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Impulsivity moderates the effect of approach bias modification on healthy food consumption

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ABSTRACT

The study aimed to modify approach bias for healthy and unhealthy food and to determine its effect on subsequent food consumption. In addition, we investigated the potential moderating role of impulsivity in the effect of approach bias re-training on food consumption. Participants were 200 undergraduate women (17–26 years) who were randomly allocated to one of five conditions of an approach-avoidance task varying in the training of an approach bias for healthy food, unhealthy food, and non-food cues in a single session of 10 min. Outcome variables were approach bias for healthy and unhealthy food and the proportion of healthy relative to unhealthy snack food consumed. As predicted, approach bias for healthy food significantly increased in the 'avoid unhealthy food/approach healthy food' condition. Importantly, the effect of training on snack consumption was moderated by trait impulsivity. Participants high in impulsivity consumed a greater proportion of healthy snack food following the 'avoid unhealthy food/approach healthy food' training. This finding supports the suggestion that automatic processing of appetitive cues has a greater influence on consumption behaviour in individuals with poor self-regulatory control.

1. Impulsivity moderates the effect of approach bias modification on healthy food consumption

The contemporary Western environment provides continual exposure to an abundance of unhealthy food cues through advertising on the internet, TV, billboards, and in magazines (Havermans, 2013). An 'obesogenic' environment has been linked to consuming too much food high in fat, salt, and sugar, and not enough fruit and vegetables (Hill & Peters, 1998). Unhealthy eating behaviour is a key contributor to the increasing rates of overweight and obesity, which have doubled during the last few decades (Cohen, 2008). It is estimated that 35% of adults can now be classified as overweight and 11% as obese (WHO, 2014a). Excess body weight can lead to negative health consequences such as cancer, cardiovascular disease and diabetes (WHO, 2014b). Therefore, it is important to identify the mechanisms by which exposure to appetitive food cues in the environment can affect unhealthy eating behaviour.

One such mechanism implicated in the development of unhealthy eating behaviour is biased automatic processing of appetitive cues (Marteau, Hollands, & Fletcher, 2012). Recent dual process models propose that two types of processing determine our behaviour: automatic and controlled processing (Strack & Deutsch, 2004). Automatic processing is fast, effortless, and implicit, while controlled processing is slow, effortful, and explicit. Moreover, automatic processing involves cognitive biases, such as an approach bias, which refers to an automatic tendency to reach out toward (approach) rather than move away from (avoid) appetitive cues in the environment (Wiers, Gladwin, Hofmann, Salemink, & Ridderinkhof, 2013).

Approach biases exist for appetitive substances such as alcohol (Wiers, Rinck, Kordts, Houben, & Strack, 2010) and unhealthy food (Brignell, Griffiths, Bradley, & Mogg, 2009; Kemps & Tiggemann, 2015; Kemps, Tiggemann, Martin, & Elliott, 2013), and importantly, have been linked to increased consumption of such substances (alcohol, Wiers et al., 2010; unhealthy food; Kakoschke, Kemps, & Tiggemann, 2015a). Dual process models posit that controlled processes regulate the impact of automatic processes on behaviour; however, the ability to regulate such processes is influenced by individual differences in self-regulatory control. For example, impulsivity, which is 'a general tendency to act without deliberation' (Hofmann, Friese, & Wiers, 2008, p. 113) may allow automatic processes to exert a greater influence on behaviour.

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Indeed, impulsivity predicts intake of unhealthy food (Kakoschke, Kemps, & Tiggemman et al., 2015b; Nederkoorn, Braet, Van Eijs, Tanghe, & Jansen, 2006).

Recently, researchers have begun to investigate whether automatic approach biases for appetitive cues can be modified using a computerized cognitive re-training paradigm. In commonly used protocols such as the Approach-Avoidance Task (AAT), participants are instructed to respond to images by pushing or pulling a joystick. Responses are based on an irrelevant feature (e.g., portrait or landscape format), rather than the image content, to ensure that the task captures automatic processing (Wiers et al., 2013). An avoidance of appetitive substances can be trained using a modified AAT in which these response contingencies are manipulated. Specifically, in 'avoidance training' target (appetitive) images are consistently presented in a format that requires them to be pushed (avoided) and control images in a format that requires them to be pulled (approached). In contrast, 'approach training' involves the reverse contingencies, while what has been termed 'sham-training' (a neutral or control condition) involves equal approach and avoidance of target and control images, which is the same as the assessment version of the task.

Previous studies have shown that manipulating the contingencies of the AAT can be used to re-train approach bias for appetitive cues. Specifically, research shows that training can be used to successfully reduce approach bias for alcohol (e.g., Wiers et al., 2010, Wiers, Eberl, Rinck, Becker, & Lindenmeyer, 2011) and chocolate (Schumacher, Kemps, & Tiggemann, 2016; Dickson, Kavanagh, & MacLeod, 2016). Furthermore, a single training session can reduce consumption of alcohol (Wiers et al., 2010) and chocolate (Schumacher et al., 2016) during a laboratory taste test. A recent literature review concluded that approach bias modification is an effective intervention for reducing approach biases for unhealthy substances and for discouraging the consumption of alcohol, cigarettes, and unhealthy food (Kakoschke, Kemps, & Tiggemann, 2017).

It is clearly possible to avoid unhealthy substances such as alcohol and cigarettes as there is no biological requirement to consume them. Food is a substance that is essential for human survival, thus complete avoidance is not possible. Instead, a healthy diet is about developing the right balance between eating enough healthy food and not too much unhealthy food. An approach bias modification protocol that simultaneously encourages the avoidance of unhealthy food and approach of healthy food may lend itself best to promoting a healthy diet. Moreover, interventions that not only discourage unhealthy behaviour, but also promote healthy behaviour, are likely to be more attractive and acceptable, an important consideration for cognitive bias modification tasks (Wiers et al., 2013).

A few studies have examined approach bias re-training in the healthy eating domain. In an early study, Fishbach and Shah (2006, Study 5) trained participants to approach healthy and avoid unhealthy food or to approach unhealthy and avoid healthy food, the former of which subsequently made healthier snack choices. More recently, Dickson et al. (2016) compared 'approach healthy food/avoid chocolate' training with 'approach chocolate/avoid healthy food' training. Although approach bias was re-trained as expected, no group difference in chocolate consumption was found. In another recent study, Maas, Keijsers, Rinck, Tanis, and Becker (2015) found that 'approach healthy/avoid unhealthy food' training successfully modified approach bias, but eating behaviour was not measured. Finally, Becker, Jostman, Wiers, and Holland (2015, Study 1) found no difference in healthy snack choice between approach healthy/avoid unhealthy food training and a control group (sham-training). Thus, evidence for the use of approach bias modification in the healthy eating domain is relatively inconsistent.

One potential methodological explanation for the mixed findings lies in the particular comparison condition used. Similar to studies on alcohol, Fishbach and Shah (2006, Study 5), who found a positive result, compared two extreme training conditions i.e., approach healthy/avoid unhealthy food versus avoid healthy/approach unhealthy food. In contrast, Becker et al. (2015, Study 1), who did not obtain a significant group difference in snack choice (only for successfully trained participants), compared approach healthy/avoid unhealthy food training with a less extreme condition (i.e., sham-training). Thus, it appears that using a more extreme comparison may result in significant differences in eating behaviour. To date, no study has compared all three conditions (i.e., 'approach', 'avoidance', and 'sham' training).

In addition, the approach healthy/avoid unhealthy food training has two interwoven components: approach healthy food; avoid unhealthy food. To determine which component is most important for effective re-training, we included two further conditions. In one, approach of healthy food was paired with avoidance of a non-food category, whereas in the other one, avoidance of unhealthy food was paired with approach of a non-food category. Thus, in total, the present study included five training conditions: simultaneous approach of healthy and avoidance of unhealthy food; a reverse training condition (i.e., simultaneous approach of unhealthy and avoidance of healthy food); a control condition in which approach-avoidance of healthy and unhealthy food was equal (i.e., sham-training); an avoid unhealthy food (approach non-food) condition and an approach healthy food (avoid non-food) condition.

A different kind of factor that may contribute to the observed inconsistent effects of approach bias re-training on food consumption is individual differences, which might make re-training differentially effective for different people. In particular, individual differences in aspects of self-regulatory control, such as trait impulsivity, have been shown to moderate the influence of impulses in general (Hofmann & Friese, 2008; Thush et al., 2008). Thus, trait impulsivity may predict whether training promotes successful regulation of approach bias in determining eating behaviour. To date, no study has examined the potential moderating role of trait impulsivity in the effect of approach bias modification on subsequent consumption. While it is possible that highly impulsive individuals may have more difficulties in adopting avoidance behaviour, and thus might benefit less from the training, we predicted that training effects would be greater for highly impulsive individuals. This prediction was based on the idea that automatic processes likely play a more important role in consumption for those who have poor self-regulatory control (Friese, Hofmann, & Wanke, 2008; Strack & Deutsch, 2004).

In sum, the main aim of the study was to investigate whether approach bias for both healthy food and unhealthy food can be modified using a single 10-min training session, and to determine the effect of such training on subsequent food consumption. Specifically, it was predicted that participants trained to approach healthy food and avoid unhealthy food would show a greater increase in approach bias for healthy food and a decrease in approach bias for unhealthy food compared to those trained to approach unhealthy food and avoid healthy food, or those in the control condition (i.e., sham-training). It was further expected that participants trained to approach healthy food and avoid unhealthy food would consume the greatest proportion of healthy food relative to unhealthy food, and that trait impulsivity would