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Approach bias and cue reactivity towards food in people with high versus low levels of food craving

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ABSTRACT

Objective: Even though people suffering from high levels of food craving are aware of the negative consequences of binge eating, they cannot resist. Automatic action tendencies (i.e. approach bias) towards food cues that operate outside conscious control may contribute to this dysfunctional behavior. The present study aimed to examine whether people with high levels of food craving show a stronger approach bias for food than those with low levels of food craving and whether this bias is associated with cue-elicited food craving.
Method: Forty-one individuals reporting either extremely high or extremely low levels of trait food craving were recruited via an online screening and compared regarding approach bias towards visual food cues by means of an implicit stimulus-response paradigm (i.e. the Food Approach-Avoidance Task). State levels of food craving were assessed before and after cue exposure to indicate food cue reactivity.
Results: As expected, high food cravers showed stronger automatic approach tendencies towards food than low food cravers. Also in line with the hypotheses, approach bias for food was positively correlated with the magnitude of change in state levels of food craving from pre-to post-cue exposure in the total sample.
Discussion: The findings suggest that an approach bias in early stages of information processing contributes to the inability to resist food intake and may be of relevance for understanding and treating dysfunctional eating behavior.

1. Introduction

Food craving refers to a strong motivational state promoting the ingestion of desired nourishments, often elicited by external cues (Meule, Lutz, Vögele, & Kübler, 2012). In contrast to ordinary states of hunger, it is experienced as more intense and specific (Hill, 2007). Food craving is closely related to the construct of food addiction (Davis & Carter, 2009; Wilson, 2010). It is a major feature of bulimic eating disorders (Moreno, Warren, Rodríguez, Fernández, & Cepeda-Benito, 2009; Van den Eynde et al., 2012) but also prevalent in sub-clinical eating disorders and in obesity (Chao, Grilo, White, & Sinha, 2014; Massey & Hill, 2012; Meule et al., 2012). From a learning theory perspective, food craving and overeating may result from both (a) classical, and (b) operant conditioning processes in which (a) environmental and/or interoceptive cues have systematically been associated with food intake so that these cues reliably signal the effects of food intake and elicit craving, and (b) food intake has been positively and/or negatively reinforced by rewarding experiences of pleasure and/or relief from discomfort (Berridge, 2009; Jansen, 1998). Even though people suffering from high levels of trait food craving may be aware of the negative consequences of overeating, they cannot resist. This is illustrated by findings of strongly aversive responses towards food cues on an explicit level (as measured by self-reports) and strongly appetitive responses on an implicit level (as indicated by decreased startle eyeblink, for example) in patients with bulimia nervosa (Friederich et al., 2006; Mauler, Hamm, Weike, & Tuschen-Caffier, 2006).

Dual-process models of addiction could help to understand this paradoxical state of affairs. According to such models, two systems

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of information processing contribute to substance-related evaluations and behavior: An impulsive system that operates rapidly, automatically, and mostly outside of conscious control, and a reflective system that works more slowly, deliberately, and on a conscious level (Bechara, 2005; Wiers, Gladwin, Hofmann, Salemink, & Ridderinkhof, 2013). Subtle biases in the former system such as learned automatic approach tendencies towards food cues may undermine conscious control and may thus contribute to excessive food intake (Berridge, 1996; Wiers et al., 2013). Only a few studies have examined such an approach bias towards food so far. Using an explicit stimulus-response compatibility task in which participants are required to move a manikin towards or away from food and non-food images, Brignell, Griffiths, Bradley, and Mogg (2009) found stronger approach tendencies towards food in overeaters than in normal eaters. Using the same task, Havermans, Giesen, Houben, and Jansen (2011) found that overweight and obese men (but not women) were slower in moving the manikin away from food cues than normal weight controls. Similarly, Mogg et al. (2012) found that obese and overweight people were faster in approaching than in avoiding food pictures. However, using food as the task-relevant stimulus makes such a task susceptible to demand characteristics. Using a more implicit measure in which participants respond to the perspective of the picture (picture seen from above or from the side) instead of the content, Veenstra and de Jong (2010) found similarly strong automatic approach tendencies towards food cues in restrained eaters as compared to unrestrained eaters. Correspondingly, by using an implicit association test, Kemps and Tiggemann (2015) showed that obese women responded faster than normal-weight controls to trials in which food words were paired with approach words than in trials that paired food words with avoidance words.

These cognitive biases in immediate responses to external food cues may become particularly problematic in an obesogenic environment as present in most western countries where palatable food is highly visible and almost permanently accessible. Such an oversupply of food may facilitate excessive food intake and thus, overweight, particularly in vulnerable individuals who feature an increased motivational responsiveness to food cues in the environment (also called *external eating* or *food cue reactivity*) (Rejeski et al., 2010; Sobik, Hutchison, & Craighead, 2005). In general, exposure to food cues automatically triggers anticipatory digestive secretions and metabolic adjustments (Nederkoorn, Smulders, & Jansen, 2000; Power & Schulkin, 2008; Zafra, Molina, & Puerto, 2006). During this cephalic phase, individual differences in the responsiveness to external food cues may become most critical (Elfhag & Morey, 2008). In fact, people with high levels of self-reported external eating were found to eat more snacks in response to food-related commercials (van Strien, Peter Herman, & Anschutz, 2012). Correspondingly, high levels of external eating are also related to high levels of food craving which in turn is related to elevated body weight (Burton, Smit, & Lightowler, 2007). The cognitive biases that occur in the early stages of information processing could play an important role in this vulnerability to external food-related cues. In line with this notion, several studies have demonstrated a positive relation between attentional and approach biases towards food cues and self-reported external eating (Brignell et al., 2009; Hepworth, Mogg, Brignell, & Bradley, 2010; Hou et al., 2011; Nijs, Franken, & Muris, 2009).

However, previous studies in this area have some limitations concerning (a) the selection of the study samples and (b) the measurement of approach bias and food cue reactivity. In the study by Veenstra and de Jong (2010) restrained eating was used as a proxy for overeating. Participants were allocated to groups of so-called restrained and unrestrained eaters on the basis of their scores in the *Restraint Scale* (Herman & Polivy, 1980). This approach is problematic. Although restrained eaters often indulge in the foods they want to avoid, the construct of restrained eating as measured by the *Restraint Scale* mainly refers to excessive dieting, control of food intake, and preoccupation with food and eating. Thus, the sample of restrained eaters in the study by Veenstra and de Jong may not only have comprised overeaters but also successful dieters, who are at the opposite end of the spectrum compared to overeaters (Soetens, Braet, Dejonckheere, & Roets, 2006). Reflecting this ambiguity in the construct of restrained eating itself, the *Restraint Scale* was found to be uncorrelated with actual caloric intake in a series of studies (Stice, Fisher, & Lowe, 2004). In the study by Kemps and Tiggemann (2015), the strength of the association between approach words and food words was examined in obese and lean individuals. Although it appears reasonable and clinically relevant to assess cognitive biases in obese samples, the conclusions that can be drawn from such an investigation regarding potential links between cognitive biases and dysfunctional eating behavior appear to be limited. Although overeating may be an important contributor to obesity in most cases (O'Rahilly & Farooqi, 2008; Raman, Smith, & Hay, 2013), not all obese individuals actually feature dysfunctional eating habits at the same time (Decaluwe & Braet, 2003). Thus, again the sample that was deemed dysfunctional in this study may have not only comprised individuals with problematic eating behavior but also some who did not display such difficulties at the time of assessment.

Furthermore, most previous studies on approach bias towards food focused on the explicit rather than the implicit processing of food cues. Several studies used explicit tasks to measure the approach and avoidance tendencies towards pictorial food cues (Brignell et al., 2009; Havermans et al., 2011; Mogg et al., 2012). In these tasks, participants are required to respond to the content of the images (food versus non-food) and thus are aware of the underlying assumptions of the task. Hence, these tasks are susceptible to demand characteristics and may not be best suited to capture automatic (implicit) responses towards food cues. In another study, an Implicit Association Test was used to assess approach bias for food cues (Kemps & Tiggemann, 2015). However, this task does not measure actual approach and avoidance behavior but the strength of association between two semantic constructs by pairing, for instance, food words with approach words. In addition, the Implicit Association Test is subject of an ongoing methodological debate and has been criticized for several shortcomings concerning its underlying models, interpretation, and susceptibility to deliberate faking (Fiedler, Messner, & Bluemke, 2006). Furthermore, previous studies examining the potential relationship between cognitive biases and food cue reactivity mostly relied on retrospective self-reports which are susceptible to a range of biases and demand characteristics (Brignell et al., 2009; Hepworth et al., 2010; Hou et al., 2011; Nijs et al., 2009).

The present study aimed to overcome these limitations of previous studies on the role of approach bias towards food in the responsiveness to external cues and dysfunctional eating behavior by (a) using an implicit task to assess automatic approach behavior towards food cues, and (b) a cue reactivity paradigm for assessing change in state food craving from pre-to post-cue exposure, and (c) by selecting unambiguous samples of individuals with high versus low difficulties in resisting food intake. Based on the theoretical models and empirical findings outlined above, we hypothesized that (1) people with high levels of trait food craving show an elevated approach bias towards food cues, and (2) that approach bias towards food is positively related to food cue reactivity.