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Examining the relationship between selective attentional bias for food- and body-related stimuli and purging behaviour in bulimia nervosa

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1 **Examining the relationship between selective attentional bias for food- and body-related**
2 **stimuli and purging behaviour in bulimia nervosa**

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Abstract

Previous research exploring cognitive biases in bulimia nervosa suggests that attentional biases occur for both food-related and body-related cues. Individuals with bulimia were compared to non-bulimic controls on an emotional-Stroop task which contained both food-related and body-related cues. Results indicated that bulimics (but not controls) demonstrated a cognitive bias for both food-related and body-related cues. However a discrepancy between the two cue-types was observed with body-related cognitive biases showing the most robust effects and food-related cognitive biases being the most strongly associated with the severity of the disorder. The results may have implications for clinical practice as bulimics with an increased cognitive bias for food-related cues indicated increased bulimic disorder severity.

Keywords: Attentional bias, bulimia nervosa, cognitive bias, purging

36 **Introduction**

37 Cognitive models of eating disorders suggest that there are individual differences
38 which are associated with the maintenance of such conditions (e.g. Vitousek & Hollon,
39 1990). These include attitudes, beliefs and perceptions of ideal body weight and shape, body
40 dissatisfaction, and over-concern with body image (e.g. Fairburn, Cooper, & Shafran, 2003;
41 Cooper, Anastasiades & Fairburn, 1992). Vitousek and Hollon (1990) have argued that in
42 eating disordered populations schemata associated with these types of categories are
43 maladaptive to the extent of generating systematic errors in the processing of relevant
44 information through processes such as selective attention. Over-concern with body image
45 (e.g., body weight and body shape) is an important diagnostic criteria for both anorexia and
46 bulimia nervosa (American Psychiatric Association, 2013), and is predictive of binge eating
47 and purging (Byrne & McLean, 2002). It has been suggested that body image-related
48 cognition may maintain eating disorder symptoms by distorting how the environment is
49 perceived and how experiences are interpreted by the individual (Blechert, Ansorge &
50 Tuschen-Caffier, 2010; Vitousek & Orimoto, 1993).

51 Information processing biases and distortions appear to play a central role in the
52 maintenance of eating disorders (see Faunce, 2002; see Dobson & Dozios, 2004; Lee &
53 Shafran, 2004; Johansson, Ghaderi & Andersson, 2005; Smeets, Roefs, van Furth & Jansen,
54 2008). One approach for understanding the nature of these biases has involved an
55 examination of attentional processes that occur during ongoing behaviour and experience. It
56 has been argued that preferential attention to concern-related stimuli (attentional bias) reflects
57 a biased processing of related experiences (see Mathews & MacLeod, 2005; Fairburn et al,
58 2003). It has also been argued that with repeated behavioural enactment these concern-related
59 stimuli are detected automatically (without conscious awareness) and result in the desire to
60 undertake both associated and ongoing behaviour (see Field, Munafo & Franken, 2009;

61 Franken, 2003). Employing a variety of experimental tasks (e.g. modified Stroop, eye
62 tracking technology, flicker induced change blindness, dot probe), attentional biases for
63 concern-related stimuli have been identified in a variety of habitual and compulsive
64 behaviours including alcohol use (e.g. Sharma, Albery & Cook, 2001), cannabis use (e.g.
65 Cane, Sharma & Albery, 2009), smoking (e.g. Attwood, O'Sullivan, Leonards, Macintosh &
66 Munafo, 2008), dieting behaviour (Wilson & Wallis, 2013) and sex-related activity
67 (Fromberger, Jordan, von Herder, Steinkrauss, Nemetschek, Stolpmann, & Muller, 2012),
68 among others.

69 In the specific realm of eating disorders, research has shown that within a modified
70 Stroop paradigm individuals with eating disorders take longer than control participants to
71 name the ink colour of concern-related words (e.g. food words, body shape words) than
72 matched neutral words (e.g. Ben-Tovim & Walker, 1991; Ben-Tovim, Walker, Fok, & Yap,
73 1989; Cooper & Todd, 1997; Green, McKenna & de Silva, 1994). There also appear to be
74 variation in cognitive biases between people with anorexia and people with bulimia. People
75 with anorexia typically display a cognitive bias for body/weight-related words whereas
76 people with bulimia demonstrate cognitive biases across a much broader range of stimuli (see
77 meta-analysis by Dobson & Dozois, 2004). This may reflect a generalised deficit in
78 attentional deployment (cf. Mattos, Saboya, Ayrão, Segenreich, Duchesne, & Coutinho,
79 2004).

80 Whilst bulimia and anorexia are distinct disorders both are associated with distorted
81 body image. Anorexia typically involves the starving of oneself to achieve the desired body
82 image, whereas bulimia is characterised by the consumption of large quantities of food
83 followed by the act of 'purging' by vomiting or laxative intake. Starvation within anorexics is
84 obviously traumatic and may manifest itself in specific body-related cognitive biases, yet the
85 trauma associated with purging may be directly related to the amount of food that has been

86 binged upon and may subsequently fluctuate or be dependent upon the quantity of bingeing.
87 That certain activities (e.g. starvation in anorexia and purging in bulimia) are common but
88 domain specific behavioural characteristics, it is also likely that these behavioural
89 characteristics may have cognitive correlates. Whilst it is plausible to assume that people with
90 bulimia may demonstrate a generalised cognitive bias, due to a distorted body-image, as well
91 accompanying behaviours of food bingeing and purging, the frequency with which an
92 individual engages in bingeing and purging behaviour may have implications for the strength
93 of food-related cognitive biases and are analogous with the severity of the condition (Edler,
94 Haedt, & Keel, 2007; Rofey, Corcoran & Tran, 2004). As such this suggestion begs the
95 question of the nature of the relationship between behavioural symptom severity and the
96 operational magnitude of related cognitive biases (see Field, Munafo & Franken, 2009).
97 Previously it has been argued that cognitive biases in attentional preference, and urges to
98 respond in an appetitive manner, results in a 'strengthening' dopaminergic response which
99 over time becomes sensitised (e.g. Franken, 2003). This sensitisation creates a saliency in the
100 cues associated with the rewarded behaviour resulting in those cues developing motivational
101 appetitive properties (i.e. providing incentives for continued behavioural enactment) and urge
102 responding (e.g. Robinson and Berridge, 1993). Ultimately the cue becomes the focus of
103 preferential attention, is experienced as 'wanted' and guides future responsive action. A
104 meta-analysis has recently identified that not only do people with eating disorders in general
105 show an attentional preference for food-related cues but that within people with bulimia these
106 stimuli have heightened incentive saliency which is related to an increasing 'need' to
107 consume food and purging of that intake (see Brooks, Prince, Stahl, Campbell & Treasure,
108 2011). In this sense, it is plausible that for the people with bulimia purging activity (and
109 other indices of symptom severity) may increase in line with increasing attentional
110 preference.

111 To separate the role of different cognitive biases (those associated with food and those
112 associated with body) in people with bulimia, the current study required such individuals (and
113 controls) to perform a simple modified Stroop task with two word categories: food-related
114 and body-related. To delineate the effect of repeated behavioural patterns on the operation of
115 these biases the frequency of purging within people with bulimia was assessed. Cognitive
116 biases were predicted to differ according to the severity of symptoms. Specifically, it was
117 anticipated that cognitive biases towards food related symptoms would increase in line with
118 symptom severity, but no such association would be observed for body shaped words.

119 Method

120 *Design.*

121 The experiment used a 3 x 2 factorial design with group (2 levels; people with bulimia
122 and controls) as a between-participants factor and word type (3 levels; food, body and
123 neutral) as a within-participants factor. The key dependent variables were the levels of
124 cognitive bias (expressed as interference scores) and self-reported levels of bingeing /
125 purging. Cognitive bias was measured by the time taken (in milliseconds) to name the ink
126 colours of neutral, food- and body-related words in a modified Stroop task.

127 Participants

128 A total of 94 females were initially approached to take part in the study. Of these five
129 decided not to take part in the study and one participant withdrew post consent. As such, the
130 final sample comprised 88 females (mean age = 30.4 years; SD=10.4) of which 45 formed the
131 people with bulimia group (mean age =28.9; SD=10.2) and 43 the control group (mean age =
132 31.9; SD = 10.6). No differences in age between groups was found, $t(86) = 1.335$; $p = .185$.
133 People with bulimia were recruited through London-based 12-Step fellowships in the
134 community, such as Over-Eaters Anonymous (OA) or Anorexics and Bulimics Anonymous
135 (ABA). As such, attendance at such anonymous fellowships indicates self-definition of

136 bulimic-type presentation. For ethical reasons it was decided that the use of categorisation
137 measures, such as the Eating Behaviours Inventory or a full clinical interview covering an in-
138 depth description and analysis of related symptomology, could be deemed as being too
139 invasive among anonymous fellowships members. However, whilst such a full diagnostic
140 inventory was not considered appropriate, for inclusion in the final analysis bulimic
141 participants had to volunteer that they had binged and purged on at least three separate
142 occasions within the last 90 days. No participants refused to provide this information and
143 withdraw from the study. Control participants were recruited from an undergraduate
144 population at a London-based University. For inclusion in the control group, participants
145 were required through self-report not to be currently following any specific diet program, nor
146 to have done so for over 90 days. Furthermore, control participants were required to self-
147 report having no current or past history of any eating disorders (no participants declared as
148 such). Participants' data were excluded if they did not meet the eligibility criteria of the group
149 to which they were allocated (no participants data were excluded).

150 *Materials.*

151 Through pilot research, three people with bulimia (who did not participate in the main
152 study but attended Fellowship-based groups) first created word lists and then rated how
153 representative the words were of bulimia-related food words and bulimia-related body words
154 on a Likert scale of 1-5 ("not at all representative" to "completely representative"). Whilst
155 previous work has been conducted using words as stimuli for food- and body-related
156 modified Stroop tasks in eating disordered individuals (see Brooks et al, 2011), the nature of
157 the current cohort comprising participants attending Fellowship groups necessitated the
158 generation of a bespoke set of stimulus words. In other words, the stimuli generated are likely
159 to be most representative of the categories 'food' and 'body' in people attending related
160 Fellowships. The highest ranking words were selected for inclusion in the study. The word

161 lists were analysed using the Kucera-Francis Psychology Linguistics Database to match
162 words for mean frequency of use. Three words had to be excluded from the study for not
163 matching in frequency with other words. Neutral words were also matched to food and body-
164 related words. Words were presented in category-specific blocks with eight words in each
165 category. Each word was repeated three times in each of the colours red, blue, yellow and
166 green in each category block making a total of 96 trials in each of the three blocks. Food
167 related words were: chocolate, binge, diet, eat, food, sick, junk, sugar; body-related words
168 were: skinny, celebrity, ugly, model, thin, fat, bum, hate; Neutral words were: compass, train,
169 holiday, generator, flowers, aviator, bench, books. The order of the words, and colours, were
170 randomised and presentation of category-specific blocks counterbalanced across
171 groups. Stroop task stimuli were presented using ePrime (Psychology Software Tools Inc.,
172 Pittsburgh, Pennsylvania) and conducted on a Toshiba Laptop with a 20" LCD
173 screen. Participants were required to respond to the colour of the word by pressing the
174 appropriately coloured key on a keyboard; accuracy and reaction time was recorded.
175 Interference scores (reflecting cognitive bias) for body-related and food-related words were
176 calculated by subtracting the mean correct reaction time (milliseconds) for the neutral words
177 separately from the mean correct reaction time for body-related words, and the mean correct
178 reaction time for food-related words. In this paradigm, if no cognitive bias is present then
179 interference scores do not differ significantly from zero. Differences in interference scores
180 from 0 indicate a cognitive bias. In this study, this translates to positive scores (significantly
181 above 0) being indicative of increased interference by either food or body-related words.
182 Participants also completed a questionnaire including basic demographic information as well
183 brief details of bulimic behaviour (i.e. the frequency of bingeing/purging and the age when
184 the bingeing/purging first began).

185 *Procedure.*

186 Participants completed the Stroop task in a quiet room. To become familiar with the
187 demands of the task participants completed a set of 48 practice trials in which letter strings
188 (e.g. YYYY, PPPP) were randomly presented in each of the four colours. Participants then
189 entered the testing phase after which individuals in the people with bulimia group were
190 presented with questions associated with purging frequency. Specifically, participants were
191 asked if they had engaged in any bulimic-type behaviour in the past 90 days on more than
192 three separate occasions. This was defined for the participants as a period of binge eating
193 (consuming vast quantities of food in a relatively short time period) followed by purging.
194 Participants were then asked to rate on average how often they behaved in that way ranging
195 from “Never” (scored as 0) to “Many times per day” (scored as 10). Since this non-diagnostic
196 information could have been deemed sensitive in nature participants were reminded of their
197 right to withdraw all data from the study at any point – no requests were made. For the
198 control group, participants were required through self-report to declare not having followed
199 any specific diet program for over 90 days nor to having any current or past history of any
200 eating disorders. These were administered after the Stroop in order to minimise the potential
201 priming effects of the questions.

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Results

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We initially performed independent-samples t-tests in order to compare interference
scores for people with bulimia and controls. The results indicate that people with bulimia
(mean = 41.067; sd = 64.374) differed significantly from controls (m = -5.535; sd = 63.915)
in terms of food-related interference scores ($t(86) = 3.406$; $p < .001$), and the bulimia group
(m = 57.533; sd = 51.167) differed significantly from controls (m = 4.233; sd = 62.618) in
terms of body-related interference scores, ($t(86) = 4.381$; $p < .0005$). This suggests that
people with bulimia show cognitive biases over controls for food-related and body-related

211 stimuli. Further, a paired-samples t-test also revealed that people with bulimia have
212 significantly different interference scores for food-related ($m = 41.067$; $sd = 64.374$) and
213 body-related words ($m = 57.533$; $sd = 51.167$), $t(44) = -2.559$; $p = .014$. This result suggests
214 that people with bulimia have an increased cognitive bias for body-related words over food-
215 related words.

216 One-sample t-tests were then used to examine whether interference scores for each
217 group differed significantly from zero (the score indicative of no attentional bias) for food-
218 and body-related words. Results showed that for the control participants, the interference
219 scores for food-related words (mean = -5.535 ; $sd = 63.915$), $t(42) = .568$; $p = .57$, and body-
220 related words ($m = 4.233$; $sd = 62.618$), $t(42) = .443$, $p = .66$, did not differ significantly
221 from 0. Significant effects were found in the bulimic group for both the food-related (mean =
222 41.067 ; $sd = 64.37$), $t(44) = 4.278$; $p < .001$, and the body-related interference scores (mean
223 = 57.533 ; $sd = 51.167$), $t(44) = 7.54$; $p < .001$). This result suggests a cognitive bias was
224 observed for food-related words and body-related words in the people with bulimia group
225 (see Figure 1).

226 Fig 1 about here

227 We were also interested in whether within people with bulimia there was an
228 association between the frequency of reported purging activity and the size of the interference
229 scores generated. Purging frequency was significantly correlated (Pearson's r) with cognitive
230 bias towards food-related words, $r(45) = .418$; $p < .005$, but not with body-related words, r
231 $(45) = .081$; $p = .598$). Purging frequency was associated with food-related interference score
232 but not body-related interference.

233

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Discussion

235 We performed a simple modified-Stroop task on a population of people with bulimia
236 and control (non-bulimic) participants. The Stroop contained food-related, body-related, and
237 neutral words. We used these words to create two cognitive bias interference scores; food-
238 related and body-related. Replicating previous work (see Brooks et al, 2011; see Rofey et al,
239 2004), results indicated that bulimics and not controls demonstrated both a food-related and a
240 body-related attentional bias. The results also indicated, within people with bulimia, an
241 increased cognitive bias for body-related over food-related words, again replicating previous
242 work (see Brook et al, 2011; see Rofey et al, 2004). Importantly, however, within people with
243 bulimia, purging frequency (which is argued to be indicative of severity of bulimic disorder)
244 was associated with food-related words and not body-related words. Previous research
245 suggests that people with anorexia typically display a cognitive bias for body/weight-related
246 words (Dobson & Dozois, 2004), whereas that people with bulimia have previously been
247 show to demonstrate cognitive biases across a much more broad-range of stimuli (Dobson &
248 Dozois, 2004). The specificity of the cognitive bias in anorexics would suggest the cognitive
249 concern or mechanism in anorexia is related to body shape/size. The results in the current
250 study share similarities to those of Flynn and McNally (1999) who found an increased
251 cognitive bias for body-related cues over food-related cues. However, whereas they only
252 observed a cognitive bias with body-related cues, we also observed a cognitive bias for food-
253 related cues. Our results imply that people in the bulimic state have a distortion of cognitive
254 processes for both food and body cues. This may reflect that, although issues related to body
255 size and shape may be an underlying cause of bulimia, the mechanism for controlling body
256 size and shape is through the traumatic experience of food bingeing and purging (cf. Farber,
257 1997), whereas, within anorexics the covert avoidance of food-related stimuli may be
258 employed in order to ease the suffering of starvation.

259 Further, there was a discrepancy observed between food-related and body-related cues
260 in terms of the association with the severity of bulimia disorder. It was only the food-related
261 cues that were associated with our severity measure. This implies that those who engage with
262 purging behaviours more frequently have an increased cognitive bias for food-related stimuli
263 and not body-related stimuli. This may be because people in the bulimic state perceive food-
264 related cues as causing more immediate psychological threat, due to the traumatic nature of
265 regular purging of food (cf. Farber, 1997). In addition, this finding may elude to a potential
266 cognitive mechanism for bulimic behaviour based on the idea that these individuals may
267 show poor awareness of one's internal somatic and affective state (or interoceptive
268 awareness). Previous work has confirmed the relationship between deficits in interoceptive
269 awareness and eating disorders (e.g. Merwin, Zucker, Lacy & Elliott, 2010). The positive
270 relationship between attentional preference for food-related words and purge frequency in the
271 current study may suggest that such stimuli are processed affectively (possibly as threat-
272 related) leading to an affective experience. This affective experience may in of itself produce
273 behaviour designed to remove such arousal, in this instance, purging of food activity. That
274 this effect is selective for food-related stimuli reinforces the idea of a one-to-one
275 correspondence with purging activity. As far as the authors are aware, this is the first such
276 finding of an association with severity of bulimia disorder and cognitive bias. Further
277 experimental work should be undertaken to explore the relationship between cognitive
278 markers such as attentional bias and severity of disorders based on behavioural indices. For
279 instance, changing bulimic behaviour (e.g. purging activity) may be dependent on either
280 encouraging interoceptive awareness and/or altering related attentional preferences through
281 attentional retraining.

282 The clinical implications of this research are related to diagnosis and assessment. The
283 emotional-Stroop task was sensitive to whether an eating disorder was present or not. The

284 findings suggest that the diagnosis and assessment of bulimia need not be confined to explicit
285 self-report measures but may benefit from the inclusion of approaches related to processes
286 which are more likely to operate outside of conscious awareness. The discrepancy in the
287 results obtained for the two stimuli types may represent another area for further research,
288 because as food-related biases increase severity of the disorder may also increase. Whilst
289 these implications are important future work should overcome limitations associated with the
290 sample derived from members of anonymous fellowships and replicate in alternative
291 populations (e.g. those in other treatment contexts).

292 Overall it appears that people with bulimia demonstrate a cognitive bias for both
293 food-related and body-related cues. However, there is an interesting discrepancy in that
294 although body-related cognitive biases appear the most robust, it is food-related cognitive
295 biases that are associated with the severity of the disorder.

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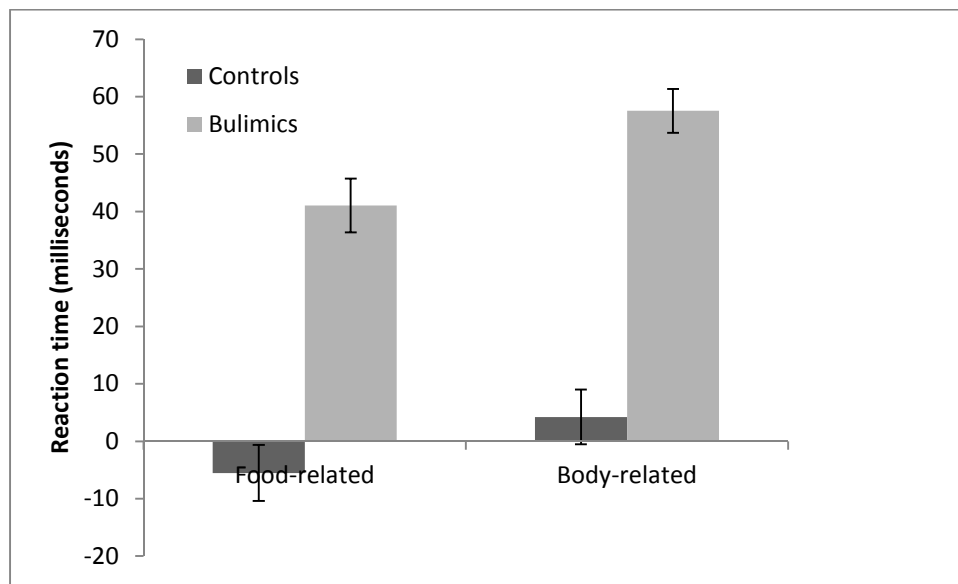
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383 Figure Caption

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385 Figure 1: Mean correct reaction times (milliseconds) for food-related words and body-related

386 words in control and bulimic participants.

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