

Attention biases in perfectionism: Biased disengagement of attention from emotionally negative stimuli by: *Tonta, K.E. and Howell, J.A. and Hasking, P.A. and Boyes, M.E. and Clarke, P.J.F.*

Perfectionism is a multidimensional process defined by the setting of personally demanding high standards, and self-evaluation based on the attainment of those standards (Shafran, Cooper, & Fairburn, 2002). As a transdiagnostic process, perfectionism has been associated with the development and maintenance of multiple psychological disorders including anxiety, depression, eating disorders, and obsessive-compulsive disorder (OCD; Egan, Wade, & Shafran, 2011). Perfectionism may also impede treatment outcomes across psychological disorders, while treatment for perfectionism is associated with a reduction in the symptoms of associated disorders (Lloyd, Schmidt, Khondoker, & Tchanturia, 2015; Egan et al., 2011). Despite the clinical significance of perfectionism, the nature of cognitive features which may underpin perfectionism, is unclear.

1.1 Multidimensional Models of Perfectionism

Within the definition of perfectionism, two higher order constructs emerge which align with the cognitive behavioural definition of perfectionism; setting personally demanding standards, also known as perfectionistic strivings, and evaluating the self against these standards, known as perfectionistic concerns (Stoeber & Otto, 2006). There is ample evidence that perfectionistic concerns is associated with psychological disorders and symptoms of those disorders (Limburg, Watson, Hagger, & Egan, 2017), while the relationship between perfectionistic strivings and psychopathologies is less clear (Limburg et al., 2017). While it has been suggested that perfectionistic strivings are adaptive or associated with positive outcomes (Stoeber & Otto, 2006), the meta-analytic evidence suggests there is an association between perfectionistic strivings and negative outcomes particularly in the context of eating disorders and obsessive-compulsive disorders (Limburg et al, 2017). This suggests that both perfectionistic concerns and strivings are relevant to consider in the context of establishing how perfectionism is associated with psychopathologies.

1.2 Threat-related Attentional Biases and Perfectionism

Theoretical models of perfectionism suggest that there are underlying cognitive biases which may act to maintain perfectionism (Shafran et al., 2002). One such bias may be an attentional preference for threat-related stimuli over non-threatening information. Researchers have proposed that an attention bias to threat (e.g., stimuli that threaten perfection) can highlight failure, which may be an important maintaining factor in perfectionism (Frost, Marten, Lahart, & Rosenblate, 1990; Hewitt & Flett, 1991; Shafran et al., 2002). As has been observed in studies of attentional bias in anxiety or depression (e.g., Harvey, 2004), the pattern of attention bias may be highly specific to the class of stimulus

relevant to an individual specific domain of concern. As such, for individuals with elevated perfectionism, perfectionism relevant threat may be more salient than stimuli that are perfectionism irrelevant. Perfectionism relevant threat is that which is related to meeting high standards, and can be positive in emotional tone (e.g., success) or negative in emotional tone (e.g., inadequate). According to models of perfectionism, these attention biases to perfectionism relevant information, relative to perfectionism irrelevant information, may give rise to other cognitive distortions often targeted in cognitive-behavioural therapy for perfectionism, such as overgeneralisation of failure or discounting of success (Shafran et al., 2002; Lloyd et al., 2015).

Within the literature examining the role of biased attention in various psychopathologies, a critical distinction is made between two sub-processes which can influence the overall manifestation of the bias. These processes are the tendency to attend more rapidly to certain stimuli (facilitated engagement) and difficulty withdrawing attention from stimuli (impaired disengagement; Cisler & Koster, 2010). Facilitated engagement may be related to increased sensitivity or heightened awareness, and associated with the initiation of anxiety (Koster et al., 2006). Conversely, impaired disengagement may be related to the continued processing of threat stimuli once observed, and the maintenance of anxiety (Koster et al., 2006). Given that the successful modification of biased attention for threat has been consistently linked to positive emotional effects for other types of psychological difficulties (Clarke, Notebaert, & MacLeod, 2014; MacLeod & Clarke, 2015; Price et al., 2016), discriminating the precise nature of attention biases which underpin perfectionism can inform our understanding of why some individuals are more likely to experience negative outcomes than others when they strive for perfection, and may also highlight potential target for direct intervention

There are only two known studies which have explored attention biases in perfectionism (Howell et al., 2016; Kobori & Tanno, 2012). Both studies present preliminary evidence that there may be a perfectionism-related attention bias, however there are methodological limitations that warrant further consideration. The earliest study aimed to compare attention biases in individuals high in perfectionism with those low in perfectionism in a Japanese population (Kobori & Tanno, 2012). In this research, participants with high and low scores in perfectionistic concerns completed a modified emotional Stroop task with either neutral or negatively valenced words associated with perfectionism (i.e., mistake). Kobori and Tanno (2012) demonstrated a slowed reaction for high-perfectionism participants for colour-

naming negative, perfectionism relevant stimuli, consistent with an attention bias towards threat. While this finding is consistent with the presence of such a bias, slowing of responses in an emotional Stroop task may be also be attributed to non-attentional processes associated with differences in the emotional state of participants (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Van Ijzendoorn, 2007). Similarly, it was not clear from this study whether perfectionism is characterised by an attention bias towards all negative words, or just those that are perfectionism relevant. The study also evaluated perfectionistic concerns, but did not examine perfectionistic strivings. Finally, the modified Stroop task produces an overall index of attentional bias but does not differentiate between categories of bias type (e.g., engagement or disengagement). Understanding how this attention bias may be characterised contributes to our theoretical understanding of the processes underpinning perfectionism and may provide insight for treatment directions.

To address some of these limitations, Howell et al. (2016) conducted a study which compared participants high and low in perfectionistic concerns on attention biases using a modified-dot probe task. Following an initial fixation, two stimuli (one emotional and one neutral) are presented, followed by a target probe in the location of one of the words (Grafton & MacLeod, 2014; MacLeod et al., 1986). Participants are required to discriminate the identity of the probe, and the relative speed to identify probes appearing in the location of threatening as compared to neutral stimuli provides the critical index of attention bias.

The emotionally-relevant stimuli included words that were perfectionism relevant and perfectionism irrelevant, with an equal proportion of each that were positive and negative. Howell et al (2016) found that participants who were higher in perfectionism showed an attention bias towards negative, perfectionism relevant, information over positive perfectionism relevant information. However, the study did not evaluate the nature of the attentional bias (e.g., engagement vs. disengagement).

Despite promising results, what still remains unclear is the component attentional processes that comprise the attentional bias towards threat in perfectionism and how the two higher-order constructs of perfectionism, perfectionistic concerns and perfectionistic strivings, may be commonly or differentially associated with biased attentional engagement and disengagement in attention bias scores. Understanding how strivings is characterised may be important considering the mixed findings around perfectionistic strivings association with psychopathology. It is possible that perfectionistic strivings (which in some research has been associated with more positive outcomes; Stoeber & Otto, 2006) may be specifically

associated with biased attentional engagement/disengagement with positive perfectionism relevant stimuli.

1.3 The Current Study

Within the literature it is unclear if perfectionism is characterised by facilitated engagement with or impaired disengagement from threatening stimuli. Additionally, no study to date has considered the effect of an attention bias for perfectionistic strivings, despite the association between perfectionistic strivings and psychological distress (Limburg et al., 2017). The present study aims to determine whether perfectionistic strivings and perfectionistic concerns are characterised by different attentional bias types (engagement vs. disengagement) across different stimulus categories (perfectionism relevant vs. irrelevant, and negative emotional valence vs. positive emotional valence). As perfectionistic concerns and perfectionistic strivings are believed to be associated with different patterns of psychopathology, it is consequently hypothesised that both perfectionistic concerns and perfectionistic strivings will uniquely predict attention bias toward negative stimuli, when they are perfectionism relevant, after controlling for symptoms of depression, anxiety, and stress. A second aim of this study is to determine how the attention bias associated with perfectionistic concerns or perfectionistic strivings may be characterised by an engagement bias, a disengagement bias, or both. As no study to date provides evidence to suggest the nature of attention bias in perfectionism, a directional prediction cannot be made.

2.0 Methods

2.1 Participants

One hundred and eight participants were recruited through various recruitment methods, including advertising through and snowball sampling from the general community, networks at a local university, and the [removed for review] School of Psychology undergraduate participation pool. A-priori power analysis through G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) indicated 108 participants were required to detect a moderate effect ($f^2 = .2$; power = 0.8, two-tailed alpha = .05). After data for four participants were removed due to low accuracy, a total of 104 participants (19 male, 84 female, and one who preferred not to disclose gender) were included in the study. The age of these participants ranged from 18 to 57 years ($M = 26.52$, $SD = 9.52$).

2.2 Measures

2.2.1 Frost Multidimensional Perfectionism Scale Brief (FMPS-Brief). The FMPS-Brief (Burgess, Frost, & DiBartolo, 2016) is an eight-item measure that assesses

experiences of perfectionistic strivings (4 items, e.g., “I have extremely high goals”; $\alpha = .81-.85$) and perfectionistic concerns (4 items, e.g., “The fewer mistakes I make, the more people will like me”; $\alpha = .83-.85$). Responses are made on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). The measure has demonstrated strong convergent validity with common measures of depression, anxiety, worry, fear of negative evaluation, and perfectionism (Burgess et al., 2016). The internal consistency for both perfectionistic strivings and perfectionistic concerns in the present study was strong ($\alpha = .83$ and $.88$ respectively).

2.2.2 Depression, Anxiety and Stress Scale (DASS 21). The DASS-21 (Lovibond & Lovibond, 1995) is a 21-item measure which assesses symptoms of depression (e.g., “I felt down-hearted and blue”), anxiety (e.g., “I felt I was close to panic”), and stress (e.g., “I found it hard to wind down”) in the past week. Previous research has indicated that anxiety and depression are related to perfectionism, and are both characterised by an attention bias in responding to emotional information (Koster et al., 2006). As such, the potential confounding effects of any symptoms of depression, anxiety, or stress related to attention bias scores were statistically controlled. Responses were given on a 4-point Likert scale of 0 (never) to 3 (almost always), and then totalled for each of the three subscales. The DASS-21 has demonstrated discriminant and convergent construct validity with other measures of depression and anxiety (Henry & Crawford, 2005). The depression, anxiety, and stress scales all have high internal consistency in non-clinical samples ($\alpha = .88, .82$ and $.90$ respectively; Henry & Crawford, 2005). The internal consistencies in the present study were: depression ($\alpha = .92$), anxiety ($\alpha = .88$), and stress ($\alpha = .83$).

2.2.3 Stimulus words. The modified dot-probe task allows for assessment of attention with regards to word/non-word pairs. The present research used the word list generated and validated by Howell et al (2016). There are five categories of words; neutral (e.g., sock), positively valenced and perfectionism relevant (e.g., achievement), positively valenced and perfectionism irrelevant (e.g., kind), negatively valenced and perfectionism relevant (e.g. unsuccessful) and negatively valenced and perfectionism irrelevant (e.g. attack).

The original 200-word list was evaluated by six independent raters, who rated all words on emotional valence and perfectionism valence in accordance with the definition of clinical perfectionism. The words were rated for perfectionism relevance from -3 (extremely perfectionism relevant) to +3 (extremely perfectionism irrelevant). Raters also scored the words for emotional valence from -3 (extremely negative) to +3 (extremely positive). These ratings informed the selection of 16 words in each category, with the final stimulus list

containing 96 words. Howell et al. (2016) conducted a two-way ANOVA on the stimulus emotional valence, and found that these words differed significantly in emotional valence ($F[1,60]= 1470.00, p < .01, \eta^2 = 0.961$). The emotional valence of these words were equal in magnitude (negative stimuli $M = -2.47, SD = 0.51$; positive stimuli $M = 2.34, SD = 0.48$). These words did not differ in perfectionism relevance ($F[1,60]= 0.001, ns, \eta^2 < 0.001$). There was also no interaction between the two factors ($F[1,60]= 0.248, ns, \eta^2 = 0.004$). A second two-way ANOVA was conducted on the stimulus perfectionism relevance, and found that these words differed significantly in perfectionism relevance ($F[1,60]= 1069.36, p < .01, \eta^2 = 0.947$). The perfectionism relevance of these words was equal in magnitude (perfectionism relevant stimuli $M = 2.34, SD = 0.48$; perfectionism irrelevant stimuli $M = -2.50, SD = 0.67$). These words did not differ in emotional valence ($F[1,60]= 0.045, ns, \eta^2 = 0.001$). There was also no interaction between the two factors ($F[1,60]= 0.401, ns, \eta^2 = 0.007$). The word list was also evaluated for word length and frequency of use in the English language, and there were no significant differences between the four categories of words (all $F < 3.40, p > .05$). For further details on development and analysis of this word list, see Howell et al (2016).

2.2.4 Experimental task. The attentional assessment task was presented using E-Prime v2.0. A Dell Latitude E6530 laptop with a 17-inch colour monitor and a standard two-button mouse was used to present stimuli and record participant responses. Participants sat approximately 60cm from the monitor and the centre of the display was at eye level. The format of the task was consistent with previous studies examining biased attentional engagement and disengagement (Grafton, Watkins, and MacLeod, 2012; Grafton, Southworth, Watkins, & MacLeod, 2016; Rudaizky, Basanovic, & MacLeod, 2014) and constructed in line with the requirements outlined by Clarke, MacLeod, and Guastella (2013) for assessing these component attentional processes. These criteria outline the necessity of cognitive assessments of attentional engagement/disengagement to initially secure attention in a given location with a non-emotional stimulus, before then assessing the relative ease with which attention can be relocated either away from a proximal emotional stimulus (disengagement) or towards a distal emotional stimulus (engagement). In line with these requirements, on all trials in the current study, a fixation cue first appeared in either the upper or lower position of the screen for 1150ms and was briefly replaced by a fixation probe consisting of a grey line that sloped either left or right for 150ms. The fixation cue oriented participant attention to the location of where the sloped line would appear. Participants were required to note the orientation of this fixation probe. This fixation probe appeared in the

upper and the lower positions of the screen an equal number of times across trials. Second, after the initial fixation probe, a letter string pair (one non-word and one word) was presented in the centre of the screen separated vertically by 3cm for 500ms. In half of the trials the word appeared in the same position as the initial probe (attention disengagement trials), and in the remaining trials the word appeared in the opposite position (attention engagement trials). Third, after the letter strings disappeared, a target probe (a grey sloped line) appeared in either the upper or lower position (equal frequency across the trials). Participants were required to discriminate whether the target probe matched the slope direction of the fixation probe as quickly as possible. Participant reaction time to make a discriminative choice was measured. Speeded reaction time to discriminate these probes that appeared in the location of the word, relative to probes in the location of the non-word, indicated increased attention to the word member pair. A total of 384 trials were presented to each participant across which each word category was exposed four times.

Based on the average reaction time to each stimulus condition, an attention bias index score was calculated. There were five stimulus categories across both engagement and disengagement trials. The stimulus categories were: emotionally positive and perfectionism relevant, emotionally negative and perfectionism relevant, emotionally positive and perfectionism irrelevant, emotionally negative and perfectionism irrelevant, and neutral. Engagement trials were those where the initial probe was in the opposite location to the stimulus word. Disengagement trials were those where the initial probe was in the same location as the stimulus word.

In line with past studies using this task format (Grafton, Watkins, and MacLeod, 2012; Grafton, Southworth, Watkins, & MacLeod, 2016; Rudaizky, Basanovic, & MacLeod, 2014), the engagement bias index, reflecting the degree to which attention moved towards the location of emotional compared to neutral stimuli, was computed from those trials where the stimulus (or neutral) word was presented in the opposite locus to the initial probe using the following formula:

Engagement bias index = ([RT: target probe in opposite locus to stimulus word – RT: target probe in same locus as stimulus word] – [RT: target probe in opposite locus to neutral word – RT: target probe in same locus as neutral word]). Separate engagement indices were computed for each stimulus type (i.e. positive/negative and perfectionism relevant/irrelevant) with a higher score representing greater speeding to engage attention with that stimulus type (i.e. higher scores = rapid engagement).

The disengagement bias index, reflecting the degree to which attention moved away from the location of the emotional compared to the neutral stimuli, was computed from trials where the stimulus (or neutral) word was presented in the same locus as the initial probe using the following formula:

Disengagement bias index = ([RT: target probe in opposite locus to stimulus word – RT: target probe in same locus as stimulus word] – [RT: target probe in opposite locus to neutral word – RT: target probe in same locus as neutral word]). Separate disengagement indices were computed for each stimulus type (i.e. positive/negative and perfectionism relevant/irrelevant) with a higher score representing difficulty disengaging attention from that stimulus type (i.e. higher scores = delayed disengagement).

Given concerns about the reliability of cognitive bias tasks (Parsons, Kruijt, & Fox, 2018), it is important to consider the reliability of the assessment across each critical condition. As per recommendations by Parsons and colleagues (2018), split-half internal consistencies were calculated across trial types. For positive engagement, positive disengagement, and negative engagement the split half correlations were .45, .35, and .07 respectively. The split half correlation for negative disengagement was -.049, which, consistent with prior work, suggests that results from this task should be interpreted with caution.

2.3 Procedure

The research was approved by the [removed for review] Human Research Ethics Committee. Participants were tested separately, and first given a link to the online questionnaire, which presented the information sheet. Participants read the information sheet and were given the opportunity to ask any questions, and then provided informed consent. After informed consent was obtained, participants completed the questionnaire package, taking between five and 10 minutes to complete. Following the questionnaire completion, participants completed the modified dot-probe assessment. Participants sat approximately 60cm away from the screen and were presented with verbal and written instructions. These instructions emphasised that participants should first note the orientation of the fixation probe, and then respond as quickly and accurately as possible in identifying if the target probe was oriented in the same or different direction to the fixation probe. Participants first completed 16 practice trials to adjust to the task before completing the main modified dot-probe task. The modified dot-probe task took approximately 20 minutes per person. Upon completion of the task participants were thanked and debriefed.

3.0 Results

3.1 Preliminary Analyses

Attention bias index scores were computed following the procedure described above. For further detail, see Clarke et al (2013). Participants displayed a high level of accuracy on the probe task, averaging less than 6% errors. Only trials where the participant provided a correct response were included in subsequent analyses. Prior to computing the attentional preference indices, outlier probe discrimination latency scores (defined as those falling > 2.58 SD from each participant's mean probe discrimination latency) were removed (Howell et al., 2016). This resulted in exclusion of 5.25% of latencies. There were no missing data.

There was a positive correlation between perfectionistic strivings and concerns, and the subscales of the DASS-21 (as shown in Table 1). Accordingly, the DASS variables were included as covariates in the analyses¹. Scores on the two dimensions of perfectionism were both approximately normally distributed within the sample, and the sample contained the full range of potential scores across both subscales (minimum 4, maximum 20). Of the sample, 59.6% were students, 13.5% worked in office/clerical roles, 9.6% worked in retail, 10.5% worked in community and mental health services, 2.9% were tradespersons, and 3.8% reported another (including home duties and not currently employed).

Table 1

Pearson Correlation Matrix among Perfectionistic Concerns, Perfectionistic Strivings and DASS Subscales, with Mean Scores, Standard Deviation and Range

	PC	PS	Depression	Anxiety	Stress	Mean (SD)	Range
PC	1.00					11.88 (3.78)	4-20
PS	.32***	1.00				13.74 (3.64)	4-20
Depression	.51***	-.07	1.00			5.64 (4.75)	0-21
Anxiety	.55***	.18***	.67***	1.00		5.28 (4.84)	0-20
Stress	.49***	.19***	.64***	.78***	1.00	8.53 (4.00)	0-20

Note: ***p < .001; PC = perfectionistic concerns; PS = perfectionistic strivings.

¹ In considering the proposition that controlling for symptoms of depression, anxiety, and stress may reduce the effects we are seeking to examine, the same analyses were run without including the DASS variables as covariates. These results did not differ from the reported findings. Additionally, we have run the same analyses including student status (student vs non-student) as a covariate, and these results did not differ from the reported findings.

3.2 Perfectionistic Strivings and Concerns, and Attention Bias Indices

Data were analysed using a Generalised Linear Mixed Model (GLMM) which included participants as a random factor, Perfectionistic Strivings and Perfectionistic Concerns as continuous fixed effects, and the following three fixed within-groups factors: Stimulus Perfectionism Relevance (perfectionism relevant vs. perfectionism irrelevant words); Stimulus Emotional Valence (emotionally positive words vs. emotionally negative words); and Attention Bias Type (engagement bias conditions vs. disengagement bias conditions).

The GLMM revealed a significant main effect for Attention Bias Type, $F(1,807) = 5.72, p = .017, \text{partial } \eta^2 = .01$, which indicated that participants were more likely to experience a disengagement bias ($M = 155.21, SD = 85.88$) than engagement bias ($M = 157.92, SD = 95.86$). No other main effects were observed. This main effect was qualified by a significant two-way interaction between Perfectionistic Concerns and Attention Bias Type, $F(1,807) = 4.73, p = .030, \text{partial } \eta^2 = .01$, which indicated that an effect for attention bias type was only found in perfectionistic concerns, and not in perfectionistic strivings. No other significant two-way interaction effects were observed. The significant two-way interaction was further subsumed within a three-way interaction between Perfectionistic Concerns, Stimulus Emotional Valence, and Attention Bias Type, $F(1,807) = 5.73, p = .017, \text{partial } \eta^2 = .01$. To determine the source of this three-way interaction, two post-hoc GLMMs were conducted between Perfectionistic Concerns and Stimulus Emotional Valence, at each level of Bias Type (Engagement Bias Trials and Disengagement Bias Trials).

For the Engagement Bias trials, there was no interaction between Perfectionistic Concerns and Stimulus Emotional Valence, $F(1,400) = 2.74, p = .099$, but there was on Disengagement Bias Trials, $F(1,400) = 5.66, p = .018, \text{partial } \eta^2 = .01$. The relationship between Perfectionistic Concerns and Attention Bias index scores were consequently evaluated at each stimulus valence level for these Disengagement Bias trials. On trials with a negative valence, Perfectionistic Concerns were positively related to attentional bias, $r(208) = .14, p = .044, b = 4.65, 95\% \text{ CI} = .55, 8.75$ indicating that higher levels of perfectionistic concerns were associated with delayed disengagement from negatively information in general. On trials with a positive valence, there was no relationship between Perfectionistic Concerns and attentional bias, $r(208) = .01, p = .870, b = .38, 95\% \text{ CI} = -2.96, 3.72$.

4.0 Discussion

The present study aimed firstly to replicate the finding that a bias in attention towards negative perfectionism relevant stimuli exists in individuals with higher perfectionistic concerns and perfectionistic strivings. The second aim of this study was to determine how this attention bias may be characterised by an engagement or disengagement bias. Findings indicate that there was an effect for attention bias, qualified by a three-way interaction with perfectionistic concerns, emotional valence, and attention bias type. This effect only occurred in disengagement trials and where the stimuli were negative in emotional valence. Contrary to our expectations, there was no significant effect for perfectionism relevance. Finally, perfectionistic strivings was not associated with attention bias scores of any valence or attention bias type.

These findings provide evidence that individuals higher in perfectionistic concerns demonstrate an attention bias towards negatively valenced stimuli, even after accounting for symptoms of psychological distress. Based on previous findings, it was expected that individuals higher in perfectionistic concerns would demonstrate an attentional preference for negative, perfectionism relevant stimuli. This was partially supported, in that individuals higher in perfectionistic concerns demonstrated slower disengagement from stimuli that were negative in emotional tone. However, there was no effect for perfectionism relevance of the stimuli, in contrast with previous findings (Howell et al., 2016). This finding suggests that individuals who are higher in perfectionistic concerns show a tendency for their attention to be 'held' (but not captured) by information that is generally negative over information that is generally positive. Finally, there was no significant effect for biased attention with respect to perfectionistic strivings. This should be considered in light of the mixed literature around the nature of perfectionistic strivings as being related to positive or negative outcomes (Stoeber & Otto, 2006). The results of the present study suggest that, in this sample, there is no bias in attention towards emotionally salient stimuli associated with perfectionistic strivings. As such in the present study, an attentional bias does not indicate why perfectionistic strivings may be related to positive or negative emotional outcomes.

Although the present study did not observe an attentional bias based upon perfectionism relevance, there were key differences in the sample used by Howell et al. (2016) which may help to explain the discrepancy between these findings and the findings of the present study. Participants recruited by Howell et al. (2016) did not differ significantly across perfectionism groups on scores of depression, anxiety, or stress symptoms. This

idiosyncrasy may have an impact on the generalisability of the findings, as individuals higher in perfectionism typically score higher on symptoms of psychological distress. In the present study, perfectionistic concerns were significantly correlated with scores of depression, anxiety, and stress symptoms, while perfectionistic strivings was correlated with anxiety and stress symptoms. The finding that perfectionism relevance was a significant predictor in Howell et al. (2016) but was not in the present study may also be explained by population differences. Howell et al. (2016) recruited participants based on extreme scores on perfectionism (high or low) rather than individuals across the continuum. The extreme groups approach may be more sensitive to detecting attention bias effects by reducing the overall variability in the data. Although there is increased sensitivity associated with extreme groups, examining bias effects across a spectrum of scores in perfectionism provides a more accurate representation of how these biases occur within the general population. Given the discord between present findings and past research, further replication may help us to understand how perfectionism relevance of the stimulus may or may not be involved in attention bias.

That the current findings were specific to attentional disengagement from negative stimuli is also of interest. Reduced top-down executive control has been repeatedly associated with biased attention to threat, and in particular, has been implicated in impaired attentional disengagement (Cisler & Koster, 2010; Heeren, De Raedt, Koster, & Philippot, 2013). This has been supported by research findings showing that neurostimulation seeking to enhance activity in areas associated with executive control contributes to reductions in biased attention to negative information (Chen et al, 2017), and may specifically facilitate attentional disengagement in combination with attention bias training (Heeren et al., 2015). It seems entirely possible that a preoccupation with perfectionistic concerns could act as a cognitive load (e.g. in a similar way to worry), that serves to reduce the total capacity for top-down control of selective attention, contributing to impaired attentional disengagement from negative information. As such, it would be interesting for future research to examine whether enhancing executive control (e.g. either through cognitive training or via neurostimulation) would potentially improve the ability to disengage attention from negative information.

The present study has implications for theoretical understandings of perfectionism. According to the cognitive behavioural model of perfectionism, there is a proposed biased allocation of attention within perfectionism. Shafran et al. (2002) suggested that individuals higher in perfectionism would show a heightened sensitivity to information that threatens their perfectionism; that is, negative stimuli that were related to threat. There is now evidence

across three studies which demonstrate a bias towards negatively valenced stimuli, although it is less clear whether this bias is specifically related to perfectionism or to generally negative information.

Biases towards generally negative information (rather than perfectionism relevant) lends further support to conceptualisations of perfectionism as a transdiagnostic process. Interestingly, it appears that the pattern of attention preference is characterised by a disengagement bias and not an engagement bias. These findings suggest that people high in perfectionism may not be more vigilant for threatening information than those not high in perfectionism – but that once their attention has been captured by that threatening information, they experience greater difficulty disengaging from the threat. Importantly, this study presents robust evidence for an attention bias towards negative information, given the objective nature of the tasks used to assess bias.

These findings also have potential clinical implications. Cognitive-Behavioural Therapy (CBT) for perfectionism often involves reducing the concerns associated with perfectionism so that an individual may still strive for excellence, though without then basing one's self-worth on the striving or achievement of these standards (Handley, Egan, Kane, & Rees, 2015; Shafran, Egan, & Wade, 2010). Within CBT for perfectionism, there are often attention broadening techniques to bring one's attention away from a focus on any imperfection. Such techniques may assist people from disengaging from these threat signals that may facilitates distress. These present findings may also provide tentative evidence that a disengagement bias associated with perfectionistic concerns is a potential mechanism for resultant psychological distress.

It is also possible that these findings could help inform future interventions that seek to target biased patterns of attention in perfectionism for re-training using attention bias modification tasks. Attention bias modification involves training of implicit biases using a modified version of the dot-probe task (MacLeod & Clarke, 2015). In this training, repeated exposure to the task leads to reduced attention bias scores. As highlighted elsewhere (Clarke et al., 2013) to the extent that research is able to explicitly describe the precise pattern of attention that underpin traits such as perfectionism, then that specific aspect of attentional selectivity can become the target of change through attention bias modification. More targeted training may therefore be likely to yield superior effects than tasks that target general bias change. Indeed, some prior research has shown some success with targeting specific aspects of attentional engagement and disengagement among individuals who experience heightened

worry (see Hirsch et al., 2011). As such, if future research serves to confirm the current pattern of findings this would suggest that selective retraining of biased attentional disengagement from negative stimuli may be of specific benefit in perfectionism. Potentially, attention bias modification that seeks to target perfectionism may be useful as an adjunct intervention to facilitate therapeutic change in disorders where perfectionism may otherwise interfere with treatment gains (such as eating disorders and obsessive-compulsive disorders; Egan et al., 2011; Limburg et al., 2017).

However, the clinical utility of this intervention would require further research into the application and efficacy of attention bias modification training in a perfectionism context, and in clinical populations. Findings on the effects of selectively targeting biases in attentional engagement and disengagement have been somewhat mixed. In examining the attentional and emotional effects of training biased attentional engagement or disengagement, Hirsch et al (2011) found that only changes in attentional engagement produced subsequent changes in emotional symptoms. However, some findings suggest that when accurately identified, disengagement biases can be reduced, and are consequently associated in a reduction in anxiety behaviours (Heeren, Lievens, & Philippot, 2011). This effect was not found for engagement biases. Other findings have shown that attention bias modification-induced changes in bias contribute to greater ease of attentional disengagement from threat (Heeren, Baeken, Vanderhasselt, Philippot, & de Raedt, 2015), which highlights the potential utility of more precisely targeting component attentional processes operating in attention bias which in principle could contribute to more effective bias modification tasks over tasks targeting general changes in bias.

The present findings also indicate that additional assessment of attentional disengagement may be warranted. Specifically, the finding that individuals who are higher in perfectionistic concern show a tendency for their attention to be 'held' by information that is generally negative over information that is generally positive may be a potential mechanism that explains the link between perfectionism and the experience of psychological distress. In fact, rumination, which is often observed as an indirect pathway between perfectionism and psychological distress has been associated with the impaired capacity to move one's attention away from potentially distressing stimuli. The modification of an individual's attentional disengagement may then mediate subsequent emotional reactivity (Amir et al., 2008). The modification of individual's difficulty disengaging from negative stimuli can also be considered in light of cognitive-behavioural therapy for perfectionism, where there are often

attention broadening techniques to bring one's attention towards non-threatening stimuli away from a focus on any imperfection. Furthermore, it would be useful for future research to determine if changes in disengagement biases mediates any reductions in perfectionism during CBT for perfectionism. The present study cannot draw conclusions regarding the impact that may result from the modification of a disengagement attention bias, but future research could further explore this by implementing a training procedure that specifically sought to target disengagement from negative information. This could be implemented through a cognitive task similar to the one included in the current study in which participants are repeatedly presented trials in which they are required to disengage attention from emotionally negative stimuli. It is possible to also envisage version of such a task that would utilise eye-tracking and could selectively encourage relocation away from negative stimuli when gaze aligns with such information.

The findings must be considered in light of limitations of this study. First, while there is a considerable effort underway to develop more reliable measures of the constructs under examination and this may well be fruitful in the future, it is nevertheless the case that theoretical models continue to implicate the cognitive processes assessed in the current study in the aetiology of psychopathology. As such, while current means of assessing such biases have their limitations that we agree should be acknowledged, it is also the case that response-time measures have the capacity to inform these theoretical models. In our own study the reliability was mixed, with some of the estimates very low, which suggests we should interpret our findings with caution, even though our findings are, in part, consistent with and extend previous research in the area (Howell et al., 2016). To date, we do not have more reliable measures of attention bias to be used in place of these modified dot-probe tasks. One way in which people may also be able to assess the reliability of the task more accurately is through the use of test-retest designs. Indeed, as discussed in detail in a recent review considering the apparent paradox of consistent associations between behavioural response time measures and attention bias, despite the apparent low reliability of these tasks, it is pointed out that, while these tasks may be poorly suited to providing precise individual data, they nevertheless provide a viable means of assessing between-group differences in patterns of bias, as was the case in the current study (MacLeod, Grafton, & Notebaert, in press).

Second, the present study was cross-sectional in design, meaning no temporal or causal inference could be made. This may be addressed with longitudinal research in future, in which there is manipulation of attention biases within individuals. Such research could

target the pattern of attention bias in perfectionism directly for retraining and assess any subsequent impact on levels of perfectionism, or conversely by examining attention bias before and after an intervention designed to reduce perfectionism to see if, and to what extent, reductions in attention bias mediate reductions in perfectionism. Even though the modified dot-probe task presents information about what is happening in a cross-sectional context, future research could also consider using an eye-movement tracking task. If the current findings were replicated in an eye-movement tracking task, this would provide formidable evidence that heightened perfectionism is characterised by difficulty disengaging with negative stimuli. Third, the sample was predominantly female. Although gender was controlled for in the analyses, it is possible that the nature of the sample in terms of the gender distribution, and composition of undergraduates, may impact the generalisability of the present findings. While it has been noted that levels of perfectionism do not differ significantly according to gender (Stoeber & Stoeber, 2009), it is possible that the expression of perfectionism may differ according to gender, which would require future studies to systematically examine such potential effects with a balanced sample. Finally, the number of trials per trial type was chosen in order to balance the quantity of data with quality as a result of participant burden. Nevertheless, given the number of trial categories it is possible that this experiment was underpowered to detect these effects that are associated with the specific stimulus type (e.g., perfectionism relevance). Future research should consider ways to ensure adequate power without impacting the quality of data collected

Bearing these limitations in mind, the present study provides evidence that one of the characteristics of perfectionistic concerns is an attentional preference for threatening information. Specifically, this preference is demonstrated through difficulty withdrawing attention from information that is negative in emotional tone. This is consistent with previous research (Howell et al., 2016, Kobori & Tanno, 2012), and provides support for the cognitive behavioural model of perfectionism (Shafran et al., 2002). These findings provide direction for future research into the mechanisms which act to maintain perfectionism, and may serve to inform novel treatments for perfectionism.

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Appendix A

Descriptive Statistics of Reaction Times at Each Level of Stimulus Emotional Valence and Stimulus Perfectionism Relevance for Engagement and Disengagement Trials.

Trial conditions	<i>Stimulus Emotional Valence</i>											
	Positive						Negative					
	<i>Stimulus Perfectionism Relevance</i>											
	Perfectionism Relevant			Perfectionism Irrelevant			Perfectionism Relevant			Perfectionism Irrelevant		
	<i>M</i>	<i>SD</i>	Median	<i>M</i>	<i>SD</i>	Median	<i>M</i>	<i>SD</i>	Median	<i>M</i>	<i>SD</i>	Median
Engagement												
Shift	791.45	180.29	770.63	787.29	175.75	750.08	803.29	180.90	789.36	804.21	187.31	772.50
Stay	745.15	167.56	726.85	736.09	150.51	714.60	753.29	159.22	722.38	768.95	178.24	754.36
Disengagement												
Shift	756.52	182.44	739.38	737.76	159.81	717.86	768.95	178.24	754.36	794.19	181.02	756.33
Stay	737.76	159.81	717.86	754.72	170.96	718.77	768.78	186.65	760.94	790.43	186.27	757.47