

**Effect of emotional valenced words
on sex differences in stress and
anxiety with age**

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Abstract

The aim of the current study was to examine the impact of emotional valenced words, that is, positive and negative words in relation to sex differences in performance on stress and anxiety scores and response time to the valenced words whilst employing the Emotional Stroop Task. The study included 40 participants with 10 male participants and 30 female participants with an age range of 19-58 years old. The experimental procedure involved participants selecting the colour tab on the keyboard to the corresponding coloured emotional word displayed on the computer. A questionnaire pertaining to stress and anxiety was provided prior and post experimental procedure. The results of the study indicated that there was a statistical difference between sex differences in performance on stress scores and response time to negative valenced words. It was concluded that there may be evidence of attentional bias and automatic vigilance.

Introduction

The Emotional Stroop Task has been used to examine word processing of emotionally valenced words. It was inferred that that slower response to negative words was due to autonomic vigilance (Estes & Adelman, 2008). Slower response time to negative stimuli compared to positive stimuli was due to the categorical negativity theory (Pratto & John, 1991). The Emotional Stroop Task has been used to examine factors such as selective bias in individuals. It was also used to examine stress factors as prolonged response time has been indicated when there is exposure to words with threatening connotations as a result of attentional bias (Metzger et al, 1997). Anxiety has been examined as a result of prolonged response time to threatening words (Amir et al, 1996). When examining sex differences, it was implied that females were susceptible to stress and anxiety in comparison to males. The task can also be used to examine age differences as it was indicated that younger adults recall negative stimuli slower than older adults (Murphy & Isaacowitz, 2008).

1.1 Literature Review

The influence of emotions can be examined in regard to social comparisons made by individuals and visual attention, which are behavioural and cognitive characteristics. (Rowe, Hirsh & Anderson, 2007). Emotions encompass two distinct areas, which include valence and arousal (Russell, 2003). Valence indicates the intensity in which there is an attraction toward objects that are appealing while resisting unappealing objects (Lewin, 1951). The term also applies to the emotionality in valence that is divided into positive and negative (Schuman, Sander & Scherer, 2013). Arousal, however, is the classification of a stimulus as either calming

or exciting (Kensinger, 2004). There is evidence of the exciting and calming effects in stimuli that is positive and negative (Kuperman et al, 2014).

Estes and Adelman (2008) inferred that cognitive based tasks containing negative stimuli such as words elicits a slower response relative to neutral stimuli due to automatic vigilance. This is due to the assessment of a stimuli by individuals as either positive or negative. For instance, “cotton”, which is a neutral word will not elicit a prolonged response as the word “coffin”, which is negative. This exemplifies individual’s predisposition towards stimuli that is negative due to its interference of their attention (Pratto & John, 1991). The processing of words is influenced by emotion in the response or decision phase as indicated by automatic vigilance. This is due to the initiating of lexical representations having no involvement in the prolonged response to words that are negative as the naming process or lexical decisions (Yap & Seow, 2014). Pratto and John (1991) coined the categorical negativity theory, which postulates that positive words do not exhibit prolonged latencies in comparison to negative words in relation to colour- naming procedures. This is due to the automatic processing containing interference for stimuli that is negative.

Research has examined the concept of approach and withdrawal in relation to individual’s propensities towards words that are emotional. It was deduced that there is a stimulation of the approach system by low arousal and positive valence whereas high arousal and negative valence lead to the stimulation of the withdrawal procedure (Citron, Abugaber & Herbert, 2016). Comparatively, it was also ascertained that low rated stimuli are assessed as negative in relation to stimulus arousal relative to high rated stimuli that is assessed as positive as a result of its nonalignment from valence (Robinson et al, 2004).

1.2 Emotional Stroop Task

Besner and Stolz (1999) examined the use of the Stroop Effect in word recognition as it involves disregarding the meaning of the word and indicating the colour of the displayed word, which leads to the eliciting of a slower word processing. This is evidenced when participants were required to identify the colour “green” for the presented word “red”. The research theorised that this was due to the influence of spatial attention in the processing of words during the Stroop Effect. The Emotional Stroop Task (EST), however, differs from the Stroop task due to its examining of individual response to stimuli that is emotional in comparison to neutral (Kuperman et al, 2014). The EST is the exhibition of words with emotional valence, which are displayed in numerous colours. Individuals are required to indicate the coloured word whilst disregarding the meaning of the presented word. They are examined on the rapidity in which they name the coloured emotional and neutral words (Ben-Haim et al, 2016). The procedure was employed by Dresler et al (2009) to assess arousal and valence of words in its creation of emotional interference using emotional valence words and neutral words. It was inferred that there is an increase in the recognition and re-call of emotional valence words relative to neutral words due to arousal. There was no indication of research considering valence present in the research. Additionally, Frings et al (2010) indicated that there is an increased response to coloured neutral words compared to negative words that are coloured.

Dudley et al (2002) used the task to infer if there is a comparable difference in performance on a task based on content related to depression and attentional bias in individuals with dementia and depression. The study indicated that individuals placed in the depression group exhibited a high response time in relation to naming the colour of the words with negative content compared to neutral and positive words. Sutton et al (2007) used the EST to examine

emotional information processing as a result of selective bias in bilingual individuals using controlled neutral words and words possessing negative valence. It was found that both languages spoken by individuals indicated interference effects as there were prolonged response time to the negative words in both languages. Fan et al (2017), however, found that in relation to emotional face-word stroop task, individuals primarily using their first language were effective in processing emotional information in relation to words. The study indicated that congruency effects in processing emotional words are evident in bilingual speakers. The results from the study were evident in Winskel's (2013) investigation using the emotional stroop task on Thai-English bilinguals. It was indicated that the response time toward emotional arousal in the content of the word in the second language are not automatic in comparison to the bilingual's first language.

1.3 Stress

The hyper-processing of stimuli with emotional features is due to attentional propensity toward threats, which is analogous to post-traumatic stress disorder (Blair et al, 2013). It was theorised that delays in the response of the colour-naming aspect for words that are threat-related in the Emotional Stroop Task are due to the emotional meaning of the words that influences its representation and attention despite its irrelevance to the task (Metzger et al, 1997).

The EST was carried out by Cisler et al (2011) in order to assess its impact on individuals with Post-Traumatic Stress Disorder (PTSD). The study employed groups of trauma exposed control, non-trauma exposed control and PTSD individuals. The study inferred that there were prolonged performances of individuals in trauma exposed control group and post-traumatic stress disorder group as a result of exposure to words related to post-traumatic stress disorder in the

Emotional Stroop Task. The effect of the EST in PTSD is due to exposure of events that are traumatic and not its characteristics.

Similarly, Khanna et al (2017) used the EST in order to examine war veterans suffering from PTSD with difficulties in emotional regulation and attentional allocation. The study employed stimuli such as generally threatening words, neutral words and combat related words. The results of the study indicated a reduced response time for words that are combat related in veterans with PTSD. Veterans who were not suffering from PTSD did not display any significant response to the three stimuli. It was identified that individuals with a phobia as a result of a motor vehicle accident did not exhibit interference effects towards words that were positive, neutral, mildly threatening and highly threatening in comparison to individuals with PTSD as a result of the accident (Bryant & Harvey, 1995). Wittekind et al (2017) inferred that attentional bias towards words that are depression related is exhibited in older individuals with PTSD when presented with randomised and blocked words in the emotional stroop task. Similar results were inferred in children suffering from PTSD as neutral words did not exhibit a delay in colour-naming response relative to words that were related to threat (Moradi et al, 1999).

When examining sex differences, Kessler et al (1995) reasoned that females in comparison to males are susceptible to stress development. This was due to the trauma experienced, which leads to an increased susceptibility for PTSD (Olf et al, 2007). This is evident in women suffering from PTSD as a result of sexual abuse in early childhood. They exhibit reduction in blood flow in the anterior cingulate as a result of exposure to emotional words such as “weapon”, “stench” and “bruise” in the EST (Bremner et al, 2004). Chaplo et al (2017), however, established an increase in the rate of exhibiting symptoms of PTSD as a result of sexual abuse in males compared to females.

1.4 Anxiety

The emotional Stroop task has been used to assess the emotional characteristic of anxiety in inducing increased interference for colour-naming of words with negative emotionality (Mogg et al, 1990). This is evidenced in the research by MacLeod and Rutherford (1992) who used the task in order to examine interference of colour-naming patterns on anxiety using a colour naming task and swift presentation of words. The results of the study indicated that there was a similar colour naming pattern when individuals are in a low state of anxiety in both high and low anxiety-trait groups. If there was a high state of anxiety due to cues such as examination, the colour-naming intervention displayed a prolonged identification of the words due to its association to negative words. Amir et al (1996) suggested that there is a decrease in the rate of response in colour-naming words that are threatening in individuals with anxiety. This was studied using individuals with social phobias and individuals without social phobia. The research inferred that there was a repression of words that are threatening to individuals in the phobic group with increased anxiety.

Williams et al (1998) proposed that there is a stimulation of anxiety as a result of threatening content due to attentional bias. This causes a decreased response time in individuals due to the association of words to their fears despite the non-threatening meaning of words (Matthews & Klug, 1993). Matthews and Sebastian (1993) instilled that the meaning of a word is pivotal as it signifies the amount of anxiety and fear associated with the word in relation to emotional interference. This is indicated by Witthoft et al (2013) who found that individuals with health anxiety display an increased attentional bias toward words relating to bodily symptoms when participating in the Emotional Stroop Task due to the fear of attaining an illness. Egloff and Hock (2001) used the card form of the EST to test attentional bias in its effect on anxiety in

relation to a stimulus that is threatening. There was a positive association found between interference in the EST and individuals with high states of anxiety compared to individuals with low states of anxiety.

Becker et al (2001) examined selective attentional bias on selective and general words that are disorder specific in relation to emotional words. The study employed individuals with Social phobias, Generalised Anxiety Disorder and control group with non-anxious individuals. The stimuli included positive and neutral valenced words, words related to Social phobia and words related to Generalised Anxiety Disorder. The results indicated that individuals with social phobias had a delay in words that were related to speech whereas there was a delay in response in all emotional word types for individuals with Generalised Anxiety Disorder due to attentional bias. A similar study conducted by Chen et al (2013) used the EST to investigate positive, neutral, generalised anxiety disorder and panic disorder related words. The study implemented forty- six healthy participants, forty-two Generalised Anxiety Disorder patients and thirty-four patients with Panic Disorder. It was found that individuals with generalised anxiety disorder had a delayed response in words relating to Generalised Anxiety Disorder and Panic Disorders. Individuals with panic disorders, however, had a prolonged response to words relating to panic disorders. The results also indicated the presence of attentional bias in Generalised Anxiety Disorder patients due to exposure to stimuli that is negative or threatening. There was, however, no attentional bias perceived in patients with Panic Disorder. The studies examine the use of attentional bias towards words that are threatening and the prolonged response time to the stimuli in a clinical setting. There is, however, no consideration of sex differences in relation to exposure to negative stimuli and its effect on response time as it could have indicated a different result.

Egloff and Schmukle (2004) used the EST to examine anxiety that is explicit and implicit in male and female participants. The results indicated that there are exponential scores when testing explicit and implicit anxiety in females relative to males. Subsequently, Stewart et al (1998) examined males and females who were highly anxiety sensitive and lowly anxiety sensitive in relation to selective processing of words relating to physical threat such as “suffocated” and psychological or socially threatening words such as “crazy”. Neutral words such as “towels” were also included in the task. The results indicated that there was a selective processing of words relating to psychological or social threat in males with high anxiety sensitivity. Females with an increased level of anxiety sensitivity, however, displayed selective processing of words relating to physical threats. It was postulated that this was due to a bias toward threat related word processing. It was inferred that there is a predisposition for anxiety disorders in females in comparison to males due to susceptibility towards symptoms possessed by the disorder (McLean et al, 2011).

1.5 Age differences

Age differences in relation to the EST was examined by Wurm et al (2004). The researched used visual and auditory forms of the EST on younger and older adults. The auditory form of the EST was used to examine if the tone of voice impacts the execution of the task in older adults. The visual form of EST, however, examined the ability of older and younger adults in identifying printed coloured emotional words. The results indicated a prolonged decision time for older adults in the auditory form of EST due to interference of cognitive processing when listening to a tone of voice that differs from the connotation of the word. When examining response time involved in the visual form of EST, it was found that there was a delayed response time for words with high levels of arousal in older adults in comparison to younger adults when

asked to identify the printed coloured word. It was theorised that the results indicated an attentional bias towards words with high levels of arousal due to the inability of older adults to hinder information that is irrelevant, which leads to the prevention of overarousal.

Similar findings were found by Bielecki et al (2017) when assessing PTSD on age using the EST. It was inferred that older adults relative to younger adults displayed a delayed response when presented with stimuli that were trauma- related compared to positive or neutral stimuli. Comparatively, Murphy and Isaacowitz (2008) postulated that younger adults showed significant effect towards negative stimuli and emotional salience in comparison to older adults. It was suggested that attentional bias toward negative stimuli is evidenced in younger adults due to increased recognition of words with negative connotation compared to neutral or positive connotative words. Increased identification of positive words, however, is apparent in older adults despite attentional bias towards positive and negative stimuli (Thomas & Hasher, 2006).

This was also investigated by Charles and Mather (2003) who employed participants who were younger, older and middle-aged adults to examine recall for pictures with emotional valence. The results indicated similar notions as the previous research as younger adults experienced a delay in recall in negative stimuli. Middle-aged and older adults recalled stimuli that was positive. It was proposed that this was due to the positivity effect displayed by older adults as there is a deviation of attention toward positive stimuli through socioemotional selectivity theory (Carstensen, Isaacowitz & Charles, 1999). Research by Ashley and Swick (2009) had also indicated that younger adults display a prolonged reaction time to both emotional and neutral stimuli whereas older adults indicated a delayed reaction time to emotional words only. The research, however, did not employ positive words in the study, which could have made

an impact on the reaction time due to suggestions made by previous studies, which suggested that the positivity effect displayed was by older adults.

1.6 Current study

The current study aims to examine sex differences in relation to stress and anxiety scores along with response time to words with emotional valence, that is, positive and negative words using an Emotional Stroop Task. The study will also examine age differences in reaction times to positive valenced words and negative valenced words. Previous studies such as one by Cisler et al (2011) have indicated a prolonged response time for words related to PTSD when examining stress. When examining anxiety, it was inferred that negative words can cause a delay in response time (MacLeod & Rutherford, 1992). Age differences have suggested a delayed response for trauma-related stimuli for older adults in comparison to younger adults (Bielecki et al, 2017).

The study will encompass a sample of college students from part-time and full-time courses at Dublin Business School due to the limited amount of research available for stress and anxiety for the sample in examining its impact using the Emotional Stroop Task. The Depression, Anxiety and Stress Scale or DASS will be provided to participants in order to examine stress and anxiety scores prior experimentation and post-experimentation to examine if there was a difference in scores. When participating in the experimental procedure, participants will be timed using a timer to indicate the reaction times to each of the words presented. The words used in the study will be derived from three studies by Mitterschiffthaler et al (2008), Mathews and Barch (2006) and Kousta, Vinson and Vigliocco (2009) to ensure that the words used contained emotional valence and had a possibility of eliciting a response.

Hypotheses

Hypothesis 1: There will be a significant difference between sex differences in performance on stress scores and response time to positive valenced words.

Hypothesis 2: There will be a statistical difference between sex differences in performance on stress scores and response time to negative valenced words.

Hypothesis 3: There will be a statistical difference between sex differences in performance on anxiety scores and response time to positive valenced words.

Hypothesis 4: There will be a significant difference between sex differences in performance on anxiety scores and response time to negative valenced words.

Hypothesis 5: There will be a statistical difference between age and performance on reaction time task for negative valenced words compared to positive valenced words.

Method

2.1 Participants

The research encompassed 40 participants of which 10 participants were male and 30 were female from Dublin Business School. The research incorporated a non-probability purposive sample due to the employment of college students from part-time and full-time courses respectively. The age range of the participants were 19 to 58 years old due to the content of the words used in the Emotional Stroop Task. When conducting the statistical analysis for the results, the participants were divided into three groups. Group 1 included participants in the age range of 19 to 22 years old, Group 2 incorporated participants from 22 to 36 years old and Group 3 had participants from 36 to 58 years old. Participants were exposed to the same experimental condition as they were shown the same set of words that were randomly displayed on the screen and received the questionnaire pertaining to stress and anxiety prior and post experimentation.

There were two methods employed when recruiting participants in the research. The first method of recruitment involved visiting part-time and full-time lecture halls at Dublin Business School and briefing the participants on the nature of the research. They were informed that words with emotional valence, that is, positive and negative words were examined using the Emotional Stroop Task in order to determine its effects on stress and anxiety scores in male and female participants. They were also informed that age was considered to examine response time. If they were interested in participating in the research experiment, they were able to either provide an email address for contact or ask for the contact details of the researcher. The second method of recruitment involved posters, which were placed around the third and fourth floor in Dublin

Business School (Appendix F). The posters included information about the research, which also included the contact detail of the researcher if there was an expressed interest in participating in the research. When contacted, the date and time of availability of the psychology lab were provided to the participants and they were able to choose or indicate a time and date that suited them to partake in the research. The psychology lab was booked in accordance to the availability of the participants. Participation in the research was voluntary as participants provided information or contacted the researcher if they were interested in participating in the research.

2.2 Design

The independent variable (IV) pertaining to the research include the sex differences and age of participants, which is pivotal in examining stress and anxiety scores along with response time. The words used in the research is also manipulated. The dependent variable (DV) of the research is the stress and anxiety scores of participants as well as the response time to the words presented. The research comprises a within-subject design due to the words presented during the experiment and the response time of participants during the intervention. The questionnaires provided to the participants during pre-intervention and post-intervention were used to determine stress and anxiety scores. There was also a between-subject design in examining sex and age differences of participants.

The research encompassed a quasi- experimental design due to the exclusion of random group allocation as participants in the research were exposed to the same emotional valenced words that was presented in a random order. There was also an inclusion of examining sex differences of participants. There was also an element of a cross-sectional design due to the examination of sex differences in relation to stress and anxiety scores as a result of the emotional valenced words. Age difference was also considered when assessing response time of

participants. The research also employed a correlational design due to the use of the questionnaire to determine stress and anxiety scores. There was no inclusion of different experimental groups in the research as participants were exposed to the same words, however, neutral words were used as a control for the positive and negative words used to ensure reliability.

2.3 Materials

Depression, Anxiety and Stress Scale- 21

The Depression, Anxiety and Stress Scale or DASS-21 was used to examine the emotional conditions of depression, anxiety and stress to determine its significance (Lovibond & Lovibond, 1995) (Appendix A). There is an inclusion of 7 units in each scale in the DASS-21, which is organised into subscales with contents alike. The current study will use the stress and anxiety scale from DASS-21. Anxiety scale includes examination of effects of skeletal muscle and autonomic arousal. The stress scale, however, examines areas such as nervous arousal and agitation. The participants were instructed to indicate answers that had significance in the past week when they were answering the questionnaire. The range of responses include 0-3 with 0 indicating “did not apply to me at all” and 3 indicating “applied to me very much or most of the time”. In order to gain an overall total for each scale, they have to be totaled and multiplied by 2. This will indicate the extremity of each scale as for instance a normal score of anxiety is 0-7 whereas a high score for stress is 34 and over. A Cronbach’s alpha was conducted to indicate internal reliability as a study conducted by Gloster et al (2008) indicated a high score of 0.89 for stress. Anxiety scores had low internal consistency of 0.69.

Emotional valence words

The emotional valence words used in the research included 30 words with 10 words in each category of positive, negative and neutral. There was an inclusion of emotional valenced words such as “Delighted” and “Dispute” with neutral words such as “Parking” (Appendix B). The words were derived from Mitterschiffthaler et al (2008), Mathews and Barch (2006) and Kousta, Vinson and Vigliocco’s (2009) studies in order to examine the impact of the emotional valenced words expressed in these studies on stress and anxiety scores. The words derived had strong emotional connotation in order to assess its significance on sex differences. The words were displayed using the software of OpenSesame 3.1 on the computer.

Information sheets for participants

Information sheet was provided to participants in order to ensure that participants were aware of the procedures of the experiment and their rights as participants within the research (Appendix C) A Debrief sheet was provided to ensure that participants were informed on the research conducted with references to previous research and the procedures used during the experiment. (Appendix D). A contact sheet was also provided to participants to ensure that if they felt discomfort, they were able to call a support service (Appendix E).

OpenSesame 3.1

The OpenSesame 3.1 software was used in the research due to its ability to generate experiments. The software was used to create the Emotional Stroop Task used in the current study. The software allowed for the coloured emotional words to be displayed in the center of the computer screen for five seconds. The software included a timer, which allowed for the recording of the participant’s time for each displayed word.

Apparatus

Four computers were required for the experiment to ensure that groups of participants would be able to participate in the experiment at the same time. Coloured tabs in the colours Red, Blue and Green were also used to ensure that the coloured words had corresponding coloured keys on the keyboard.

2.4 Procedure

The experiment had taken place in the Psychology lab room 3.8 in Castle House, Dublin Business School. Prior to participating in the research, participants were informed that the research was examining stress and anxiety scores as a result of exposure to emotional valence words using the Emotional Stroop Task on sex differences with the inclusion of age assessment in relation to response time. Participants had taken part in the experiment on the time and date that was suited to them. The psychology lab allowed a group of four participants at a time due to the availability of four computers.

Upon entering the lab, participants were provided with an information sheet with information pertaining to the research experiment (Appendix C). They were also handed the first questionnaire with a number at the top of the page indicating their participant number. The participant number served as an identification as participants were not asked to reveal any personal information other than the information that was relevant to the research. Once the participants had completed the questionnaire, which did not take more than ten minutes to complete, they were asked to remember their participant number. They were asked to sit by a computer, which had the software displayed on the screen. They were instructed to pay attention to the colours of the words presented on the screen and match the colours to the keyboard keys with the corresponding coloured tabs. The coloured tabs were placed on the R, B and G keys on

the keyboards, which corresponded with the first letter of the coloured tabs used. The words on the screen were displayed in the colours, 'red', 'blue' or 'green' for five seconds each in the center of the screen, during which participants were required to click on the corresponding coloured key before the time was up. They were also told that there would be a practice test prior to the core experiment to ensure an understanding of the experimental method. The participants were then asked to click on the green arrow to start and indicate their participant number, which would save the response time data of the participants under the participant number. The experimental procedure had lasted approximately five to seven minutes. Once the participants had completed the task, they were provided with the final questionnaire, which was identical to the first questionnaire, to assess stress and anxiety scores after exposure to the emotional valenced words. They were handed a debrief sheet (Appendix D) and a sheet with contact information (Appendix E). The overall experiment lasted twenty minutes and participants were also allowed to ask questions.

2.5 Ethical considerations

In order to ensure that participants had not felt any discomfort during the experiment, they were provided with an information sheet, which outlined that the participants were able to withdraw from the experiment at any time should they feel any discomfort and that participants will remain anonymous as only the information provided in the research will be used. They were also provided with a debrief sheet to ensure that they were aware of the research and were able to ask any questions. A contact sheet for support services was also provided if they felt any discomfort.

Results

3.1 Descriptive Statistics

The study examined the statistical differences between sex differences, that is, male and female participants in relation to stress and anxiety scores post experimentation along with the reaction timings for positive and negative valenced words with age differences using the Emotional Stroop Task. It was reported that male participants obtained higher stress scores post experimentation ($M = 16.80$, $SD = 10.29$) in comparison to female participants ($M = 12.60$, $SD = 7.93$). Pre- experimentation stress scores had shown higher stress scores in comparison to post experimentation stress score in males ($M = 19.00$, $SD = 8.86$) and female participants ($M = 13.13$, $SD = 7.75$). Female participants demonstrated a prolonged response time for positive words ($M = 950.7$, $SD = 316.70$) relative to male participants ($M = 747.0$, $SD = 134.2$). Similarly, female participants reported a delayed response time for the presented negative words ($M = 967.6$, $SD = 294.3$) in comparison to male participants ($M = 745.9$, $SD = 135.1$) (Appendix G). There was a non- distribution for skewness with 1.90 ($SE = 0.69$) and kurtosis with 3.97 ($SE = 0.72$) for males in relation to stress scores. Female stress scores, however, indicated a normal distribution for skewness with 0.17 ($SE = 0.43$) and kurtosis with -0.92 ($SE = 0.83$) as indicated in Table 1.1.

When investigating the statistical difference between sex differences and anxiety scores, it was found that male participants reported higher anxiety scores post experimentation ($M = 10.20$, $SD = 8.77$) in comparison to female participants ($M = 7.07$, $SD = 6.16$). Anxiety scores for pre- experimentation displayed higher scores relative to post experimentation scores in male ($M = 11.00$, $SD = 10.25$) and female participants ($M = 8.33$, $SD = 7.50$). Additionally, as observed in

Table 1.1, anxiety scores in male participants indicated a normal distribution for skewness with 0.11 (SE= 0.69) and kurtosis with =1.55 (SE = 1.33). Female participants had also demonstrated a normal distribution in skewness with 0.72 (SE = 0.43) and kurtosis with -0.6 (SE = 0.83).

The age range of participants were divided into three groups in order to assess the statistical difference between the three age groups and the reaction time to positive and negative valenced words. The response time was measured from millisecond (ms) to seconds (s). It was reported that participants in the second age group demonstrated a prolonged response time to positive (M = 1006.4, SD = 476.6) and negative valenced words (M = 1010.5, SD = 448.6). Comparatively, participants in the first age group displayed a faster response time for words with positive (M = 799.1, SD = 186.3) and negative valence (M = 832, SD = 177.6). Participants in the third age, however, displayed a slower response time relative to the first age group for positive (M = 909, SD = 108.4) and negative valenced words (M = 908, SD = 128.4). There is no normal distribution indicated with group 2's reaction time for positive words with 2.40 skewness (SE= 0.64) and 6.96 of kurtosis (SE= 1.23). There is, however, a normal distribution for group 1 in relation to reaction time for negative words with a skewness of 0.39 (SE = 0.6) and -0.52 kurtosis (SE = 1.15) (Table 1.2).

Table 1.1 *Descriptive statistics for sex differences in relation to stress scores and response time*

Variables	Sex	
	differences	
Stress	Male	Female
Mean	16.80	12.60
Standard Deviation (SD)	10.30	7.93
Mean (Pre-experiment)	19.00	13.13
Standard Deviation (SD) (Pre-experiment)	8.86	7.75
Minimum	6.00	0.00
Maximum	42.00	28.00
Range	36.00	28.00
Skewness	1.90	0.17
Standard error for skewness	0.69	0.43
Kurtosis	3.97	-0.92

Standard error for kurtosis	1.33	0.83
Anxiety		
Mean (post-experiment)	10.20	7.07
Standard Deviation (SD)	8.77	6.16
(Post-experiment)		
Mean (Pre-experiment)	11.00	8.33
Standard Deviation (SD) (Pre-experiment)	10.25	7.50
Minimum	0.00	0.00
Maximum	24.00	22.00
Range	24.00	22.00
Skewness	0.11	0.72
Standard error for skewness	0.69	0.43
Kurtosis	-1.55	-0.60
Standard error for kurtosis	1.33	0.83

Table 1.2 *Descriptive statistics for age groups and response time for positive and negative words*

Variables	Groups		
Response time for positive words	1	2	3
Mean	799.1	1006.4	909.00
Standard Deviation (SD)	186.3	476.6	108.4
Minimum	563	543	730
Maximum	1212	2376	1172
Range	650	1833	441
Skewness	1.10	2.40	0.72
Standard Error (SE)	0.60	0.64	0.60
Kurtosis	0.77	6.96	1.69
Standard Error (SE)	1.15	1.23	1.15
Response time for			

negative			
words			
Mean	832.0	1010.5	908.0
Standard	177.6	448.6	128.4
Deviation			
(SD)			
Minimum	560	572	646
Maximum	1183	2233	1126
Range	622	1661	480
Skewness	0.39	1.99	0.88
Standard	0.60	0.64	0.60
Error (SE)			
Kurtosis	0.52	5.02	0.99
Standard	1.15	1.23	1.15
Error (SE)			

Inferential statistics

3.2 Sex differences and stress scores

A one-way multivariate ANOVA was conducted to examine sex differences in stress scores and words that have positive and negative valence. Hypothesis 1 postulated there will be a significant difference between sex differences in performance on stress scores and response time to positive valenced words. The results indicated no statistical difference between sex differences in relation to stress scores and reaction timings for positive words ($F(2,37) = 2.92, p = 0.66$). When examining sex differences in relation to stress scores completed post experimentation, following a Bonferroni adjustment to 0.025, no significant difference was found ($F(1,38) = 1.81, p = 0.187$). Similarly, there was no significant difference between sex differences and response timing for words with positive valence ($F(1,38) = 3.85, p = 0.057$).

Additionally, hypothesis 2 indicated a statistical difference between sex differences in performance on stress scores and response time to negative valenced words. There was a statistical difference was detected between sex differences, stress scores and response time for words with negative valence ($F(2,37) = 3.70, p = 0.034, \text{effect size} = 0.17$). Following a Bonferroni adjustment to 0.025, it was revealed that there was no statistical difference between sex differences and stress scores ($F(1,38) = 1.81, p = 0.187$). There was no reported statistical difference between sex differences and response time for words with negative valence ($F(1,38) = 5.24, p = 0.028$). A statistical difference was identified between sex differences, stress scores and response time for the control group of neutral words ($F(2,37) = 3.52, p = 0.040, \text{effect size} = 0.16$). There were, however, no statistical differences between sex differences and stress scores ($F(1,38) = 1.81, p = 0.187$) and sex differences and reaction time for neutral words ($F(1,38) = 5.08, p = 0.030$) following a Bonferroni adjustment to 0.025 (Table 2.1). A Cronbach's alpha

was performed in order to assess the internal consistency of stress scores. The scores indicated a high internal consistency of 0.83.

Table 2.1 *MANOVA results for sex differences in relation to stress scores and response time*

Variables	Groups	F.	Dfs	Error dfs.	P.	Partial Eta Square.
Sex	Stress	1.81	1	38	0.187	0.05
Differences						
	Response time for positive words	3.85	1	38	0.057	0.09
	Stress*Response time for positive words	2.92	2	37	0.66	0.14
	Response time for negative words	5.24	1	38	0.028	0.12
	Stress*Response time for negative words	3.70	2	37	0.034	0.17
	Response time for neutral words	5.08	1	38	0.030	0.12
	Stress*Response time for neutral words	3.52	2	37	0.040	0.16

3.3 Sex differences and anxiety scores

A one-way multivariate ANOVA was performed in order to examine statistical differences between sex differences, anxiety scores and response time for positive valenced words.

Hypothesis 3 indicated that there will be a statistical difference between sex differences in performance on anxiety scores and response time to positive valenced words. The results indicated that there was no statistical difference between sex differences in relation to anxiety scores and response time for positive valenced words ($F(2,37) = 2.57, p = 0.090$). Similarly, there was no statistical difference between sex differences and anxiety scores ($F(1,38) = 1.56, p = 0.19$) following a Bonferroni adjustment to 0.025. Response time for positive valenced words also indicated no statistical difference with sex differences ($F(1,38) = 3.85, p = 0.057$).

Furthermore, Hypothesis 4 indicated that there will be a significant difference between sex differences in performance on anxiety scores and response time to negative valenced words.

There was no statistical difference identified when examining sex differences, anxiety scores and words with negative valence ($F(2,37) = 3.22, p = 0.052$). There was also no statistical difference between sex differences and anxiety scores post experimentation ($F(1,38) = 1.56, p = 0.219$) following a Bonferroni adjustment to 0.025. Response time for negative valenced words and sex differences indicated no statistical difference ($F(1,38) = 5.24, p = 0.028$) (Table 3.1). A

Cronbach's alpha was conducted in order to examine the internal consistency of anxiety scores.

The scores for anxiety indicated a high internal consistency of 0.796.

Table 3.1 *MANOVA results for sex differences in examining anxiety and response time*

Variables	Groups	F.	Dfs	Error dfs.	P.	Partial Eta Squared.
Sex	Anxiety	1.56	1	38	0.219	0.04
Differences						
	Response time for positive words	3.85	1	38	0.057	0.09
	Stress*Response time for positive words	2.57	2	37	0.090	0.12
	Response time for negative words	5.24	1	38	0.028	0.12
	Stress*Response time for negative words	3.22	2	37	0.052	0.15

3.4 Age difference and response time

Hypothesis 5 indicated that there will be a statistical difference between age and performance on reaction time task for negative valenced words compared to positive valenced words. It was elucidated that there was no statistical difference between age groups and response time for positive and negative valenced words as indicated by the one-way multivariate ANOVA Wilks Lambda ($F(4,72) = 0.92, p = 0.459$). When investigating age groups across the specific response time, no statistical difference was indicated for positive valenced words ($F(2,37) = 1.67, p = 0.203$) following a Bonferroni adjustment to 0.025. There was also no statistical difference found between age groups and words with negative valence ($F(2,37) = 1.34, p = 0.273$) (Table 4.1).

Table 4.1 *MANOVA results for age groups and response time for positive and negative words*

Variables	Groups	F.	Dfs	Error dfs.	P.	Partial Eta Squared.
Age groups	Response time for positive words	1.67	2	37	0.203	0.08
	Response time for negative words	1.34	2	37	0.273	0.07
	Response time for positive words*Response time for negative words	0.92	4	72	0.459	0.05

Discussion

The aim of the current research was to examine sex differences on stress and anxiety scores separately with response time to emotionally valenced words, that is, positive and negative words using the Emotional Stroop Task. Age differences was also examined in the reaction time to the emotionally valenced words presented.

The results of the study indicated that males reported higher scores in stress and anxiety post-experimentation in comparison to female participants. Higher stress and anxiety scores were also reported in pre-experimentation relative to post-experimentation as indicated in Table 1.1. It was also inferred that female participants indicated a prolonged response to positive and negative valenced words in comparison to male participants (Appendix G). In relation to age differences, individuals in Group 2, in the age range of 22-36 years old displayed a prolonged response time to positive and negative valenced words in comparison to individuals in Group 1 and Group 3 who displayed faster responses as shown in Table 1.2.

When examining sex differences in stress scores and response time to positive valenced words, the results found no statistical differences, disproving the first hypothesis. There was a statistical difference, however, found when examining sex differences across stress scores and response time to negative valenced words, which is consistent with the second hypothesis as indicated in Table 2.1. A statistical difference was also indicated between sex differences in stress scores and response time to neutral words, which was not hypothesised. There were no statistical differences indicated for sex differences in performance on anxiety scores and response times for both positive and negative valenced words, thus disproving hypotheses three

and four (Table 3.1). Age differences in reaction time to positive and negative valenced words had also resulted in no statistical difference, disproving hypothesis five (Table 4.1).

Kessler et al (1995) indicated that females in comparison to males are susceptible to the development of stress. This was not indicated in the current research as the results indicated that male participants reported a higher stress score in comparison to female participants. The results from the current research can be viewed in Chaplo et al's (2017) research as it was indicated that males relative to females develop PTSD symptoms. While the current study does not examine PTSD, the concept of stress development can be inferred to the results due to the increased stress scores in male participants post-experimentation. Metzger et al (1997) reported that prolonged response in naming words that are threat related in the Emotional Stroop Task are due to the emotional meaning of the words, which has an influence over its attention and representation. This view can be evidenced in the current research as a statistical difference was indicated between sex differences in stress scores and response times to words with negative valence. The current research had not used threat-related words; however, both the studies had implemented the use of negative stimuli in the Emotional Stroop Task, which had exhibited a prolonged response time. It can be deduced that there is attentional bias when processing the negative valenced words in the Emotional Stroop Task, which leads to the delay in response time in participants. Prolonged response to the negative stimuli, however, was evidenced in female participants in comparison to male participants in the study.

The results of the study do suggest the possibility of the occurrence of the categorical negativity theory by Pratto and John (1991), which theorises the occurrence of prolonged response time for negative words relative to positive words. This is identified in the study due to the statistical difference found between sex differences in stress scores and response time to

negative valenced words as opposed to the examination of sex differences in stress scores and response time to positive valenced words, which exhibited no statistical difference. The phenomenon of automatic vigilance was also detected within the study as it was found that females in comparison to males exhibited prolonged response time for negative relative to positive valenced words. This is exhibited in Estes and Adelman's inference on the appraisal made by individuals on a stimulus as either negative or positive, which could lead to a prolonged or increased response time to the presented words.

MacLeod and Rutherford (1992) found that there is a prolonged response time for words associated with negative stimuli in individuals in high states of anxiety. It was inferred that anxiety is stimulated due to threatening content as there is an attentional bias towards it (Williams et al, 1998). This leads to the prolonged response time to the content as indicated by Matthews and Klug (1993). The current research had found no statistical difference when examining sex differences in anxiety scores and response time for negative valenced words. The results had caused an inability to determine if there was an attentional bias towards the emotional valenced words presented in the Emotional Stroop Task in relation to anxiety. The results, however, do indicate a prolonged response time for female participants in comparison to male participants as there is presence of attentional bias towards the words presented in the experimental procedure. Egloff and Hock's (2001) study using the card form of the Emotional Stroop Task found interference effects in high states of anxiety relative to low states of anxiety when exposed to threatening stimuli. The findings have some application to the current research due to the results indicating that males display higher scores for anxiety in comparison to females. The results, however, also showed a higher anxiety score pre-experimental procedure, which could indicate that the effect of the Emotional Stroop Task in anxiety scores, post-

experimentation has a diminishing effect. This is due to the decrease in anxiety scores from pre-experimentation to post-experimentation.

McLean et al (2011) instilled that females have an increased susceptibility towards symptoms of anxiety in comparison to males. This was not found in the study as it was shown that males in comparison to females reported a higher anxiety score as indicated in Table 1.1. Stewart et al (1998) found that anxious males were susceptible to words relating to social threat and females with anxiety were susceptible to words relating to physical threat. The current study does not apply specific negative valenced words, however, it can be postulated that the negative valenced words used in the study could have similarities to words relating to social threat, which could indicate the increased anxiety scores in males.

When examining sex differences, Charles and Mather (2003) found delays in recall of negative stimuli for younger adults and increased recall of positive stimuli for middle- aged and older adults. This was evidenced in the study in relation to the younger adults in Group 2 with the age range of 22-36 years old who displayed a prolonged response for words with negative valence when participating in the Emotional Stroop Task. This relates to Murphy and Isaacowitz's (2008) suggestion that younger adults display significant affect towards negative stimuli and emotional salience. Participant's in Group 3 with the age range of 36-58 years old did not display an increased response to positive valenced words in comparison to participants in Group 1 with the age range of 19-22 years old. The socioemotional selectivity theory as indicated by Carstensen, Isaacowitz and Charles (1999) was not evident in the study as there was no indication of positivity effect in participants in Group 3 as they had indicated a prolonged response time toward positive words in comparison to Group 1.

4.1 Limitations

The limitations of the study are firstly, in relation to the ratio of the participants as there were 30 female participants and 10 male participants in the study. This gender imbalance could have caused a skew in the results as it was indicated that males had a higher stress and anxiety score in comparison to females. If there was an inclusion of more male participants, the research could have determined if such a result was still exhibited or if another result was exhibited, such as those from previous studies, which indicated a high anxiety score for females. The use of a timer in the study could pose as a limitation as the participants were given five seconds per emotional word to select the colour corresponding to the word. This could have affected the results as participants were given a maximum time limit to respond, which could have impacted what was considered a prolonged response time. Exclusion of a timer could have provided an insight into the amount of time participants took to respond without time restriction, thus allowing for examination of response time to the emotional valenced words for sex and age difference. Another limitation of the study is the handing out of the questionnaire prior and post-experimentation as the results had indicated to increased scores for stress and anxiety in the pre-experimental questionnaire. This could support the notion that Emotional Stroop Task had no significant impact on participant's stress and anxiety. The use of one questionnaire in post-experimentation could potentially indicate if exposure to emotional valenced words had a significant impact on stress and anxiety scores in participants. The duration of the experiment also indicates a limitation to the study as participants were only exposed to words for a short duration. This could impact the results as participants were not exposed to the emotional words for a prolonged period, which would not have a significant impact on them.

While the study does obtain limitations, there are numerous strengths that indicates its success. The study had provided support to the hypothesis that there would be a statistical difference between sex differences in performance on stress scores and response time to negative valenced words. The study had also indicated a statistical difference between sex differences in stress scores and response time to neutral words, which gives rise for examination into the area. An understanding of the increased stress and anxiety scores in males in comparison to females was provided in the research as most research suggested susceptibility to stress and anxiety was prevalent in women. This allows for further research to examine the impact of emotional valenced words on males. The results of the study had also given rise to the fact that females in comparison to males had a prolonged response to emotional valenced words. It was also indicated that younger adults had a prolonged response time to emotional words in comparison to middle-aged adults. The study had participants from a wide age range, which allowed for the examination and comparisons of response time to the emotional words presented in the different age groups.

Further research into this area is pivotal as it will enhance an understanding of the impact of emotionally valenced words on sex differences and age. Research could focus on another age group such as adolescents in order to examine if the emotionally valenced words has an impact on the stress and anxiety scores in the specific age group. Research would also be able to determine the presence of attentional bias and automatic vigilance in younger age groups. There could also an inclusion depression scores to examine if exposure to emotionally valenced words could have a significant impact on depression scores in individuals. This could provide more insight into areas such as clinical settings when examining factors such as stress, anxiety and depression. Further research into the impact of emotional valence words on middle-aged

individuals should also be considered due to the limited amount of research surrounding the age group as most research examines younger and older adults. This could indicate if there are differences in the impact of exposure to emotional valenced words on middle-aged individuals.

4.2 Conclusion

In conclusion, the study indicated a statistical difference in sex differences in performance on stress scores and response to negative valenced words, which could give rise to the presence of attentional bias and automatic vigilance when there is exposure to emotional valence words. While no significance was indicated for the other variables examined, the research does indicate a difference in stress and anxiety scores when examining sex differences. The research was also able to indicate a difference in response time for sex differences and age differences to determine if there was an increased or prolonged response time due to exposure of emotional valence words.

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Appendices

Appendix A

Effect of emotional valenced words on sex differences in stress and anxiety with age

Please indicate your gender:

Male Female Other

Please indicate your age: _____

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

- 0 Did not apply to me at all
- 1 Applied to me to some degree, or some of the time
- 2 Applied to me to a considerable degree, or a good part of time
- 3 Applied to me very much, or most of the time

1	I found it hard to wind down	0	1	2	3
2	I was aware of dryness of my mouth	0	1	2	3

3	I couldn't seem to experience any positive feeling at all	0	1	2	3
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5	I found it difficult to work up the initiative to do things	0	1	2	3
6	I tended to over-react to situations	0	1	2	3
7	I experienced trembling (eg, in the hands)	0	1	2	3
8	I felt that I was using a lot of nervous energy	0	1	2	3
9	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10	I felt that I had nothing to look forward to	0	1	2	3
11	I found myself getting agitated	0	1	2	3
12	I found it difficult to relax	0	1	2	3
13	I felt down-hearted and blue	0	1	2	3
14	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15	I felt I was close to panic	0	1	2	3
16	I was unable to become enthusiastic about anything	0	1	2	3
17	I felt I wasn't worth much as a person	0	1	2	3

18	I felt that I was rather touchy	0	1	2	3
19	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
20	I felt scared without any good reason	0	1	2	3
21	I felt that life was meaningless	0	1	2	3

Appendix B

Emotional Valenced words used in the experiment

Positive words	Negative words	Neutral words
Delighted	Pain	Note
Excited	Blame	Parking
Joy	Error	Walk
Passion	Trouble	Writing
Calm	Dispute	Brushing
Gentle	Fatigue	Dial
Peaceful	Failure	Navigate
Relaxed	Bother	Invent
Carefree	Confusion	Follow
Friendly	Gloom	Run

Appendix C

Effect of emotional valenced words on sex differences in stress and anxiety with age

My name is Tanesha Nair and I am a final year student at Dublin Business School. I am conducting research examining the impact of positive and negative words using the emotional Stroop task and I would like to invite you to participate in this research study. The research study conducted is part of an undergraduate thesis.

The study will include a questionnaire relating to stress and anxiety which will be handed prior and post experimentation. The questionnaires should not take more than ten minutes to complete. The experiment will display words that are positive, negative and neutral and it is important that the participant is in the age group of 18 years old and older.

Participation in the experiment will be taken as consent, however it is voluntary, and you have a right to withdraw from the research at any time if you feel any discomfort. Data collected from the research will be securely stored and transferred into an electronic device, which is password protected to ensure that the information is protected.

There are no risks associated with participation. There will be an information sheet with contact details for support services provided at the end of the experiment if there is any discomfort.

All information collected as part of the study is solely for experimental purposes. The information will remain confidential and participants will be anonymous.

If you have any further questions about the research, you can contact:

Researcher: xxxxxxx@mydbs.ie

My supervisor: xxxxxxx@dbs.ie

Appendix D

Debrief Sheet

Thank you for your participation in this study. The aim of the current study is to investigate the impact of positive and negative words on stress and anxiety levels using the Emotional Stroop Task.

Previous studies have alluded to an increase in the recall and recognition of words with emotional valence in comparison to neutral words (Dresler et al, 2009). It was deduced that there is slower performance on the emotional Stroop task in individuals with stress and anxiety due to the presentation of words that have an emotional valence (Amir et al, 1996, Cisler et al, 2011).

How was this tested?

In this study, you were asked to click on the coloured keys that matched the colour of the words displayed on the screen without paying attention to the displayed word. A practice run was provided at the beginning to ensure an understanding of the experimental method. A questionnaire was provided before and after the experiment in order to examine the variables of stress and anxiety.

Why was this studied?

This was studied in order to examine the impact of emotionally valenced words, i.e., positive and negative words on sex differences in relation to inducing stress and anxiety levels using the Emotional Stroop Task. The reaction time is accounted for in order to determine if there is a prolonged response time to the words presented. The variable of age was also used in order to examine if there was a reduced performance in specific age groups over other age groups due to the emotionally valenced words presented.

How can I learn more?

If you would like to receive a report of this research when it is completed or if you would like to learn more about the research, please contact Tanesha Nair at xxxxxxx@mydbs.ie.

If you feel any discomfort after completing the experiment, a page with contact details of support services will be provided in the next page.

Thank you once more for your participation.

Appendix E

Contact information

Thank you for taking part in the research. If you feel any discomfort after completing the experiment, the contact information below of support services will be able to provide help. If there are any further questions regarding the research, the contact information for the researcher will also be provided below.

Good Samaritan: 116123

Aware: 1-800-804-848

Researcher email: xxxxxxxx@mydbs.ie

Appendix G

Table 1.4 *Descriptive statistics for sex differences in relation to response time*

Variables	Sex differences	
	Male	Female
Response time for positive words		
Mean	747.0	950.7

Standard Deviation (SD)	134.2	316.7
Response time for negative words		
Mean	745.9	967.6
Standard Deviation	135.1	294.3