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Sex Differences in Processing Aggression Words Using the Emotional Stroop Task

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There is a robust relationship between the salience of stimulus materials presented in the Emotional Stroop task and inhibition of response in clinical populations. Researchers have now found information-processing biases in both forensic and non-forensic samples presented with threatening or aggressive stimuli [Cohen et al., 1998; Eckhardt and Cohen, 1997; Smith and Waterman, 2003; Van Honk et al., 2001]. We sought to explore sex differences in processing words relating to acts of direct and indirect aggression using a group of undergraduates (50 males and 50 females). Participants also completed self-report questionnaires (AQ and EXPAGG) to allow some consideration of the relationship between objective and subjective measures. We predicted that males would demonstrate delayed responses when presented with words relating to acts of direct aggression. We also predicted that high levels of physical aggression would be the best predictor of bias for direct aggression words, high levels of verbal aggression would be the best predictor of bias for indirect aggression words, physical aggression would predict bias in males, and verbal aggression would predict bias in females. Males demonstrated a perceptual bias for words relating to acts of direct aggression, taking significantly longer to correctly colour name direct aggression words. Females were slower to correctly colour name indirect aggression words, but not significantly so. Verbal aggression, as expected, predicted bias performance for indirect aggression words but anger rather than physical aggression was the best predictor of bias for direct aggression words. Gender was a predictor for bias with both sets of words. Contrary to our predictions, it was observed that a high level of physical aggression was the best predictor of bias in both males and females. These data provide further evidence to confirm the saliency of aggression words to aggressive individuals in non-forensic populations. Aggress. Behav. 31:271–282, 2005. © 2005 Wiley-Liss, Inc.

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INTRODUCTION

The Stroop colour naming task [Stroop, 1935] requires participants to be shown words printed in a variety of colours, and they are then instructed to name the colour of the word as quickly as possible whilst ignoring the word meaning. It takes longer for participants to correctly colour name words that are antagonistic colour names than it does for meaningless stimuli (e.g., brown vs. xxxxx). The latency of the naming response is seen to reflect the extent

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to which the processing of word meaning takes place [Williams et al., 1997]. Stroop interference occurs when respondents are slower to colour name a particular class of words compared to neutral control words; conversely, Stroop facilitation occurs when respondents are quicker to colour name a class of words. A variant was subsequently developed called the Emotional Stroop [e.g., Ray, 1979; Matthews and MacLeod, 1985] and was initially used to examine cognitive processing associated with emotional disturbance. Participants with clinical anxiety disorders generally take longer to identify the colour of words with threatening themes than neutral words when compared to controls [Williams et al., 1996, 1997]. Delays are seen as reflecting the salience of the stimulus to the participant [Riemann and McNally, 1995]. There are several theoretical explanations for Stroop effects [see Williams et al., 1997], but they all focus upon the conflict between the colour naming task and the automaticity of the word-reading interference.

Information processing approaches to aggression are not new [Berkowitz, 1990; Dodge and Crick, 1990; Huesmann, 1988], but recently, there has been a resurgence of interest, such as the emerging body of work linking executive cognitive functioning (ECF) and aggression [Giancola et al., 1996; Hoaken et al., 2003; Villemarette-Pittman et al., 2003]. Evidence now suggests that trait anger [Cohen et al., 1998; Eckhardt and Cohen, 1997; Van Honk et al., 2001], criminal convictions for violent offending [Smith and Waterman, 2003], and previous self-reported aggressive experience [Smith and Waterman, 2004b] also predict bias performance for material that is either threatening or aggressively themed. To date no research has attempted to identify the presence of any sex differences in bias performance on these cognitive tests with regard to aggressive material.

The existence of sex differences is one of the most robust findings in aggression research [Bettencourt and Miller, 1996; Eagly and Steffen, 1986]. Females are reported to be less aggressive than males [Eagly and Steffen, 1986] and appear to estimate the danger and harm of similar aggressive acts to be higher than males [Bettencourt and Miller, 1996]. They also see their aggression in terms of a loss of control, rather than a gain of control, as perceived by males [Campbell and Muncer, 1994; Campbell et al., 1992], and are more likely to experience guilt and anxiety at the consequences of their aggression [Eagly and Steffen, 1986]. We decided to explore these sex differences based upon the conceptualisation of preferences for different forms of aggression (direct vs. indirect) [Björkqvist, 1994]. Direct aggression refers to episodes that include overt acts of physical or verbal aggression; whereas indirect aggression refers to covert acts such as malicious gossip or the manipulation of social networks [Lagerspetz et al., 1988]. Females are more likely to employ indirect aggression than males, who appear to favour direct aggression [Björkqvist, 1994; Björkqvist et al., 1992]. If the distinction between direct and indirect aggression does extend into sex differences in adulthood, presumably underpinned by social roles and societal norms, one might legitimately expect to observe distinctive sex-based patterns of bias for material representative of these acts.

The automaticity reflected in the Stroop effect may have important implications for our understanding of aggression. When the participants read the word presented, it activates representations associated with that word that are based upon that individual's previous learning history, and influenced by the individual's current emotional state. The greater the meaning ascribed to that stimulus word, the greater the interference that will be manifest in the colour-naming task. This information processing approach is consistent with the role of stimuli in the environment as automatic sources of aggression [Todorov and Bargh, 2002], as representational activity is of course not restricted to activation by simple word

presentations. Trigger stimuli have been argued to increase the chances of aggressive behaviour emerging by chronic accessibility [Dodge and Crick, 1990] and automatic effects on behaviour [Berkowitz, 1990]. We are not suggesting that the words themselves act as primes for aggressive behaviour, but simply that the bias elicited by their presentation reflects the strength and potency of representations associated with the words.

However, the long established use of tests of attentional bias in clinical populations [MacLeod et al., 1986] should not be taken to suggest that all aggression can be psychopathologised. Stroop interference can frequently be seen in normal samples presented with words pertinent to their current concerns [McNally, 1998]. For example, if presented with a list of names that contains the names of members of one's family, it will take the subject longer to correctly identify the colour of those names, compared to names of individuals who are not personally known to the subject [Riemann and McNally, 1995]. Emotional Stroop effects have been shown in samples ranging from students undertaking examinations [Ray, 1979] to normal participants fasting [Lavy and van den Hout, 1993]. We would argue that salience of material can originate from either pathology (e.g., anxiety disorders, depression, or perhaps in the case of aggression – neurological damage or psychiatric disorder) and/or from experience [Riemann and McNally, 1995; Smith and Waterman, 2004b]. A preference for, or extended experience of, acts of either direct or indirect aggression will be manifest in Stroop inhibition (slowed responses to colour name the presented word) when presented with words reflecting the specific type of aggression.

Individual differences in trait emotion are strongly associated with performance in the Emotional Stroop [Williams et al., 1997]. To allow a consideration of the roles of trait levels of aggression and beliefs about aggressive behaviour we included two self-report measures. To examine beliefs we used the revised Expressive-Aggression Questionnaire (EXPAGG) [Archer and Haigh, 1997a, b; Campbell et al., 1992]. The revised EXPAGG produces two independent scales that measure instrumental social representations and expressive social representations of aggression [Campbell et al., 1999] and consistently demonstrates sex differences [Archer and Haigh, 1997a, b; Campbell et al., 1992; Smith and Waterman, 2002]. We used the Buss-Perry Aggression Questionnaire (AQ) [Buss and Perry, 1992] to examine trait levels of aggressiveness in the two groups as it includes subscales for physical and verbal aggression that could be used to examine the effects on bias for direct and indirect aggression material.

In early studies, response latency in the Emotional Stroop was calculated by comparing response times to target (affectively valenced) words with neutral words [Williams et al., 1997]. However, this is a relatively gross measure of attentional bias, as it fails to address the fact that the words differ both semantically and affectively. Consequently researchers now tend to use affectively similar words as controls for the comparisons (content specific bias scores). However, whilst this is easily implemented in clinical samples (e.g., negative emotion words acting as controls for anxiety words) it is more difficult to address this issue when using words relating to aggressive acts. Participants can attribute either positive or negative valence to aggression words and it is difficult to identify in advance the direction of this interest. The attention of a sadist is captured by the word "hit" because he gains pleasure from the act; the attention of the sadist's victim is also captured by the word "hit" because he is distressed by the act. Both participants are slowed in the colour-naming task but this does not identify the emotional content of the representation activated by the exposure to the word, simply the interference it causes. The valence properties of a target word are specific to that individual. Yet it would hold salience for both victim and protagonist in this instance [Riemann and

McNally, 1995]. Consequently, it is important to stress that the presence of a bias for either direct or indirect material is not a measure of behaviour per se, but rather an indicator of meaning ascribed to the target word. The salience of the word is a function of that individual's learning history. Given the expected differences in male and female learning histories as a consequence of social roles and reinforcement, it seemed likely that sex differences would emerge in bias performance.

In summary, the study was an attempt to identify the presence of gender differences in information processing bias for direct and indirect aggression words. We predicted that males would demonstrate a perceptual bias for words relating to acts of direct aggression, with the increased salience of the stimuli being related to their suggested preference for this type of aggressive behaviour [Björkqvist, 1994]. No specific predictions were made for females, as there was insufficient evidence to suggest that indirect aggression is the preferred form of aggression in adult females [Green et al., 1996; Walker et al., 2000]. Research also predicted that high levels of self-reported physical aggression would be the best predictor of bias for direct aggression words, high levels of verbal aggression would be the best predictor of bias for indirect aggression words, and physical aggression would be the best predictor in males and verbal aggression the best predictor in females. Elevated levels of instrumental aggression (as measured by EXPAGG) were expected to predict greater bias for direct aggression words in all participants.

METHOD

Participants

Participants were all undergraduate students at the School of Psychology, University of Leeds, and were volunteers who attended lectures given by the authors. They received no payment or course credits for their participation. The female participants ($n = 50$) were between 18 and 25 years of age ($M = 18.48$, $SD = 0.58$) and the male participants ($n = 50$) between 18 and 22 years ($M = 19.64$, $SD = 1.33$). The males were significantly older than the females ($t\ (98) = 5.63$, $p < .005$).

Stimulus Materials

Stimulus words were taken from the MRC psycholinguistic database. Words were matched as closely as possible for both length and frequency of occurrence. Prior to testing, all the aggression words were independently rated for aggressive content on a scale of non-violent (1) to exceptionally violent (9) by a panel of four academic psychologists (two males and two females) blind to the purposes of the study. Direct and indirect aggression words were classified using a forced choice allocation by the panel. Words on which there was not complete agreement amongst the panel were excluded. Direct aggression words (e.g.,, slap, punch) had a mean rating of 6.5 (range 4–9) and indirect aggression words (e.g.,, gossip, bitch) had an aggression rating of 4 (range 1–6). Cohen's Kappa (mean value) for the panel was 0.70.

The Emotional Stroop Task

The words presented were direct aggression themed, indirect aggression themed positive emotion, negative emotion, colour, or neutral. A fixation "x" appeared for 500ms in the

centre of the screen. The participants were asked to ignore the word and to say the ink colour of the word (Red, Green, or Blue) as quickly as possible into the microphone, whilst making as few errors as possible. The word remained on screen until the participant responded. Responses were recorded using a voice activated key system linked to a laptop computer for timings. The experimenter indicated whether the response was correct by entering C or I on the keyboard attached to the laptop. Colour naming response latency was the dependent variable. Each participant was given 10 practice trials. There were 120 experimental trials in the study: direct aggression themed words (20), indirect aggression themed words (20), positive emotion words (20), negative emotion words (20), neutral words (20), and colour words (20). The colour words were always incongruent with the colour presented to the participants. Given the mismatch between the number of colours used (Red, Green, and Blue) and number of stimuli words in each class, the software was configured so that each colour was presented at least six times within each word class (leaving two remaining random colour word pairings). We normally expect to see the greatest Stroop interference occur in respect of the colour naming of colour words as the participant is naming a colour and reading a colour word simultaneously, it is most semantically related to the task and normally causes greatest disruption. However, on occasion, with the Emotional Stroop participants experience more interference with the target words [Williams et al., 1997].

Self-Report Questionnaires

The Aggression Questionnaire (AQ) [Buss and Perry, 1992] is a 29–item questionnaire that records self-reported aggressive feelings and behaviours. There are four subscales: physical aggression, verbal aggression, anger, and hostility. Test-retest reliability and internal and construct validity for the scales has been found to be high [Buss and Perry, 1992; Harris, 1995; Williams et al., 1996] All the test items are assessed using a 5–point Likert scale (1 = never or hardly ever applies to me and 5 = very often applies to me). Two items on the scale are reverse scored (numbers 4 and 19). The AQ has been previously used with UK populations [Archer and Haigh, 1997a, b, 1999; Smith and Waterman, 2002, 2003]. The revised EXPAGG questionnaire [Campbell et al., 1992; Archer and Haigh, 1997a, b] is a 40–item scale that measures instrumental and expressive beliefs about aggressive behaviour. Respondents' answer each of the items using a 5–point Likert scale (1 = strongly agree and 5 = strongly disagree) with the expressive scores reversed. The instrumental and expressive components of the scale each comprise 20 questions. The 40 questions were randomly distributed within the questionnaire.

Procedure

Participants were administered the two aggression questionnaires in counter-balanced order. Half the participants completed the questionnaires prior to the cognitive task to control for priming effects [Todorov and Bargh, 2002]. Participants were tested in an experimental cubicle in the School of Psychology. The words were presented on a Pentium II (233MHz) laptop computer with a VGA (11.4 inch screen) display and 60—Hz refresh rate. The programs ran under the DOS operating system and the screen resolution was 16 bit (800×600 pixels). Participants were seated 70 cm from the screen. Response selection was by means of a microphone connected to a voice activated relay key connected to the RS232 port of the laptop computer. The computer recorded participants' response time, stimulus configuration (word and colour), and whether their response was correct. Inter-trial intervals

varied randomly between 500–1000ms. Stimulus order was randomised by a seed generator and timed by the internal clock of the computer. All testing was conducted by the first author. Each test session lasted approximately 20 minutes.

RESULTS

Participant scores by gender for the self-report measures of aggression are shown in Table I. There were no significant effects for order of presentation of questionnaires. Group comparisons using ANCOVA with gender as the between groups factor and age as a covariate were conducted (alpha set at 0.05) and significant results and effect sizes (η^2) are indicated in the table. There was no significant effect of age for any of the self-report measures. Self-reported gender differences were consistent with those previously found using EXPAGG [Archer and Haigh, 1997a, b; Campbell and Muncer, 1994; Smith and Waterman, 2002]. As expected men scored higher on the Instrumental scale and women scored higher on the Expressive scale. The men also reported themselves to be more physically aggressive and angry than the women on the AQ. It is not unusual for males to score higher on physical aggression [Archer and Haigh 1997b; Buss and Perry, 1992] but generally there is no gender difference in anger [Buss and Perry, 1992; Harris, 1997]. There were no differences in self-reported levels of verbal aggression or hostility. Instrumental scores were found to be significantly negatively correlated with Expressive scores ($r = -.35$, $p < 0005$). This is consistent with previously reported correlations from student samples [Archer and Haigh, 1997a].

Reaction Time [RT] Data Preparation

Emotional Stroop

Mean RTs and standard deviation scores are shown below in Table II. There were no significant differences between the two groups in terms of the mean time taken to correctly identify the colour of the direct aggressive, indirect aggressive, positive emotion, negative emotion, neutral, and colour themed words. Content-specific bias scores were then calculated for each participant by subtracting the mean RT for the negative emotion and positive

TABLE I. Participant Mean Scores (Standard Deviations in Parentheses) for the Self-Report Measures of Aggression (AQ and EXPAGG) With Age as a Covariate

Scale/Sub-scale	Males (n = 50)	Females (n = 50)	Effect Size (η^2)
AQ Physical*	24.11 (6.43)	15.66 (4.16)	.322
AQ Verbal	14.27 (4.23)	14.20 (4.04)	.000
AQ Anger*	19.16 (5.03)	15.57 (3.65)	.109
AQ Hostility	20.49 (5.49)	19.88 (6.09)	.002
AQ Total Score*	78.05 (18.33)	65.42 (14.48)	.101
EXPAGG Instrumental*	59.90 (10.69)	48.97 (7.51)	.212
EXPAGG Expressive*	62.51 (8.50)	69.48 (7.84)	.126

Significant Group Differences Key: *($p < .05$).

TABLE II. Mean RT's in Milliseconds for the Stroop Task by Word Type (Neutral, Direct Aggression, Indirect Aggression, Positive, Negative, and Colour) and Gender. Standard Deviation Scores in Parentheses

Word Type	Male	Female
Neutral Word	560.43 (81.96)	568.56 (79.61)
Direct Aggression Word	595.04 (63.18)	599.68 (68.83)
Indirect Aggression Word	590.77 (64.84)	617.47 (73.28)
Positive Emotion Word	576.98 (64.79)	594.89 (55.03)
Negative Emotion Word	583.82 (66.96)	616.43 (62.98)
Colour Word	620.31 (79.62)	615.80 (75.99)

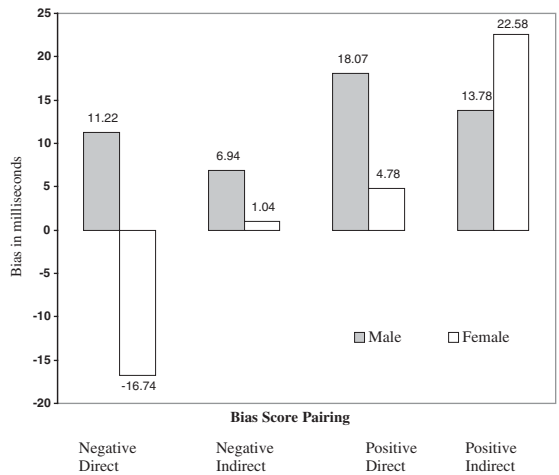

Fig. 1. Participant content-specific bias scores by gender and stimulus word condition in the emotional Stroop task. (Positive scores indicate Stroop interference in that participants are slower than for the associated emotion words.)

emotion word presentations from each of the mean RTs to stimulus word conditions (direct aggression, indirect aggression). This produced four bias scores for each participant. A positive content-specific bias score indicated slowed response latency in either the direct or indirect aggression word condition compared to the negative or positive emotion word condition. Slower response latencies are taken within the Stroop task to indicate interference - i.e. increased cognitive processing of the word meaning that is superfluous to the colour naming task.

The mean bias scores by group and condition are shown in Figure 1. Generally, the participants were slower to correctly colour name the aggression words (direct and indirect) compared to the time it took them to colour name the emotion words (positive and negative), with the exception of the negative emotion word-direct aggression word pairing. In this task, females appeared to be considerably slower to respond to negative emotion words compared to the time taken to respond to direct aggression words. Both male and female participants were slower to respond to negative emotion words compared to positive emotion words. This suggests that participants experienced greater interference when presented with negative

words compared to positive words, and that generally the aggression words were more disruptive to performance than any of the emotion words.

The bias scores were then entered into a $2 \times 2 \times 2$ ANCOVA with one between-subjects variable of group (male and female) and two within-subjects factors of aggression word type (direct or indirect) and emotion word bias type (negative or positive) and age of participant as a covariate. There were no significant main effects for gender ($F(1,97) = 1.13$, $p > .05$, $\eta^2 = .070$), aggression-word type ($F(1,97) = 1.21$, $p > .05$, $\eta^2 = .064$) or age ($F(1,97) = 1.74$, $p > .05$, $\eta^2 = .070$). There was a significant main effect of emotion word type ($F(1,97) = 3.74$, $p < .05$, $\eta^2 = .482$). Participants were significantly slower to correctly colour name negative emotion words compared to positive emotion words (14.85ms vs. 0.62ms). There was a significant interaction effect between gender and aggression word type ($F(1,97) = 3.22$, $p < .05$, $\eta^2 = .428$). Post hoc analysis showed that males were significantly slower (14.64ms vs. −5.98ms), to correctly colour name direct aggression words ($t(98) = 1.95$, $p < .05$), but females were not significantly slower (11.81ms vs. 10.36ms) to colour name indirect aggression words ($t(98) = -.119$, $p > .05$).

In order to examine the relationships between subjective (self-report) measures and objective (cognitive tests) performance a stepwise multiple regression was conducted for the dependent variables of direct and indirect aggression response latencies with gender, age, EXPAGG instrumental and expressive scores, and AQ subscales (physical aggression, verbal aggression, anger, and hostility) as predictor variables. AQ anger ($\beta = .45$, $p < .005$) and gender ($\beta = .26$, $p < .05$) made up the best predictive model for direct bias score ($F(2,97) = 10.19$, $p < .0005$, $R^2 = .17$). Age, AQ physical aggression, AQ verbal aggression, AQ hostility, and EXPAGG instrumental/expressive scores were not observed to be significant predictors in this model. AQ verbal aggression ($\beta = .24$, $p < .05$) and gender ($\beta = .20$, $p < .05$) made up the best predictive model for indirect response latency ($F(2,97) = 5.15$, $p < .01$, $R^2 = .10$). Age, AQ verbal aggression, AQ anger, and AQ hostility and EXPAGG instrumental/expressive scores were not observed to be significant predictors. The regressions were then repeated for males and females to test the prediction that AQ physical aggressiveness would be the best indicator of impaired performance in males and AQ verbal aggression the best indicator in females (using combined direct and indirect bias scores). AQ physical aggression ($\beta = .52$, $p < .0005$) made up the best model for males ($F(1,48) = 17.77$, $p < .0005$, $R^2 = .27$). AQ physical aggression ($\beta = .44$, $p < .005$) also made up the best model for females ($F(1,48) = 11.77$, $p < .005$, $R^2 = .20$). The other items were not found to be significant predictors in either model.

DISCUSSION

As predicted, males demonstrated a perceptual bias for words relating to acts of direct aggression, taking significantly longer to correctly colour name words relating to acts of direct aggression. Given the elevated levels of self-reported aggression reported in the male sample, this is consistent with explanations of stimuli salience (i.e., previous experience) predicting performance [Riemann and McNally, 1995]. Females were found to be slower to correctly colour name indirect aggression words, but not significantly so. However, the absence of sex differences in indirect aggression is not unusual in adult studies [Richardson and Green, 1999; Walker et al., 2000]. It may be that within adult populations, increased levels of both verbal and social skills reduce any gender differences [Björkqvist et al., 1992]. It

is also likely that the social network of the undergraduates is well suited to the expression of indirect aggression by both sexes [Green et al., 1996; Walker et al., 2000]; for example indirect aggression more specifically includes verbal behaviours relating to manipulation of social structure [Lagerspetz et al., 1988].

Verbal aggression, as expected, was the best predictor of bias for indirect aggression words and this is, of course, consistent with the conceptualisation that it is heavily reliant upon verbal activity [Lagerspetz et al., 1988; Björkqvist et al., 1992]. However, the failure of elevated levels of physical aggression to predict bias for direct aggression words requires some explanation. As previously identified, there is generally no gender difference in anger using the AQ [Buss and Perry, 1992; Harris, 1996]. Males in the current sample reported significantly higher levels of anger than females, and it seems likely that this underpins the finding. Physical aggression was found to be the best predictor of bias for aggression words for both males and females (we had predicted that verbal aggression would be the best predictor in females). This, however, is consistent with our previous findings [Smith and Waterman, 2003, in press], and strongly suggests that experience is the best predictor of aggression word salience in the Emotional Stroop task [Riemann and McNally, 1995]. The presence of gender as a predictor for both direct and indirect aggression word bias can be attributed to the aggression word type x gender interaction (males responding more slowly to direct aggression words). Finally, elevated levels of instrumental aggression (as measured by EXPAGG) did not predict increased bias for direct aggression words in either group. As EXPAGG may be construed as a measure of belief systems rather than behaviour per se, this may account for the absence of any relationship to bias performance. Furthermore, there is now some evidence to suggest that the factor structure of the EXPAGG may be inconsistent across samples [Forrest et al., 2002].

The content-specific bias scores suggest that the participants generally ascribed more negative valence to the aggression words (their response latencies were reduced when compared to the negative words). Females also demonstrated much more disturbance in performance in response to negative words compared to the direct aggression words, suggesting that the potency of these words was substantially reduced. This is consistent with earlier data collected by these researchers, which showed highly aggressive individuals demonstrate greater impairment for aggressive words than for emotional words [Smith and Waterman, 2003]. Consequently, in a high functioning student sample we would anticipate greater interference from negative emotional material.

Males reported higher levels of anger; this was the best predictor of bias performance for direct aggression words. A recent meta-analysis of emotional arousal and gender differences in aggression [Knight et al., 2002] concluded that the absolute levels of incremental arousal associated with stimuli may be critical in producing gender effects. Buss and Perry [1992] argue that the anger subscale reflects the emotional component of aggressive experience, suggesting elevated levels of arousal may have been elicited by the stimuli for this group. The authors suggest that future studies should incorporate measures of arousal to help establish the role of emotional reactivity/regulation on information processing sex differences in aggression. The merits of this approach are further emphasised by the recent work on the mediating roles of social intelligence and empathy on aggression [Björkqvist et al., 2000].

Researchers focusing upon cognitive bias in affective disorders such as anxiety and depression sometimes argue for a distinction between perceptual and higher-level, more elaborative processing as a fundamental difference between the two pathologies [Mogg and Bradley, 1998, 1999; Williams et al., 1997]. Anxiety dictates the requirement for a system that

achieves information uptake and processing at an early stage to allow speeded responses [Williams et al., 1997]. Depression, conversely, requires the processing of information at much "higher" levels, conceptual processing of internally generated material rather than perceptual stimuli. A representation-driven model of aggression could comfortably accommodate both these views. It is not immediately obvious whether direct and indirect acts can be easily conceptualised as dichotomous in terms of representational activation requirements. It would seem likely that processing at both levels would be implicated dependent upon the circumstances and the nature of the episode itself. It may be that the traditional account of affective aggression can best be seen as operating at the early perceptual stage of representational activation and that instrumental acts of aggression can be seen (due to their nature) to be more dependent upon internally generated stimuli driving activations at a "conceptual" level. Interestingly, if depression is seen as an adaptive response [Williams et al., 1997; Dixon, 1998] that loses its adaptive function as severity increases, then an analogy may be drawn with those extremely violent offenders who utilise elaborate fantasy and detailed planning of their acts representing a similar end of a continuum.

One obvious direction for future research would be to categorise participants into groups based upon their preference for either direct or indirect aggression [e.g., Green et al., 1996] and we acknowledge that the failure to measure this is a weakness in the current study. Another problem lies in the differences in intensity between acts of direct and indirect aggression. Word selection is critical in eliciting effects using the Emotional Stroop [McNally, 1998]. Whilst we accept that controlling for intensity is artificial, as escalation is an integral component of aggressive behaviour, nevertheless it has to be considered that the increased valence and imagability associated with more intense aggressive acts are likely to recruit attention in participants. Any replication should use stimuli that are comprehensively matched to control for this potential confound.

In summary, these data provide further evidence for the presence of processing bias in normal adult samples for aggression related words. Males are significantly slower to correctly colour name direct aggression words. Trait anger predicts bias performance for direct aggression words and verbal aggression predicts bias for indirect aggression words, whilst gender is a predictor of bias performance for both types of words. Individuals who reported elevated levels of physical aggression showed inhibited performance (i.e. they were slower to correctly colour name target words) in respect of all aggression words. This is consistent with our previous findings that antisocial behaviour (criminal convictions in offenders), and experience of aggression (self-reported acts in undergraduates) are indicators of impaired performance in several cognitive tests of attentional bias [Smith and Waterman, 2003, 2004a,b]. Whether these data support the notion of sex differences in aggressive behaviour (as opposed to the processing of words related to that behaviour) is still a matter of some conjecture.

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