Appetite 64 (2013) 5–11

Contents lists available at SciVerse ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Research report

Temporal attention for visual food stimuli in restrained eaters

Renate A.M. Neimeijer [a,*], Peter J. de Jong [a], Anne Roefs [b]

[a] Department of Clinical Psychology, Faculty of Behavioral and Social Sciences, University of Groningen, Grote Kruisstraat 2-1, 9712 TS Groningen, The Netherlands
[b] Department of Experimental Psychology, Faculty of Psychology, Maastricht University, P.O. Box 616, 6200 MD Maastricht, The Netherlands

ARTICLE INFO

Article history:
Received 21 August 2012
Received in revised form 11 December 2012
Accepted 14 December 2012
Available online 29 December 2012

Keywords:
Restrained eating
Attentional bias
Attentional blink
Rapid serial visual presentation task
Food

ABSTRACT

Although restrained eaters try to limit their food intake, they often fail and indulge in exactly those foods that they want to avoid. A possible explanation is a temporal attentional bias for food cues. It could be that for these people food stimuli are processed relatively efficiently and require less attentional resources to enter awareness. Once a food stimulus has captured attention, it may be preferentially processed and granted prioritized access to limited cognitive resources. This might help explain why restrained eaters often fail in their attempts to restrict their food intake. A Rapid Serial Visual Presentation task consisting of dual and single target trials with food and neutral pictures as targets and/or distractors was administered to restrained ($n = 40$) and unrestrained ($n = 40$) eaters to study temporal attentional bias. Results indicated that (1) food cues did not diminish the attentional blink in restrained eaters when presented as second target; (2) specifically restrained eaters showed an interference effect of identifying food targets on the identification of preceding neutral targets; (3) for both restrained and unrestrained eaters, food cues enhanced the attentional blink; (4) specifically in restrained eaters, food distractors elicited an attention blink in the single target trials. In restrained eaters, food cues get prioritized access to limited cognitive resources, even if this processing priority interferes with their current goals. This temporal attentional bias for food stimuli might help explain why restrained eaters typically have difficulties maintaining their diet rules.

Introduction

The prevalence of obesity has tripled in many countries of the WHO European Region since the 1980s, and the numbers of those affected have risen at an alarming rate. Because obesity is the result of a chronic imbalance between energy intake and energy expenditure, dieting is a logical strategy to lose weight. However, not many dieters are able to maintain their initial weight loss over a longer period of time (Elfhag & Rössner, 2010; Jeffery et al., 2000). As soon as they quit dieting, many dieters even gain more weight than they initially lost (Mann et al., 2007). People with a chronic intention to lose weight are called restrained eaters (Herman & Polivy, 1980). Although restrained eaters are very motivated to control their weight by dieting, they are often unsuccessful in these attempts, and their eating behavior is characterized by alternating periods of restraint and bouts of overeating (Gorman & Allison, 1995).

Biased processing of food cues might be one of the mechanisms involved in restrained people's difficulty to control their food intake. Germane to this, it has been proposed that there is a reciprocal relationship between selective attention for food cues (attentional bias) and craving (Franken, 2003). Following this view, attentional bias would lead to craving for food, whereas in its turn, enhanced craving would again strengthen the attentional bias for food. Accordingly, people may end up in a self-reinforcing cycle, which will logically undermine their attempts to restrict their food intake.

However, previous studies, using various paradigms to measure attentional bias, largely failed to find evidence for the hypothesized heightened vigilance toward high caloric food items in restrained eaters. Originally, the Stroop paradigm was often used. Previous studies using this paradigm in the context of restrained eaters found mixed evidence for color naming interference effects for food words compared to neutral words (see for a review: Dobson & Dozois, 2004). However, the use of Stroop tasks in research for attentional bias is debatable, because the color-naming interference effects can be the result of both heightened attention for food related material as well as avoidance of food-related material (De Ruiter & Brosschot, 1994). A recent study used a modified version of the Stroop task to distinguish between orientation and disengagement and found that restrained eaters had no orientation bias but showed a slowed disengagement for food cues as well as for ego threat cues (Wilson & Wallis, 2012). Furthermore, studies used also other more straightforward indices of (spatial) attention such as the visual probe task. However, studies using visual probe tasks failed to find evidence for heightened attention towards (or away from) food words (Boon, Vogelzang, & Jansen, 2000) or food

* Corresponding author.
E-mail addresses: R.A.M.Neimeijer@rug.nl (R.A.M. Neimeijer), P.J.de.Jong@rug.nl (P.J. de Jong), A.Roefs@Psychology.Unimaas.nl (A. Roefs).

0195-6663/$ - see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.appet.2012.12.013

pictures (Ahern, Field, Yokum, Bohon, & Stice, 2010) in restrained eaters. Likewise, a study using an exogenous cuing task with food pictures also failed to find an attentional bias for food stimuli in restrained eaters (Veenstra, de Jong, Koster, & Roefs, 2010). Finally, a study employing a visual search task did show that restrained eaters were faster in detecting a food word in a neutral matrix. However, restrained eaters were also faster in detecting neutral words in a food matrix (Hollitt, Kemps, Tiggemann, Smeets, & Mills, 2010).

In sum, previous research provided no straightforward support for the hypothesized role of attentional bias in restrained eaters' failure to regulate their caloric intake. However, all of these earlier studies on attentional bias in restrained eating exclusively focused on spatial selective attention. Importantly, attention is not only distributed over space, but also over time. The privileged processing of food cues may be especially prominent in the temporal dimension. For example, it could be that for restrained eaters food stimuli are processed relatively efficiently and require less attentional resources (lower threshold) to enter people's awareness. Once a food stimulus has captured attention, it may be preferentially processed and granted prioritized access to limited cognitive resources (cf. Koster, De Raedt, Verschuere, Tibboel, & De Jong, 2009). Such privileged access may not only prevent new information from entering working memory, but may also provide the opportunity for more elaborate processing of the food stimulus. This is in line with the 'elaborated intrusion theory of desire', that states that intrusive thoughts about appetitive targets are triggered automatically by external cues. When intrusions elicit significant pleasure or relief, this will usually promote cognitive elaboration. Elaboration competes with concurrent cognitive tasks through retrieval of target related information and its retention in working memory (Kavanagh, Andrade, & May, 2005). External cues of 'forbidden food' might have this same effect for restrained eaters. Finally, food cues might not only receive processing priority when people are actively looking for food cues (top down controlled), but may also more automatically attract attention (bottom up), even at the expense of current task performance (Piech, Pastorino, & Zald, 2009). Thus far, the potential role of the *temporal* dimension of attentional bias in restrained eating has been largely ignored. Further insight into the temporal dynamics of attention for food stimuli may help explain why restrained eaters may experience difficulty in regulating their food intake. Therefore, the aim of the current study is to test whether temporal attentional bias might indeed be involved in restrained eating.

A task often used to measure temporal attention is the Rapid Serial Visual Presentation task (RSVP), in which stimuli are presented sequentially without inter-stimulus interval (e.g., 118 ms/stimulus) on a computer screen. In every stream of pictures one or two targets appear, that have to be identified *after* each stream. The lag (time) between the two targets can be manipulated. Basic research in the temporal dimension of visual attention has consistently shown that the ability to identify a particular target is deteriorated when another target is presented in close temporal proximity (<500 ms). The deficit in the identification of the second target (T2) has been called the attentional blink, referring to the apparent refractory period following the presentation of the preceding target (T1). When the interval (lag) between the targets increases (>500 ms), T2 performance is no longer hampered (Fig. 1).

Temporal attentional bias can be expressed in at least four different ways within the context of a RSVP task: (1) Attentional blink can be diminished (magnitude of attentional blink is reduced) when T2 is a salient cue (e.g., food stimulus), and therefore T2 will be identified despite the preceding T1. (2) The appearance of a salient T2 (e.g., food) may interfere with the correct identification of a preceding T1 (backward interference). (3) Attentional blink can be enhanced when T1 is a salient cue and, therefore, the attentional blink will last longer than the usual attentional blink (500 ms). (4) An attentional blink can be elicited when a salient task-irrelevant distractor (e.g., food) is presented shortly before the actual target. The distractor can be ignored but may nevertheless induce an attentional blink. In the following each of these four types of temporal attentional bias will be addressed in more detail.

First, it has been shown that the attentional blink is diminished (i.e., higher identification rates of T2) when the T2 is of high personal relevance (e.g., the participant's name: Shapiro, Caldwell, & Sorensen, 1997). To explain this reduced attentional blink effect, it has been argued that highly salient stimuli are processed relatively efficiently thereby lowering the threshold for accurate identification, even when only little attentional resources are available. To the extent that food cues are highly salient for participants, also food stimuli may diminish the attentional blink, thereby heightening the probability that food items will enter people's awareness. The present study will examine whether indeed food stimuli, as compared to neutral stimuli, are more easily identified (diminish the attentional blink) when presented as T2, and whether this might be especially the case for restrained eaters.

Second, there is evidence that the appearance of a salient T2 may interfere with the correct identification of a preceding T1 (i.e., lower identification rates of T1), this backward interference effect has also been called a 'backward blink' (Potter, Staub, & O'Connor, 2002). For example, when a T2 is presented very shortly after a T1, T2 has even been found to be correctly identified more often than the preceding T1 (Potter, Staub, & O'Connor, 2002). There might as well be an interference effect of food T2 targets on T1 identification for restrained eaters.

Illustrating the third type of temporal attentional bias, that attentional blink can be enhanced by a salient T1, (i.e., lower identification rates of T2), it has been shown that negative self-descriptors as T1 resulted in an enhanced attentional blink in dysphoric participants (Koster et al., 2009). A similar T1-enhanced attentional blink effect has been shown when angry faces were presented as T1 (de Jong, Koster, van Wees, & Martens, 2010). Thus, it appears that self-relevant salient stimuli elicit more elaborate processing, which is reflected in the associated temporal attention costs. In a similar vein, it can be hypothesized that specifically for restrained eaters, food stimuli might also receive more elaborate processing thereby enhancing the attentional blink.

The fourth type of temporal attentional bias refers to the phenomenon that also task irrelevant distracters may elicit an attentional blink (i.e., lower identification rates of a target presented after the distractor). In the typical attentional blink tasks people have to identify two targets, which are presented in a stream. Hence, the content of the stimuli (e.g., food) is typically a task relevant stimulus feature. If food items are used as T1 or T2, this implies that people are instructed to actively search for food stimuli. However, it is also important to verify whether food items may also attract attention when they are task-irrelevant. In other words, also when people are not intentionally searching for food stimuli, such stimuli may nevertheless elicit an attentional blink. To assess such processing priority of food stimuli, food cues may be used as task-irrelevant distractors in a single target RSVP. Germane to this, it has been shown that positive arousing pictures (nudes of the preferred sex) as a task irrelevant distractor stimulus, can elicit an attentional blink when presented close to the target slide (Most, Smith, Cooter, Levy, & Zald, 2007). Interestingly, this preferential processing of task-irrelevant distractors (the nude stimuli) was evident despite a strong incentive to ignore the task-irrelevant distractor. This is therefore assumed to reflect more automatic (non-intentional) attentional processes. In a similar vein, it could be that food items may attract attention even if these items are irrelevant for people's current goals. Therefore, the present study also included a third type of RSVP trials, that were