part at any time. If you do agree to take part you will be asked to sign a consent form, then give some brief health information to determine if you are able to take part.

You will begin by filling out a personality questionnaire called the Eysenck Personality Questionnaire (EPQ). How to complete this will be explained further when you are given the questionnaire.

You will then be asked to submerge your non-dominant hand in a bucket of cold water until it becomes too uncomfortable to stand; you are completely in control of when you withdraw your hand. After you have withdrawn your hand, you will be given a bucket of warm water to warm up your hand, and a towel to dry it with.

Finally you will be asked to complete a short questionnaire to establish the intensity of the pain and discomfort you felt whilst your hand was in the water.

Although you may experience some discomfort whilst you have your hand submerged in the water, this is purely temporary and will not cause any damage. You are able to withdraw your hand at any point during the experiment. At any point you have the free decision to stop taking part and withdraw from the study completely.

If you wish then you are also able to withdraw your results from the study completely by contacting me, Emily Brown, on the email address given below, requesting your data be removed from the study and quoting your participant number.

If you have any questions please contact me, Emily Brown, via email;

u0956630@hud.ac.uk

Appendix Five – Participant Information Sheet (Experimental)

Thank you for expressing interest in taking part in this experiment. This information sheet will provide you with information about the purpose of the study, and what will take place during the study. Please feel free to ask any questions regarding the study after reading the information sheet. You do not have any obligation to consent to take part in the study by reading this; you can decline to take part at any time. If you do agree to take part you will be asked to sign a consent form, then give some brief health information to determine if you are able to take part.

You will begin by filling out a personality questionnaire called the Eysenck Personality Questionnaire (EPQ). How to complete this will be explained further when you are given the questionnaire.

You will then be asked to submerge your non-dominant hand in a bucket of cold water until it becomes too uncomfortable to stand; you are completely in control of when you withdraw your hand. You will be given a simple task to complete whilst your hand is submerged, it is important to remember that the experiment does not rely on your successful completion of the task, so please do not feel you need to withdraw if you make a mistake. After you have withdrawn your hand, you will be given a bucket of warm water to warm up your hand, and a towel to dry it with.

Finally you will be asked to complete a short questionnaire to establish the intensity of the pain and discomfort you felt whilst your hand was in the water.

Although you may experience some discomfort whilst you have your hand submerged in the water, this is purely temporary and will not cause any damage. You are able to withdraw your hand at any point during the experiment. At any point you have the free decision to stop taking part and withdraw from the study completely.

If you wish then you are also able to withdraw your results from the study completely by contacting me, Emily Brown, on the email address given below, requesting your data be removed from the study and quoting your participant number.

If you have any questions please contact me, Emily Brown, via email;

u0956630@hud.ac.uk

Appendix Six – Consent Form

Thank you for considering taking part in my experiment, please could you answer the following questions. The intention is to confirm that you know the purpose of the study and that you are willing to take part.

Are you clear on the purpose of the study and have you have you had the chance to ask about it?

Yes ☐ No ☐

Do you understand that you can withdraw from the study at any stage?

Yes ☐ No ☐

Do you understand that you may experience some discomfort during the experiment?

Yes ☐ No ☐

Do you give your consent for your results to be used in the research report, which may be read by others or published later, on the condition that you will remain anonymous?

Yes ☐ No ☐

I give my consent to take part and for the use of my data.

Signed: ____

Name: ____ **Date:** _____ / _____ / _____

Appendix Seven – Inclusion Form

Thank you for consenting to take part in my experiment, please could you answer the following questions. The intention is to confirm that you have no medical condition that could affect you taking part in this experiment.

Age:

Gender: Male ☐ Female ☐

Do you suffer from any skin condition that is worsened by the cold? (For example; eczema)

Yes ☐ No ☐

Do you have a history of poor circulation or Raynaud's disease?

Yes ☐ No ☐

Do you have any heart conditions or a history of heart disease?

Yes ☐ No ☐

Signed: ____

Name: ____ **Date:** _____ / _____ / _____

Appendix Eight – EPQ-R (Short Form)

EPQ-R SHORT SCALE

	Age	Sex M / F	P	E	N	L

INSTRUCTIONS: Please answer each question by putting a circle around the 'YES' or 'NO' following the question. There are no right or wrong answers, and no trick questions. Work quickly and do not think too long about the exact meaning of the questions.

PLEASE REMEMBER TO ANSWER EACH QUESTION

1	Does your mood often go up and down?	YES	NO
2	Do you take much notice of what people think?	YES	NO
3	Are you a talkative person?	YES	NO
4	If you say you will do something, do you always keep your promise no matter how inconvenient it might be?	YES	NO
5	Do you ever feel 'just miserable' for no reason?	YES	NO
6	Would being in debt worry you?	YES	NO
7	Are you rather lively?	YES	NO
8	Were you ever greedy by helping yourself to more than your fair share of anything?	YES	NO
9	Are you an irritable person?	YES	NO
10	Would you take drugs which may have strange or dangerous effects?	YES	NO
11	Do you enjoy meeting new people?	YES	NO
12	Have you ever blamed someone for doing something you knew was really your fault?	YES	NO
13	Are your feelings easily hurt?	YES	NO
14	Do you prefer to go your own way rather than act by the rules?	YES	NO
15	Can you usually let yourself go and enjoy yourself at a lively party?	YES	NO
16	Are *all* your habits good and desirable ones?	YES	NO
17	Do you often feel 'fed-up'?	YES	NO
18	Do good manners and cleanliness matter much to you?	YES	NO
19	Do you usually take the initiative in making new friends?	YES	NO
20	Have you ever taken anything (even a pin or button) that belonged to someone else?	YES	NO
21	Would you call yourself a nervous person?	YES	NO
22	Do you think marriage is old-fashioned and should be done away with?	YES	NO
23	Can you easily get some life into a rather dull party?	YES	NO
24	Have you ever broken or lost something belonging to someone else?	YES	NO
25	Are you a worrier?	YES	NO

PLEASE TURN OVER

26	Do you enjoy cooperating with others?	YES	NO
27	Do you tend to keep in the background on social occasions?	YES	NO
28	Does it worry you if you know there are mistakes in your work?	YES	NO
29	Have you ever said anything bad or nasty about anyone?	YES	NO
30	Would you call yourself tense or 'highly-strung'?	YES	NO
31	Do you think people spend too much time safeguarding their future with savings and insurance?	YES	NO
32	Do you like mixing with people?	YES	NO
33	As a child were you ever cheeky to your parents?	YES	NO
34	Do you worry too long after an embarrassing experience?	YES	NO
35	Do you try not to be rude to people?	YES	NO
36	Do you like plenty of bustle and excitement around you?	YES	NO
37	Have you ever cheated at a game?	YES	NO
38	Do you suffer from 'nerves'?	YES	NO
39	Would you like other people to be afraid of you?	YES	NO
40	Have you ever taken advantage of someone?	YES	NO
41	Are you mostly quiet when you are with other people?	YES	NO
42	Do you often feel lonely?	YES	NO
43	Is it better to follow society's rules than go your own way?	YES	NO
44	Do other people think of you as being very lively?	YES	NO
45	Do you always practise what you preach?	YES	NO
46	Are you often troubled about feelings of guilt?	YES	NO
47	Do you sometimes put off until tomorrow what you ought to do today?	YES	NO
48	Can you get a party going?	YES	NO

PLEASE CHECK THAT YOU HAVE ANSWERED ALL THE QUESTIONS

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Appendix Nine – State-Trait Anxiety Scale (STAI)

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the most appropriate number to the right of the statement to indicate how you feel right now, at this moment.

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 your present feelings best.

	Not at all	Somewhat	Moderately	Very Much
1. I feel calm	1	2	3	4
2. I am tense	1	2	3	4
3. I feel upset	1	2	3	4
4. I am relaxed	1	2	3	4
5. I feel content	1	2	3	4
6. I am worried	1	2	3	4

Appendix Ten – Numerical Rating Scale (NRS)

How bad was the pain you felt during the task? (0 being no pain at all and 10 being severe pain)

Please mark your choice with an ‘x’