



Examining the effect of cue exposure and introspective responses to cues on impulsivity in restrained and unrestrained eaters

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ABSTRACT

The current study extends cue-reactivity research by evaluating impulsive valuation as an outcome of exposure to food cues. This study also separates introspection after viewing cues (e.g., responding to questions about craving and affect) from mere cue exposure, to examine if introspection changes self-regulation behaviors in response to food cues. Finally, we compared restrained and unrestrained eaters to ascertain the influence of motivation toward food on how cue-reactivity influences impulsive behavior. In the current study, restrained and unrestrained eaters were randomly assigned to view food or neutral cues and were randomized to respond to cues with either craving and affect questions (e.g., introspection) or filler questions. Following cue exposure, participants completed a purchase task as a measure of impulsive lack of self-control. Results revealed that unrestrained eaters who introspected on craving and affect showed decreased impulsive behavior, whereas restrained eaters who introspected on craving and affect showed increased impulsive behavior. Although there was no effect of food cues on impulsive behavior, the interaction of introspective response and restraint status suggests that attending to craving and affect has differential effects on subsequent self-control behavior for restrained and unrestrained eaters. Implications for further cue-reactivity work and treatment of chronic dieters (i.e., restrained eaters) will be discussed.

1. Introduction

Cues such as images, smells, or mood states associated with eating are known to increase food craving and subsequent food consumption (Boswell & Kober, 2016; van den Akker, Stewart, Antoniou, Palmberg, & Jansen, 2014). However, recent theoretical work in the substance use arena has suggested that a broader understanding of the phenomena of cue-reactivity may be warranted (Veilleux & Skinner, 2015; Wray, Gass, & Tiffany, 2014). Specifically, might cues depicting desired substances (e.g., food) actually influence other kinds of outcomes such as impulsive behavior? Does the influence of cues on subsequent behavior differ depending on whether people acknowledge the mood and/or subjective craving response they experience when interacting with the cues? Finally, does the effect of cues on behavior differ based on motivation toward the cued object (e.g., desire to restrain or restrict food intake)? The current study begins to answer these questions for food cue-reactivity.

1.1. Beyond eating-related outcomes

Understanding the influence of food cues on non-food related outcomes may have practical implications, such as if Janet sees donuts in the breakroom and subsequently makes data entry mistakes in her work, or if Ken smells macaroni and cheese and then goes over budget by buying too many toys for his daughter's birthday. Theoretically, food cues activate approach motivation toward food (Hofmann & Van Dillen, 2012; Kavanagh, Andrade, & May, 2005), drawing upon the impulse system per dual process models of self-control (Hofmann, Friese, & Strack, 2009). Prior work has shown that cues disrupt subsequent self-control, as has been shown in both smoking (Hagger et al., 2013; Veilleux & Skinner, 2016; Veilleux, Skinner, & Pollert, 2016) and alcohol research (Muraven & Shmueli, 2006). Yet it is unclear if these disruptions in self-control are due to increased impulsive drives toward reward ("Those toys look amazing!") or an impaired reflective system (lack of a voice saying "Restrain yourself; she doesn't really need all those toys"; Hofmann et al., 2009; Metcalfe & Mischel, 1999). Examining only impulsive drives could be a useful step toward understanding the influence of cues on subsequent behavior, such as whether

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food cue exposure increases the value of non-food related rewards.

1.2. Differentiating cue exposure and craving responses to cues

Typical food cue-reactivity studies examine eating (e.g., choice of a healthy or unhealthy snack; Kroese, Evers, & De Ridder, 2009) following randomization to either food-related cues or neutral cues (Coelho, Jansen, Roefs, & Nederkoorn, 2009). This type of design directly tests the effect of cue presentation on eating behavior. Other cue-reactivity studies add an assessment of responses to cues (e.g., physiological reactivity, brain activity, craving) after cue exposure, prior to the behavioral outcome (Boswell & Kober, 2016; Lawrence, Hinton, Parkinson, & Lawrence, 2012; Nederkoorn & Jansen, 2002; Veilleux & Skinner, 2016). These studies evaluate how the response to the cues predicts the outcome, not the presentation of the cues themselves (see Veilleux & Skinner, 2015 for discussion of these differences in methodology).

Particularly when the responses are internal states (e.g., affect, craving), understanding the distinction between food cue exposure and responses to cues are important because of potential implications for intervention. When encountering cues, does attention to internal processes (i.e., stopping and assessing emotion and/or craving) help subsequent self-control, or hinder it? Competing theories suggest either outcome is plausible. Theories of desire (Hofmann & Van Dillen, 2012; Kavanagh et al., 2005) suggest that conscious attention to craving likely decreases self-control as thoughts of urges and desires “hijack” the mind. From this perspective, heightened awareness of affect and craving would consume attention, disrupt cognitive processes and lower self-efficacy such that subsequent self-control would decline. Alternately, mood-as-information theories (Schwarz & Clore, 1983) would suggest that consciously acknowledging craving could allow people to recognize the affective and motivational influences on their current state such that subsequent self-control would improve. The latter is more consistent with mindfulness and acceptance based approaches to psychological treatment which encourage awareness of internal states (Hayes, Strosahl, & Wilson, 1999). Empirically, only one study in the smoking domain has tested these ideas and found that smokers who introspected on their craving and affect following cue exposure discounted delayed rewards more than those assigned to a non-introspection control condition (Veilleux & Skinner, 2016), tentatively supporting the desire theory account.

1.3. Motivation and cue-reactivity

In the food domain, consideration of motivation toward food is likely important when thinking about how cues might influence self-control. Cue exposure prompts approach or desire for food. This desire toward food really only becomes a self-control conflict in the face of a contrasting longer-term goal (i.e., desire to avoid or reduce eating), such as with “restrained eaters,” often referred to as chronic unsuccessful dieters. Restrained eaters are motivated to avoid food; they want to restrict their eating (with limited success; Heatherton & Wagner, 2011; Hofmann, Adriaanse, Vohs, & Baumeister, 2013; Stroebe, van Koningsbruggen, Papies, & Aarts, 2013). They also experience heightened craving toward food (Stroebe et al., 2013). These competing motivations between weight control and eating enjoyment are described in the goal conflict theory of eating behavior (Stroebe et al., 2013), where restrained eaters' efforts to manage the conflict often results in disinhibited behavior (Fedoroff, Polivy, & Herman, 2003) due to heightened attention toward the reward of palatable food (Stroebe et al., 2013). Prior work in the smoking domain has underscored the importance of considering motivation in the effects of cues on subsequent behavior, where smokers interested in quitting—who, similar to restrained eaters, experience a conflict between approach and avoidance—exhibited greater impulsive gambling following a cigarette cue compared to smokers not interested in quitting (Veilleux et al.,

2016).

1.4. The current study

The current study was designed to address these noted gaps in food cue-reactivity research (Veilleux & Skinner, 2015) by exploring a non-food outcome of food cue-reactivity indicative of impulse processing. We specifically pursued a more “pure” index of impulsive processing rather than using a more traditional measure of self-control (i.e., delay discounting, stop-signal task) to isolate the effect of cue exposure on the impulsive system. We also aimed to separate cue exposure from introspective responses to cues, and to examine the role of motivation toward food by examining outcome differences by restrained eating status. We predicted that food cues would prompt greater impulsive responding than non-food cues, particularly for restrained eaters. In addition, if food cues operate like smoking cues (Veilleux & Skinner, 2016), and the desire theories are correct, then introspecting to craving and affect should increase impulsive responding in response to food cues.

2. Method

2.1. Participants and procedure

Adult participants ($N = 555$) living in the United States were recruited through Amazon Mechanical Turk (MTurk), a viable online recruitment source that produce reliable and valid data (Buhrmester, Kwang, & Gosling, 2011; Shapiro, Chandler, & Mueller, 2013). All materials were completed online via Qualtrics, and participants were compensated \$2.00. People who reported eating during the study ($n = 20$) and people who admitted to looking up the prices of items in the purchase task ($n = 8$) were excluded from analyses, leaving a final sample size of 528 ($M_{\text{age}} = 35.66$, 52.4% female, 75.3% White, 40.3% married).

2.2. Measures

Participants completed the Revised Restraint Scale (RRS; Polivy, Heatherton, & Herman, 1988) to assess restrained eating. The RRS is a ten-item measure given on a Likert-type scale (0 = never to 4 = always) where responses are summed to produce a total score ranging from 0 to 40 (current study $\alpha = 0.81$). Unrestrained eaters were classified as people with RRS scores of 15 or below, and restrained eaters as people with RRS scores of 16 or above. Participants were also given the Eating Disorder Diagnostic Scale (EDDS; Stice, Telch, & Rizvi, 2000) with the total score of Items 1–19 used as a basic index of eating pathology ($\alpha = 0.87$), considering past work suggesting that restrained eating may be a risk factor for other psychopathology (Pollert, Kauffman, & Veilleux, 2016).

2.3. Procedure

This study used a 2 (cue type: food or neutral) \times 2 (response condition: introspection on craving/affect or control) \times 2 (restraint status: unrestrained, restrained eaters) online design. Via Qualtrics, participants were randomized to view 20 food or neutral cues. Food cue images (e.g., cheeseburger, pizza, cake) were taken from the internet (determined by an independent pilot test to elicit significant self-reported craving compared to neutral images) and neutral images were from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008), chosen based on normed arousal ratings to be neither positive nor negative and relatively low on arousal. All images were presented in randomized order.

Participants were also randomized to response condition, where the introspection group received questions regarding their craving/affective responses to images with four items assessing craving (e.g., “After

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