Manchester Metropolitan University

Investigating occupational stress utilising the dot probe task to elicit attentional bias in food retail employees

Pete Tendyra

March 2011

Investigating occupational stress utilising the dot probe task to elicit attentional bias in food retail employees

ABSTRACT

Research continually demonstrates anxious individuals hold an attentional bias towards threatening stimuli. This study aimed, in a new application of the dot probe paradigm, to investigate attentional bias for occupational stress in a retail setting. Opportunity sampling was used to select 48 colleagues from food retail companies. Each completed a word dot probe task containing occupational stress related (OSR) and neutral words before completing an occupational stress questionnaire to divide them in to higher or lower stress groups. Attentional bias was found in the higher stress group when the probe appeared in a position congruent to the OSR word, $t(22)=2.79$, $p=.011$. This shows that the higher stressed individuals reacted significantly faster in terms of their reaction to the location of the probe when it appeared congruent to an OSR word. No other significant effects were found. Future research should aim to refine dot probe methodology in order to continually develop this as an objective measure of occupational stress.

KEY WORDS:	**ATTENTIONAL BIAS**	**OCCUPATIONAL STRESS**	**DOT PROBE**	**RETAIL**	**WORD STIMULI**

Introduction

Attentional bias

Attentional bias refers to the tendency to 'selectively allocate processing resources towards threat stimuli' (Mogg et al., 1994 p.841). Siegle (1999) describes attentional bias as being the 'cognitive over arousal to negative stimuli [which] invokes stress associated with negative effect'. Furthermore, individuals tend to have 'difficulty disengaging from threat related material' (Amir et al., 2003 p.1326). Attentional bias has been argued to be an adaptive process; the ability to attend to and recognise threatening stimuli aids an organism's chances of survival (Amir et al., 2003; Fox et al., 2002; Maidenberg et al., 2006; Segerstrom, 2001). Individuals are perhaps therefore primed toward the recognition of negative stimuli. Attentional bias, according to Fox et al. (2002) may result from fear, with individuals attempting to identify threatening stimuli in the vicinity (Morris et al., 1996). It has also been argued that each individual's attentional bias is different, reflecting a preparedness; a 'biased recall for threatening information that was significant at some time' (Kulas et al. 2003 p.104).

Posner (1988) attested that the process of spatial attention allocation, as evident in the dot probe method of attentional bias measurement, is not a singular process but divided into four smaller sub-processes. Activity is initially interrupted then disengagement from that stimulus occurs. Attention then shifts toward the novel, threatening stimulus before attention is engaged on the threat. Individuals become increasingly more alert toward the threat. However, although many theorise as to the aetiology of attentional biases and the processes involved in their formation, 'the precise nature of this mechanism is unclear' (Kulas et al., 2003 p.104).

Fox (1994) suggested that inhibition failure may be crucial in maintaining attentional biases. Fox (1994) contested that some individuals are capable of inhibiting negative, threat related stimuli, which is why they do not show an attentional bias to threat. In those who do show bias, the inhibitory system must be deficient.

It has been contested that 'anxiety related words have emotional meaning and attention is drawn to these words, creating an attentional bias' (Kulas et al., 2003 p.104). A substantial amount of research has focussed on attentional bias in both clinically and non-clinically anxious individuals (Fox et al., 2002; MacLeod et al., 1986; Mogg & Bradley, 2005; Mogg et al., 1992; Mogg et al., 1994). Early attentional bias research focused on the Stroop colour naming task (Stroop, 1935). This requires subjects to name the colour of the word rather than semantic content. A wide range of studies have found an attentional bias to threat in anxious subjects using this task (Fox, 1993; Mathews & MacLeod, 1985; Mogg et al., 1989; Ray, 1979).

Contemporary anxiety research favours the dot probe method. A significant advantage the dot probe holds over the Stroop task is that it is possible to observe the spatial allocation of visual attention in the presence of threatening stimuli. Furthermore, extraneous variables in the Stroop such as colour blindness do not impact on the dot probe task. The dot probe paradigm presents word pairs on a screen, one word is 'threatening' whilst the other is neutral. The words disappear and a small dot appears in the location of one word for the participant to identify as quickly as possible. Although a word-based dot probe shall be employed for this investigation, consistent with much previous research, pictorial dot probe tasks have also been applied to anxiety (Koster et al., 2005; Koster et al., 2006; Mogg & Bradley, 1999).

Stress and anxiety are inextricably linked; the debilitating nature and varying strengths are only two shared characteristics. Stress, it could be argued, is a form of anxiety. 'Anxiety is the psychophysiological signal that the stress response has been initiated' (Robinson, 1990 p.935). It is reported that when stressed, anxious participants show increased attending to threat related stimuli (Mathews & MacLeod, 2002).

Williams et al. (1997) attested that anxious individuals selectively process threatening material. Mogg et al. (1993) found that anxious rather than depressed individuals displayed a greater attentional bias toward threatening stimuli, suggesting a potential attentional processing deficiency in anxious individuals. A follow up study utilising the dot probe method rather than the Stroop task again found that anxious, rather than depressed individuals, displayed a greater attentional bias toward threatening information (Mogg et al., 1995). Social phobics show selective attentional bias toward threat stimuli where control individuals do not (Asmundsen & Stein, 1994). Maidenburg et al. (1996) further this, contesting that social phobic anxiety sufferers show an attentional bias to social threat words in comparison to panic disorder sufferers who attend to a more general set of threat words. Healthy controls in this study again showed no attentional bias to threat.

Broadbent and Broadbent (1988) argued that trait anxiety rather than state anxiety produced larger attentional biases. Muris et al (2003) found that those high in trait anxiety were susceptible to a more sensitive threat perception and had lower 'threat thresholds'. This could be due to the chronic nature of trait rather than state anxiety. For those low in trait anxiety, according to MacLeod and Mathews, (1988), the threat must be stronger to elicit a response. This, it is anticipated, shall also be evident in the present study regarding stress status. It is apparent therefore that individuals with severe (and even mild) anxiety show an increased sensitivity toward aversive stimuli.

The role of occupational stress

The study of stress is diverse (Moore & Cooper, 1998) and has been explored from different angles. Some, such as Cannon (1932) and Selye (1956) argue stress is a response to environmental stimuli, while others recognise a transactional aspect, where stress is the outcome of an interaction between the individual and the environment (for an overview see Cox (1978)).
Powell and Enright (1990) estimated that stress can be a causal factor in up to 80% of health problems and disorders. It is undeniable that stress is currently a critical issue, with the estimated cost of lost work days annually at four billion

pounds and rising (Williams & Cooper, 1998). In the period 2009-10, 9.8 million work days were lost due to employee stress, and some 1.5% of the working population were affected (HSE, 2011). In addition, occupational stress has been shown to be responsible for up to 80% of all workplace injuries, and a shocking 40% of all employee turnover (Atkinson, 2004).

There is still no consensus on a finite definition for occupational stress (Hart & Cooper, 2002). In the most basic of terminology, occupational stress refers to the outcome 'when work characteristics contribute to poor psychological or physical health' (Hart & Cooper, 2002 p.94).

Williams and Cooper (1998) recognise that stress is not an easy topic to research due to the lack of consistent measures available. Self report studies are open to many methodological flaws and biases such as response bias and social desirability bias. These biases are prevalent especially in a business or occupational research setting (Donaldson & Erant-Vallone, 2002).

Selecting a reliable and valid questionnaire to measure such a serious and widespread problem is crucial. The Occupational Stress Indicator (OSI) (Cooper et al., 1988) was considered, until redeveloped, a credible measure of occupational stress. However, Williams (1996) contended that not all of the OSI's scales were reliable. Furthermore, Williams (1994) cited the negative connotations of the term 'stress' in the title. For these reasons, the follow-up to the OSI, the Pressure Management Indicator (PMI) (Williams & Cooper, 1996) shall be employed in this study. The PMI should be applicable to everyone (Williams and Cooper, 1998). In addition, Williams and Cooper (1998) report that all PMI subscales demonstrate Cronbach's Alpha of 0.70-0.89 with the exception of 'Daily Hassles' at 0.64. The figure of 0.70 is that at which a scale is deemed reliable (Nunnally, 1978). Internal consistency has also been verified by Williams and Cooper (1998). The PMI is shorter and therefore more efficient than the OSI, containing 120 items compared with 167. The particular subscale of interest for this research is the 40-item 'Sources of Pressure' subscale, with a Cronbach's Alpha ranging from 0.7-0.84. This is the subscale which provides the greatest insight into workplace stressors.

Methodological factors

A topic of debate surrounding dot probe methodology is that of stimulus onset asynchrony (SOA), regarding the presentation of the word pairs. An SOA of 500 milliseconds is broadly considered an acceptable presentation duration (Fox et al., 2002; MacLeod et al., 1986; Mogg et al., 1994; Mogg et al., 1997).Conversely, Noel et al. (2006) contested that at 500ms, disengagement effects are evident due to the fact that attention can rapidly shift a number of times within that timeframe. This factor could lead to the diminished validity of the task. Others claim attentional bias to still occur at SOAs in excess of 1000ms (Bradley et al., 1997). It has been suggested that it takes up to 200ms to initially orient attention in humans (Duncan et al., 1994). Consequently, too short an SOA, possibly 50-500ms (Fox et al., 2002) could produce automatic reactions and not measure the spatial allocation of visual attention. Bradley et al. (1999), researching attentional bias maintenance, claimed stimulus onset asynchrony (SOA) to be unimportant in displaying an attentional bias; anxious individuals in comparison to controls displayed an attentional bias at both 500ms and 1250ms.

It has been found that the dot probe is susceptible to a mood-congruent response bias (MacLeod et al., 1986). This occurs when attention is directed toward stimuli congruent to an individual's current mood state. This, understandably, confounds validity.

DeRuiter and Brosschot (1994) claim individuals inhibit strongly threatening stimuli. This would in fact increase response latency to threatening words presented, not hasten responses as expected; this is consistent with Bryant and Harvey (1997) who did not find a significant reaction to a strong threat stimulus, yet did for both mildly and moderately threatening stimuli.

Finally, Schmuckle (2005) contends that the dot probe cannot be considered reliable for non-clinical samples due to retest unreliability and contrasting research conclusions. Despite this damning criticism, prior research has vindicated the dot probe's suitability. The dot probe, despite previous criticism, remains a valid method with which to investigate attentional bias.

Many dot probe studies have selected words with the aid of Carroll et al's., (1971) publication on word frequency. The present study shall not use this work as it can be viewed as somewhat outdated due to the dynamic nature of language. In addition, an American publication, such as Carroll et al's., (1971) '*Word Frequency Book*' does not account for the numerous lexical inconsistencies between English and American-English. It is for this reason Kilgarriff's (1996) investigation into word frequency in the British National Corpus, alongside the words selected using this by Reeves (2010), shall form the basis of selecting the neutral, valence-free words for the dot probe word pairs in this study.

Valence has previously been shown to impact on attentional processing (Mogg et al., 2000). 'The valence of a stimulus is important in determining its capacity to capture attention' (Mogg et al., 2003 p.828). Although heavily negative stimuli have a greater chance of attracting attention (Mogg et al., 2000), Martin et al. (1991) contend that anxious individuals also display attentional biases toward positive words. This view is echoed by Lang et al. (2000) who contend that highly positive or negative stimuli elicit attentional biases compared to neutral stimuli. Curiously, Mathews and Klug (1993) contend that stimulus valence does not predict the elicitation of an attentional bias.

The present study seeks to understand whether the concept of attentional bias can be applied to the extensive field of occupational stress. Crucially, the study of occupational stress has never before utilised the dot probe method aimed at identifying attentional bias to threat.

Rationale

The rationale for this investigation is to develop an objective measure of occupational stress. Emphasis is given on attempting to somewhat alleviate biases traditional methods are currently vulnerable to. The dot probe is already an accepted method for measuring anxiety and as outlined, the parallels between anxiety and stress are clear. Although this is fundamentally a new application of the dot probe, it is anticipated that this application shall prove successful. It is hoped that in the future this methodology can be continually adopted to objectively measure occupational stress and to assess the effectiveness of stress management interventions.

Hypotheses

There are two one-tailed hypotheses for this investigation.

1- Those scoring as higher stress on the SOP scale shall respond significantly quicker to the probe replacing an occupational stress related (OSR) word than a neutral word.

2- Those scoring as higher stress on the SOP scale shall respond significantly quicker to the probe in a congruent position to the OSR word than those scoring as lower stress.

Methodology

Design

This study has employed an experimental design, specifically a 2x2 mixed factorial design. The dependant variable was reaction time in milliseconds to the location of the probe. The between subjects independent variable was stress status (either higher or lower) as separated by responses to the 'Sources of Pressure' subscale of the Pressure Management Index (PMI) (Appendix 1). The within subjects independent variable was the position of the dot probe; in a position congruent with the occupational stress related (OSR) word or a position incongruent to the OSR word.

Participants

The target population for this study were 48 individuals; males (N=26) and females (N=22) working within the food retail industry. Opportunity sampling was used to select participants from the target population. No participants were excluded on the basis of gender, age or average hours worked per week. This was both to promote equality and because these variables were not being investigated. One condition of subjects being recruited was that they all held a similar occupational position, Store Assistant level. Management were not approached to partake as the perceived difference in work role was too great and therefore may have skewed the findings of the study. As this was a direct comparison between higher and lower levels of stress, the control group comprised those scoring lower on the Sources of Pressure (SOP) scale of the Pressure Management Indicator (PMI). The employees present at each store visited were all given the opportunity to participate, and participation was wholly voluntary. Recruitment of participants continued until the quota was filled. All participants claimed they were fluent in English therefore able to understand the content of the PMI questionnaire and the words presented in the dot probe test.

Each subject was asked prior to participation what their perceived level of fluency was and their responses, although subjective, were assumed to be correct. Each participant was asked if they had a minimum of six months service within the company. This is to ensure individuals recently taking up employment who may be unfamiliar with the company and their duties were not included in the investigation; their responses may have skewed the final results. Finally, each participant was assigned an identification number. This was solely to be used to enable the matching of questionnaire and dot probe data. The identification number was in no way used to obtain the identity of the participant.

A caveat was that participants wishing to retrieve their data may do so by retaining their identification number and making contact with the researcher in order to obtain it.

Apparatus

To maintain efficiency of data collection, a small yet crucial selection of apparatus was utilised. A quiet area was used for testing to minimise extraneous variables such as noise, interruptions, and general disturbance. Although each store and location in which testing occurred differed, a quiet area was always accessible. The participants were presented with a set of standardized instructions on screen. This was to ensure equality, to prevent any unfair advantage or disadvantage. The standardized instructions were accompanied by an experimental brief (Appendix 2) outlining the participant’s rights, a succinct overview of the experiment, and a section for the subject to sign in order to acknowledge informed consent. A thorough debrief (Appendix 3) was issued post-experiment to notify participants of the test’s nature and researcher’s contact details in case of further issues. A HP laptop with a 15 inch screen was used to deliver participants the dot probe programme. To ensure that each participant was seated the same distance from the screen, a tape measure was used, and the test was administered on a level surface.

A dot probe programme was loaded onto the laptop and used to measure attentional bias. The disc containing the dot probe programme was programmed by a member of the IT support team at Manchester Metropolitan University. Twenty word pairs (consisting of one OSR word and one neutral word per pair) (Appendix 4) were programmed to appear on the screen followed by a dot in either a location congruent or incongruent to the OSR word (on an equal probability of occasions). This appeared an equal number of times at both the top and bottom location. Words were derived from Reeves (2010), whose words stemmed from focus groups and interviews. Additional words were selected with the aid of the researcher’s professional background in food retail management. The additional words were matched for frequency in the English language and syllabic content. This process used the work of Kilgarriff's (1996) analysis of the British National Corpus. All neutral words were as devoid of valence as possible in order to eliminate, as far as practicable, the possibility of emotional responses to neutral words. The Sources of Pressure (SOP) subscale of the PMI (Williams & Cooper, 1996) was used as the self report occupational stress questionnaire. Participants were then divided by this into groups of either higher or lower stress. This questionnaire was employed as it has commendable levels of reliability and validity across its scales (Conbach's alpha ranging from 0.64 to 0.89). The SOP scale itself has Cronbach's alpha ranging from 0.7-0.84 across its eight subscales. The SOP scale contains 40 items and subjects rated their responses on a Likert scale to a set of statements regarding different aspects of workplace stress. Permission has been granted by the authors of the PMI for its usage. Demographic questions (Appendix 5) were included as a means to further analyse the higher and lower stress groupings.

Procedure

Three food retail stores were approached to participate. Once permission was granted to use premises and employees, participants were approached individually. Upon deciding to participate, subjects were seated at a flat surface and the correct distance from the laptop screen before being fully briefed. Upon signing to confirm they gave informed consent to participate, the researcher started the dot probe programme and left the area to avoid distracting or exerting a perceived pressure on the subject. On-screen standardised instructions then appeared before four practise trials of the dot probe experiment began to familiarise participants with the task. A fixation cross was situated in the centre of the screen until the appearance of the word pairs.

Each test consisted of 80 trials. The subject was presented with a word pair for 500 milliseconds, one neutral and one OSR word per pair. Words were located with equal probability above and below the initial central fixation cross, and were presented in a white, upper case font to aid clarity and legibility. When the words disappeared, a small dot appeared in the location of one of the words. When the dot appeared, the subject was required to press one of two clearly labelled keys ('up' for the top location and 'down' for the bottom location) on the laptop keyboard to indicate they had seen the location of the dot, which remained onscreen until the participant had responded. Upon completion of this task, an instruction to call the researcher back appeared. The subject was then thoroughly debriefed on the dot probe task before being given a copy of the PMI.

The questionnaire was presented after the dot probe task to prevent any priming effects that may occur, due to the fact attention may be already by directed toward stress related stimuli, thus skewing dot probe results. Due to time and practicality constraints on testing in the workplace (participants volunteered a portion of their own break time to complete the dot probe task, and organizations graciously agreed to participate), some participants were instructed to complete the PMI alone in a quiet place and to return it to their store manager within one week. A debrief (Appendix 6) was attached to the rear of the PMI to ensure participants were fully debriefed. The researcher collected the completed questionnaires once the allotted time had elapsed. Data analysis then began.

Ethics

Prior to beginning the study, two departmental ethics forms were completed, the PSC Application for Ethics Approval Form (Appendix 7) and the PSC Ethics Check Form (Appendix 8) and signed by the project supervisor. A detailed experimental brief was issued to each participant immediately preceding the commencement of testing. This document outlined the participants' rights, the guarantee of anonymity, and contained a section for each subject to sign before participation commenced. Furthermore, each participant was expressly reminded of their right to withdraw their participation and data at any time. This was to ensure full informed consent was given so the risk of harm was minimal.

A thorough debrief was administered upon completion of the dot probe task and a separate debrief delivered for the questionnaire. This provided the opportunity for subjects to raise any concerns, provide information on the study and to supply the researcher's contact details. Although it was expected that some participants would show higher levels of stress, it was not anticipated that any participants could be classified as vulnerable in any way that may have induced harm from participation in this study. To counteract any negative effects, a link to the Health and Safety Executive's (HSE) website on stress management was provided, along with the opportunity to contact the researcher if any issues arose.

Justification for methodology

Although the application of the dot probe to an occupational stress setting is a first, the use of the dot probe method for investigating attentional bias has become commonplace, largely replacing the Stroop task. As outlined, the concept of stress is similar to anxiety, in that both can occur to differing degrees and elicit severe effects. In order to divide participants into groups of higher and lower stress, a reliable and valid self report method was used, the SOP subscale of the PMI. The use of two different measures provides the best chance of obtaining accurate and valid results. The use of the PMI allows the comparison of a new occupational stress measure to a previously validated measure.

Results

Preparation of Data

Data was inputted to SPSS V.18 for analysis. Raw data and SPSS output can be found in Appendices 9 and 10 respectively. The 40-item Sources of Pressure (SOP) subscale of the PMI was used as the measure of occupational stress for this research. The total score for each participant on the SOP scale was calculated. A normality check of all the variables was undertaken to ensure any outliers did not skew the data. Following this check, two participants were removed as their average dot probe reaction times were above two standard deviations from the mean for both the congruent and incongruent probe position. See Appendix 11 for a box plot relating to the normality check.

No participants were removed on the basis of their SOP score. On the basis of the dot probe reaction times, error rate for both congruent and incongruent times was less than 2%, therefore all data was retained for analysis. This is in line with other studies reporting similar error rates, for example, Mogg et al. (1997).
A reliability check of the SOP scale was conducted with the remaining 46 participants to test for internal consistency. The reliability check returned a Cronbach's alpha (α=0.92, CI 95% .89-.96). This showed that all the SOP items have good internal consistency; Nunnally (1978) attested that any scale with a Cronbach's alpha of above 0.7 can be considered a reliable measure of a particular concept.

An attentional bias score was calculated by subtracting the mean congruent reaction time from the mean incongruent reaction time. 'Positive scores indicate attentional bias for threat, whereas negative values indicate avoidance' (Mogg et al., 1997 p.301). A value of zero indicates no instance of attentional bias. See Table 3 for the descriptive statistics regarding attentional bias scores.
A Pearson's correlation coefficient was calculated between the attentional bias score and scores on the SOP scale. This can be expressed as r=.35, p=.017. This indicates that there was a significant positive correlation between the SOP scale scores and attentional bias scores. A significant positive correlation infers that a strong relationship exists between two variables.

Participant Characteristics

Two comparison groups (higher stress and lower stress on the SOP scale) were created using a median split (median=126.5). Participants with an SOP score of 126 and below were labelled as lower stress (*N*=23, *M*=98.83, *SD*=23.24). Those attaining a score of 127 and above were labelled as higher stress (N=23, *M*=152.61, *SD*=18.72). An independent samples t-test was undertaken to assess whether the means of the scores on the SOP differed significantly. The between subjects independent variable was stress status as divided by scores on the SOP scale, either higher or lower. The dependent variable was the mean total score on the SOP scale. There was a significant difference in the scores for higher stress and lower stress groups; $t(44)=8.64$, $p<.001$. This illustrates that those in the higher stress group were significantly higher in terms of stress scores than the lower stress group. Table 1 illustrates the descriptive statistics for the SOP scale.

Table 1: Descriptive statistics for the Sources of Pressure scale for all participants.

Overall (N=46)		Lower Stress (N=23)		Higher Stress (N=23)	
M	*SD*	*M*	*SD*	*M*	*SD*
125.72	34.27	98.83	23.24	152.61	18.72

Table 2 illustrates the participant demographic characteristics as divided by higher and lower stress.

Table 2: Participant demographics following the division into higher and lower stress groupings.

	Lower Stress		Higher Stress	
	M	*SD*	*M*	*SD*
Age	31.39	12.78	28.83	9.36
Hours Worked Per Week	25.65	12.71	35.76	15.95
Years in Job	5.33	3.98	4.87	3.54

Independent t-tests were then conducted to compare the means between participants' scores on the SOP scale and any of the participant demographics. No significant differences were observed for SOP scores and age or years worked. This therefore suggests that as all participants share similar demographics, it is pressure that caused the demonstrated attentional bias. An independent samples t-test was conducted to compare hours worked between higher stress and lower stress groups. There was a significant difference in the hours worked for higher stress (M= 35.76 SD= 15.95) and lower stress (M=25.65 SD=12.71) conditions; $t(44)=2.38$, $p = .022$. This illustrates that the more hours an individual worked, the higher their levels of occupational stress were, as defined by the SOP scale of the PMI.

Analysis of Variance

A 2x2 mixed repeated measures ANOVA was conducted on the dot probe reaction time data and SOP scale data. The within subjects independent variable was the position of the probe (in a congruent or incongruent position to the occupational stress related (OSR) word, whilst the between subjects independent variable was the level of occupational stress (as measured by the Sources of Pressure subscale of the Pressure Management Indicator), either higher or lower. The dependent variable is the reaction time to identify the location of the dot probe following the word (in milliseconds).

Table 3: Reaction times to the dot probe test overall, and for both higher and lower stress individuals (milliseconds)

	Overall		Higher Stress		Lower Stress	
	M	*SD*	*M*	*SD*	*M*	*SD*
Congruent	482.00	65.75	473.39	72.67	490.61	58.37
Incongruent	487.57	64.32	488.74	74.03	486.39	54.57
Attentional Bias Score	5.57	24.85	15.35	26.42	-4.22	19.01

There was an insignificant main effect for the within subjects independent variable, the probe position, $f(1,44)=2.68$, $p=.11$. This suggests that, irrespective of occupational stress levels, reaction times across all participants were not significantly different. A second insignificant main effect was established for the between subjects independent variable, higher or lower occupational stress level, as divided by the SOP scale, $f(1,44)=.15$, $p=.70$. This shows that higher and lower stress groups did not differ in overall reaction times, irrespective of the probe being in a congruent or incongruent position.

A significant interaction was observed between probe position and occupational stress levels, $f(1,44)=8.29$. $p=.006$. Figure 1 illustrates this interaction.

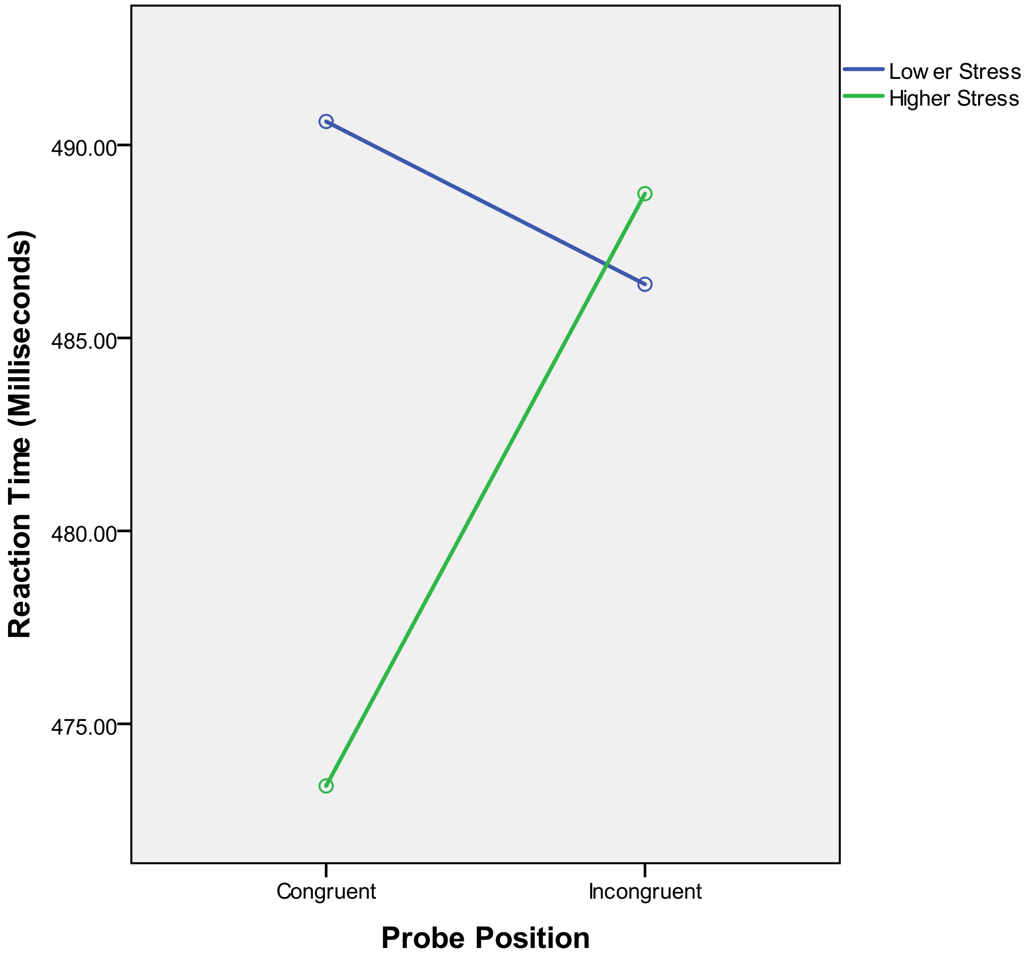

Figure 1: Graph to show the significant interaction between probe position and occupational stress level.

Figure 1 illustrates the significant interaction between higher and lower stressed individuals' reaction times and dot probe position.
To further investigate this interaction, a series of post-hoc tests were conducted. A Bonferroni correction was applied (0.05÷4=0.0125) to obtain a new significance level in line with the number of pairwise corrections made; the new level of significance being 0.0125. This controls for the possibility of a Type 1 error.

An independent samples t-test was conducted to compare the higher and lower stress groups on reaction time when the probe appeared in a location congruent to the OSR word. There was no significant difference in reaction times for higher stress (*M*=473.39 *SD*=72.67) and lower stress (*M*=490.61 *SD*=58.37); $t(44)=.89$, $p=.38$.
An independent samples t-test was conducted to compare the higher and lower stress groups on reaction time when the probe appeared in a location incongruent to the OSR word. There was no significant difference in reaction times for higher stress (*M*= 488.74 *SD*=74.03) and lower stress (*M*= 486.39 *SD*=54.57); $t(44)=.12$, $p=.90$.

A paired samples t-test was then conducted to compare reaction times to the location of the probe in both a congruent and incongruent position to the OSR word in the lower stress group. There was no significant difference between reaction times to the probe in a congruent (*M*=490.61 *SD*=58.37) or incongruent position (*M*=486.39 *SD*=54.57) within the lower stress group, $t(22)=1.06$, $p=.301$. This shows that the lower stressed individuals did not differ significantly in their reaction time, irrespective of probe position.

Another paired samples t-test was conducted to compare the reaction times to the location of the probe in both a congruent and incongruent position to the OSR word in the higher stress group. A significant difference was observed between reaction times to the probe in a congruent position (*M*=473.39 *SD*=72.67) and incongruent position (*M*=488.74 *SD*=74.03) within the higher stress group, $t(22)=2.79$, $p=.011$. This shows that the higher stressed individuals reacted significantly faster in terms of their reaction to the location of the probe; when it appeared congruent to an OSR word, than when it appeared incongruent to the OSR word.

Summary

The results clearly illustrate that an interaction exists between stress levels as defined by the SOP scale and performance on the dot probe task, with higher stress individuals reacting significantly quicker to the location of the probe in a congruent position than an incongruent position. However, no significant difference was found when comparing between reaction times and stress status; there was no significant difference in reaction times to the probe location between the higher and lower stress groups. Interestingly, although not linked to attentional bias, a significant difference was found between overall hours worked and levels of stress, with higher stress individuals working significantly more hours than lower stress individuals. No other significant effects were found.

Discussion

The results of this study indicate that there was a significant interaction between probe position and occupational stress status. Post hoc paired samples t tests revealed that reaction times to the location of the probe (in a congruent or incongruent position to the OSR word) differed within the higher stress group. That is, those in the higher stress group reacted faster to the location of the probe when it appeared in a position congruent to the OSR word rather than a neutral word. On the basis of this, Hypothesis 1 ‘Those scoring as higher stress on the SOP scale shall respond significantly quicker to the probe replacing an occupational stress related (OSR) word than a neutral word’ can be accepted.

There were insignificant main effects for both the within subjects independent variable, probe position (congruent or incongruent to the OSR word), and the between subjects independent variable, stress status (higher or lower). This means that irrespective of occupational stress status, reaction times across all participants to the location of the probe did not differ significantly. In addition, irrespective of the location of the probe, reaction times for higher and lower stress did not differ significantly. It is for this reason, Hypothesis 2 'Those scoring as higher stress on the SOP scale shall respond significantly quicker to the probe in a congruent position to the OSR word than those scored as lower stress' must be rejected.

In addition, a significant difference was found between hours worked and stress status, with the higher stress group working significantly more hours than the lower stress group. Although this isn't related to the current research question, it may form the basis of future investigations.

As this study is the first examining the link between occupational stress and attentional bias, there is no research with which to directly compare the findings to. The results of this study are at least partially consistent with a number of studies pertaining to anxiety and attentional bias. Mathews and MacLeod (2002) argued that when stressed, anxious individuals display a greater attentional bias to threat. This interaction of stress and anxiety may provide an explanation for the demonstrated attentional bias in the present study; the presence of occupational stress may elicit or induce any underlying anxieties individuals possess which then surface during an exercise such as the dot probe task.

The finding that the higher stress group respond significantly faster to the probe in a congruent location is consistent with much attentional bias research (Asmundsen & Stein, 1994; Maidenburg at al., 1996; Mathews & MacLeod, 2002; Mogg et al., 1992; Mogg et al., 1995). All showed anxious individuals hold a greater attentional bias to threat. Also consistent is the work of Muris et al. (2003), who attested that higher trait anxious individuals are more susceptible to threat and possess lower 'threat thresholds' than lower trait anxious individuals. The notion of higher and lower anxiety here is paired with higher and lower occupational stress, and the present study has demonstrated this to an extent.
Attentional biases have previously been found in non-clinical samples (Mogg et al., 1992), which is again consistent with the population sought after in this research. Conflicting research has attested that the dot probe is not a reliable measure of attentional bias in non-clinical samples (Schmuckle, 2005). This view has also been partially supported due to the non-definitive nature of this study's results; it was anticipated a significant difference in reaction times would also be found between the higher and lower stressed groups. However, sample size and selection may be partially liable for this result.

The stimulus onset asynchrony (SOA) for this study was 500ms, consistent with much previous dot probe research (Fox et al., 2002; MacLeod et al., 1986; Mogg et al., 1994; Mogg et al., 1997) that have all succeeded in eliciting an attentional bias. Research centred on disengagement of attention at this SOA, for example, Noel et al. (2006) is inconsistent with the present findings.
Crucially, the literature on attentional bias is only partially supported. Although one significant effect was found, other expected outcomes have not been achieved. Many, for example, Mogg et al.(1997) and Bradley et al. (1999) established strong differences between their control group (lower stress in the present study) and their anxious group. The present study has failed to do this.

Limitations

This study has a number of limitations. The OSR words, although matched for frequency may in fact be more common in the food retail industry compared to the general population. Perhaps using two different exposure lengths such as 500ms and 1250ms (Bradley et al., 1999) may produce findings of greater significance. Conversely, disengagement effects may occur.

A fundamental limitation of this study concerned sample selection and size. The final sample comprised 46 individuals, which is relatively small. Results from larger samples can be more confidently generalised to a population. The method of dividing participants (a median split), although necessary, was not a guaranteed means by which to result in higher and lower stress groups that differed significantly in terms of stress levels. Future research could aim to target participants that are known to be highly stressed and participants known to have lower levels of stress in order to ensure the distinction is clear. This in turn should positively impact on results.

Due to testing constraints, a limited amount of time was available to obtain a sample. Opportunity sampling was the only method available to achieve the participant quota. One organisation understandably had strict conditions for the researcher to follow; only one day was permitted for testing, which could take place solely in the staff canteen. Furthermore to minimise disruption, employees were only available during their lunch hour. Although participation was voluntary, this may have led to individuals hastily completing their questionnaires or being inadvertently distracted (both during the dot probe and whilst responding to the questionnaire) by colleagues in the quiet area of the canteen. This is consistent with Donaldson and Erant-Valone’s (2002) conclusion that self report measures administered in a business setting are more vulnerable to response biases.

Benefits

Despite its limitations, this study was a first of its kind attempting to develop an objective measure of occupational stress using the dot probe task. This study has created a base with which future research can build on, continually develop and refine. This study had a number of methodological controls in an attempt to enhance reliability. The dot probe trials were programmed to be equal in terms of presentation locations to prevent anyone guessing the forthcoming location of the words or probe. The word pairs were matched both syllabically and for frequency in the English language and as devoid of valence as possible in an attempt to avoid any word producing an unwanted attentional bias. Additionally, each participant was processed in exactly the same way to avoid any disadvantage to anyone or to skew the results.

Summary and Future Implications

This study aimed to establish the dot probe as an objective measurement of occupational stress. It is clear that there has been only a partial success. It is possible to say that individuals with a higher level of occupational stress show greater attentional bias, but this is not a firm conclusion. A central matter is still evident, however; was the displayed attentional bias caused by stress, or is attentional bias an unintentional method of reinforcing stress inducing stimuli or principles? Regardless of this question, future research must continue to refine the methodology used in the present study in order to further validate the dot probe as a credible method of stress measurement. Larger, more diverse samples, different word pairs, and a selection of different industries should be used in the future in order for further development to take place. The reasons why the higher and lower stress groups did not differ significantly on reaction times overall must be examined further.

References

Amir, N., Elias, J., Klumpp, H. & Przeworski, A. (2003). Attentional bias to threat in social phobia: Facilitated processing of threat or difficulty disengaging attention from threat? *Behaviour Research and Therapy, 41*, 1325-1335.

Asmundsen, G.J.G. & Stein, M.B. (1994). Selective processing of social threat in patients with generalised social phobia: Evaluation using a dot probe paradigm. *Journal of Anxiety Disorders, 8*, 107-117.

Atkinson, W. (2004). Stress: Risk management’s most serious challenge? *Risk Management, 51*, 20-24.

Bradley, B.P., Mogg, K. & Lee, S.C. (1997). Attentional biases for negative information in induced and naturally occurring dysphoria. *Behaviour and Research Therapy, 35*, 911-927.

Bradley, B.P., Mogg, K., White, J. & De Bono, J. (1993). Attentional bias for emotional faces in generalised anxiety disorder. *British Journal of Clinical Psychology, 38*, 267-278.

Broadbent, D. & Broadbent, M. (1988). Anxiety and attentional bias: State and trait. *Cognition and Emotion, 2*, 165-183.

Bryant, R.A. & Harvey, A.G. (1997). Attentional bias in post-traumatic stress disorder. *Journal of Traumatic Stress, 10*, 635-644.

Cannon, W. (1932). *The wisdom of the body.* New York: Norton.

Carroll, J.B., Davies, P. & Richman, B. (1971) *Word frequency book.* New York: American Heritage.

Cooper, C.L., Sloan, S.J. & Williams, S. (1988). *Occupational stress indicator.* Windsor: Nelson.

Cox, T. (1978). *Stress.* London: Macmillan.

Donaldson, S.I. & Grant-Vallone, E.J. (2002). Understanding self-report bias in organisational behaviour research. *Journal of Business and Psychology, 17*, 245-260.

Duncan, J., Ward, R. & Shapiro, K. (1994). Direct measurement of attentional dwell time in human vision. *Nature, 369*, 313-315.

Fox, E. (1994). Attentional bias in anxiety: A defective inhibition hypothesis. *Cognition and Emotion, 8*, 165-195.

Fox, E. (1993). Attentional bias in anxiety: Selective or not? *Behaviour Research and Therapy, 31*, 487-493.

Fox, E., Russo, R. & Dutton, K. (2002). Attentional bias for threat: Evidence for delayed disengagement from emotional faces. *Cognition and Emotion, 16*, 355-379.

Hart, P.M. & Cooper, C.L. (2002). Occupational stress: Toward a more integrated framework. In: N. Anderson, D.S. Ones, H.K. Sinangil & C. Viswesvaren (Eds.) *Industrial, work and organisational psychology.* London: Sage.

Health and Safety Executive Management Standards Tool. Retrieved 25/10/10 from: www.hse.gov.uk/stress/standards/notesindicatortool.htm

Health and Safety Executive (2011). Occupational stress figures and statistics. Retrieved 25/03/11 from: www.hse.gov.uk/statistics/causdis/stress/scale.htm

Kilgarriff, A. (1996) British National Corpus database and word frequency lists. Retrieved 14/10/10 from: http://www.kilgarriff.co.uk/bnc-readme.html

Koster, E.H.W., Crombez, G., Verschuere, B., Van Damme, S. & Roelf Wiersema, J. (2006). Components of attentional bias to threat in high trait anxiety: Facilitated engagement, impaired disengagement and attentional avoidance. *Behaviour Research and Therapy, 44*, 1757-1771.

Koster, E.H.W.,Verschuere, B., Crombez, G. & Van Damme, S. (2005). Time course of attention for threatening pictures in high and low trait anxiety. *Behaviour Research and Therapy, 43*, 1087-1098.

Kulas, J.F., Conger, J.C. & Smolin, J.M. (2003). The effects of emotion on memory: An investigation of attentional bias. *Anxiety Disorders, 17*, 103-113.

Lang, P.J., Davis, M. & Ohman, A. (2000). Fear and anxiety: Animal models and human cognitive psychophysiology. *Journal of Affective Disorders, 61*, 137-159.

MacLeod, C. & Mathews, A. (1988).Anxiety and the allocation of attention to threat. *The Quarterly Journal of Experimental Psychology, 40*, 653-670.

MacLeod, C., Mathews, A. & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology, 95*, 15-20.

Maidenburg, E., Chen, E., Craske, M., Bohn, P. & Bystritsky, A. (1996). Specificity of attentional bias in panic disorder and social phobia. *Journal of Anxiety Disorders, 10*, 529-541.

Martin, M., Williams, R. & Clark, D. (1991). Does anxiety lead to selective processing of threat related information? *Behaviour Research and Therapy, 29*, 147-160.

Mathews, A. & Klug, F. (1993). Emotionality and interference with colour naming in anxiety. *Behaviour Research and Therapy, 31*, 57-62.

Mathews, A. & MacLeod, C. (2002). Induced processing biases have causal effects on anxiety. *Cognition and Emotion, 16*, 331-354.

Mathews, A. & MacLeod, C. (1985). Selective processing of threat cues in anxiety states. *Behaviour Research and Therapy, 23*, 563-569.

Mogg, K. & Bradley, B.P. (2005). Attentional bias in generalized anxiety disorder versus depressive disorder. *Cognitive Therapy and Research, 29*, 29-45.

Mogg, K., Bradley, B.P., De Bono, J. & Painter, M. (1997). Time course of attentional bias for threat information in non-clinical anxiety. *Behaviour Research and Therapy, 35*, 297-303.

Mogg, K., Bradley, B.P., Field, M. & DeHouwer, J. (2003). Eye movements to smoking related pictures in smokers: A relationship between attentional biases and implicit and explicit measures of stimulus valence. *Addiction, 98*, 825-836.

Mogg, K., Bradley, B.P. & Hallowell, N. (1994). Attentional bias for threat: Roles of trait anxiety, stressful events and awareness. *The Quarterly Journal of Experimental Psychology, 47*, 841-864.

Mogg, K. & Bradley, B.P. (1999). Some methodological issues in assessing attentional biases for threatening faces in anxiety: A replication study using a modified version of the probe detection task. *Behaviour Research and Therapy, 37*, 595-604.

Mogg, K., Bradley, B.P. & Williams, R. (1995). Attentional bias in anxiety and depression: The role of awareness. *British Journal of Clinical Psychology, 34*, 17-36.

Mogg, K., Bradley, B.P., Williams, R. & Mathews, A. (1993). Subliminal processing of emotional information in anxiety and depression. *Journal of Abnormal Psychology, 102*, 304-311.

Mogg, K., Mathews, A. & Eysenck, M. (1992). Attentional bias to threat in clinical anxiety states. *Cognition and Emotion, 6*, 149-159.

Mogg, K., Mathews, A. & Weinman, J. (1989). Selective processing of threat cues in anxiety states: A replication. *Behaviour Research and Therapy, 27*, 317-323.

Mogg, K., McNamara, J., Powys, M., Rawlinson, H., Seiffer, H. & Bradley, B.P. (2000). Selective attention to threat: A teat of two cognitive models of anxiety. *Cognition and Emotion, 14*, 375-399.

Moore, K. & Cooper, C.L. (1998). Theories of stress among mental health professionals. In: S. Hardy, J. Carson & B. Thomas (Eds.) *Occupational stress: Personal and professional approaches.* Cheltenham: Stanley Thornes.

Morris, J.S., Frith, C.D., Perrett, D.I., Rowland, D., Young, A.W., Calder, A.J., et al. (1996). A differential neural response in the human amygdala to fearful and happy facial expressions. *Nature, 31*, 812-815.

Muris, P., Rapee, R., Meesters, C., Shouten, E. & Geers, M. (2003). Threat perception abnormalities in children: The role of anxiety disorders symptoms, chronic anxiety and state anxiety. *Journal of Anxiety Disorders, 17*, 271-287.

Noel, X., Colmant, M., Van Der Linden, M., Bechara, A., Bullens, Q., Hanak, C., et al. (2006). Time course of attention for alcohol cues in abstinent alcoholic patients: The role of initial orienting. *Alcoholism, Clinical and Experimental Research, 30*, 1871-1877.

Nunnally, J.C. (1978). *Psychometric theory (2nd Edn.)* New York: McGraw-Hill.
Posner, M.I. (1988). Structures and functions of selective attention. In: T. Boll & B. Bryant (Eds.) *Clinical neuropsychology and brain function.* Washington DC: American Psychological Association.

Powell, T.S. & Enright, S.J. (1990). *Anxiety and stress management.* London: Routledge.

Ray, C. (1979). Examination stress and performance on a colour-word interference test. *Perceptual and Motor Skills, 49*, 400-402.

Reeves, E. (2010). An objective indicator of occupational stress using the Stroop task to elicit attentional bias. Unpublished PhD thesis, Manchester Metropolitan University, England.

Robinson, L. (1990). Stress and anxiety. *Nursing Clinics of North America, 25*, 935-943.

Ruiter, C. de. & Brosschot, J.F. (1994). The emotional Stroop interference effect in anxiety: Attentional bias or cognitive avoidance? *Behaviour Research and Therapy, 32*, 315-319.

Schmukle, S.C. (2005). The unreliability of the dot probe task. *European Journal of Personality, 19*, 595-605.

Segerstrom, S.C. (2001). Optimism and attentional bias for negative and positive stimuli. *Personality and Social Psychology Bulletin, 27*, 1334-1343.

Selye, H.J. (1956). *The stress of life.* New York: McGraw-Hill.

Siegle, G. (1999). Delay predictions from theories of rumination and affective stress. Retrieved 19/03/11 from: www.sci.sdsu.edu/CAL/greg/thesis/node28.html

Stroop, J.R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*, 643-662.

Williams, J.M.G., Watts, F., MacLeod, C. & Mathews, A. (1997). *Cognitive psychology and emotional disorders (2nd edn.)* Chichester: Wiley.

Williams, S. (1996). A critical review and further development of the Occupational Stress Indicator. Doctoral thesis, University of Manchester, England.

Williams, S. & Cooper, C.L. (1998). Measuring occupational stress: Development of the Pressure Management Indicator. *Journal of Occupational Health Psychology, 3*, 306-321.

Williams, S. & Cooper, C.L. (1996) *Pressure management indicator.* Harrogate: RAD.

Williams, S. (1994). *Managing pressure for peak performance.* London: Kogan Page.