

Don't Mind If I Do: Disinhibited Eating Under Cognitive Load

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Past research has shown that strong emotional or motivational states can cause normally restrained eaters to overeat. In this article it is argued that simple cognitive load can also disinhibit eating by restrained eaters. Two studies examined this disinhibition effect. In Study 1, restrained and unrestrained eaters were given the opportunity to consume high-calorie food while performing either a high cognitive-load or low cognitive-load task. Restrained eaters consumed more food when under high cognitive load than when under low cognitive load; unrestrained eaters showed the opposite pattern. Study 2 replicated the disinhibition effect and ruled out stress, diminished awareness of food consumption, and ironic rebound as probable mediators. Results suggest that cognitive load may disinhibit consumption by preventing restrained eaters from monitoring the dietary consequences of their eating behavior. Implications for theories of self-regulation are discussed.

Dieting is like holding your breath.

—John Foreyt, quoted in the newsletter *Environmental Nutrition*

There is perhaps no behavior that Americans struggle more to inhibit than their own consumption of food. At any one time approximately 40% of women and 25% of men report they are on a diet to control their weight (Williamson, Serdula, Anda, & Levy, 1992), contributing an estimated 30 to 50 billion dollars a year to the weight-loss industry (Gladwell, 1998). And yet, nearly 95% of individuals fail at their initial attempt to diet (Garner & Wooley, 1991), most resolving to try again, hoping that next time will bring success. But can they succeed? Or is dieting, as our opening quote suggests, ultimately doomed to fail?

Chronic dieting, or what has been called *restrained eating* (Herman & Polivy, 1980), like the inhibition of most pleasurable activities, entails self-regulation, an overriding of a normal re-

sponse through the substitution of a competing response (Baumeister, Heatherton, & Tice, 1994).¹ Precisely how self-regulation is accomplished has been one of psychology's oldest concerns (e.g., in 1890, William James wrote of the battle between impulses and inhibitions that resulted in either the "explosive" or the "obstructed" will). In the last 25 years it has been the focus of a number of theories, and in the last decade research on self-regulation has expanded dramatically (Baumeister et al., 1994). Thus, the field now includes many constructs that relate to individuals' attempts to control their own thoughts, emotions, or behaviors. These constructs include self-regulation (Carver & Scheier, 1981; Pyszczynski & Greenberg, 1987), self-control (Kanfer & Karoly, 1972), self-management (Karoly & Kanfer, 1982), self-efficacy (Bandura, 1977), self-awareness (Duval & Wicklund, 1972), mental control (Wegner, 1989), mood regulation (Parrott, 1993), delay of gratification (Mischel, 1974), and others (for a review, see Wegner & Pennebaker, 1993; see also Baumeister et al., 1994).

One influential theory has posited three principle components to self-regulation (Carver & Scheier, 1981, 1982, 1998; see also Baumeister et al., 1994; Miller, Galanter, & Pribram, 1960). The first involves standards, or ideal states that an individual wishes to attain. The second component is monitoring, the process by which an individual's current state is compared with the standard or ideal state. The final component is an "operating" process, a process designed to change the current state when it falls short of the standard. Thus, an individual attempting to regulate his or her eating might possess a standard that prohibits overindulgence,

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¹ Whereas all dieters are not technically restrained eaters, we use the terms interchangeably in this article. Restrained eaters are chronic dieters who, perhaps ironically, experience occasional lapses in restraint (Heatherton, Herman, Polivy, King, & McGree, 1988). Although it has been argued that these lapses arise from the fact that restrained eaters are often below their biologically determined set point for a stable weight, a variety of social factors have also been shown to disinhibit restrained eaters (see Herman & Polivy, 1988).

might monitor dieting success through the counting of calories or portions, and might operate on a perceived discrepancy between the amount of food consumed and the desired amount by restricting future caloric intake.

Any of the three components can be involved in the failure of self-regulation. For example, individuals who fail to restrict caloric intake may not possess a standard that values the consumption of low-calorie foods, or they may temporarily abandon such a standard. This failure has been documented in studies in which restrained eaters who initially consume a high-fat milkshake "preload" go on to consume more calories than those who do not consume the preload (e.g., Herman & Mack, 1975). Apparently, preloaded, restrained eaters adopt a "devil may care" attitude, believing that a low-calorie ideal is already unattainable and therefore not worth pursuing (see Spencer & Fremouw, 1979).

Similarly, individuals may sometimes be incapable of behaving or operating in a manner that is compatible with decreased food consumption. An impaired operating process has been implicated in many common instances of self-regulation failure. For example, Baumeister and his colleagues (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister & Heatherton, 1996) have argued that resource-taxing activities can deprive an individual of the "strength" required to alter responses in a desired direction. Although not disputing the potential relevance of the strength model to restrained eating, the focus of this article is on the monitoring component of self-regulation rather than the operating process.

Monitoring

As discussed by Carver and Scheier (1981; see also Baumeister et al., 1994; Duval & Wicklund, 1972), monitoring involves awareness of both one's current behavioral state and how that state compares with a relevant standard. Accordingly, dieters may fail to adhere to a dietary standard if they experience a lapse in awareness of their current behavior. As Herman and Polivy (1993) have stated, "[I]f one wants to induce the dieter to abandon the diet, the trick is to present highly attractive food but to prevent the dieter from realizing that he or she is eating it!" (pp. 499–500). But even if dieters are aware of their behavior, they may still experience disinhibited eating if they are prevented from comparing that behavior with a relevant standard. In other words, dieters may fail to restrict eating if they are unable to realize the implications of that eating in terms of their own dietary prohibitions.

What types of stimuli or events are required to disrupt restrained eaters' monitoring of relevant standards? This question motivated the present studies.

The Role of Attention

Attentional failure may lead to the disruption of monitoring, as "[m]anaging attention is not only the most common technique of self-regulation, it may well be the most generally effective one" (Baumeister et al., 1994, p. 25). Thus, events or actions that serve to reduce the amount of attention directed toward oneself should make it more difficult to monitor internal standards. In particular, a dieter may fail to appreciate the implications of overeating if his or her attention is otherwise occupied.

One model of binge eating suggests that attention plays a central role in self-regulation failure (Heatherton & Baumeister, 1991).

According to the model, episodes of binge eating are most likely to occur as a result of a motivated attempt to escape from negative self-awareness. In particular, when an individual suffers an ego-relevant failure, he or she is motivated to direct attention away from the self, as self-focus is especially painful in the face of personal failure. This escape is fostered by narrowing one's attention to the immediate external environment, a state of awareness that succeeds in leading to an escape from a painful self-view but prevents one from attending to personal or societal standards. Once attention is narrowed, disinhibited behavior is likely to occur, as inhibition seems to require attention to internal standards (Diener, 1979; Diener & Wallbom, 1976). For a dieter, that disinhibited behavior is likely to take the form of binge eating.

Parenthetically, we note that restrained eaters may be particularly susceptible to distraction because they are continually monitoring their diet standards and their eating behavior. Indeed, even when food is not present, restrained eaters show impaired cognitive processing. In one study, distraction impaired the proofreading accuracy of restrained eaters, but not unrestrained eaters (Herman, Polivy, Pliner, Threlkeld, & Munic, 1978). In another study, compared with unrestrained eaters, dieters exhibited slower reaction times, impaired recall, and poorer accuracy during a cognitive task (Green, Rogers, Elliman, & Gatenby, 1994).

A motivated escape from self-awareness, however, does not appear to be the only route to disinhibited eating. Strong emotional states, such as those induced by viewing a frightening or humorous film, have also been shown to disinhibit eating among normally restrained eaters (Cools, Schotte, & McNally, 1992). This has led some researchers (e.g., Cools et al., 1992; Schotte, 1992) to conclude that strong positive or negative moods can disinhibit eating without involving any sort of ego threat to the restrained eater. Although acknowledging that self-threat may not be involved in every instance of disinhibited eating, others (e.g., Heatherton, Herman, & Polivy, 1992) have suggested that watching certain engrossing films may disinhibit eating through distraction from self-awareness. However, this latter prediction, which presumably entails disruption of monitoring through altered attentional focus, has not been previously confirmed with dieting individuals. Indeed, one study (Boon, Stroebe, Schut, & Jansen, 1997) found that cognitive distraction did not lead to overeating by dieters. As the authors acknowledged, however, the participant sample included relatively few individuals who were significantly restraining their eating at the time of the study. A second study (Ross, 1974b), intended as a refinement of Schachter's (1968, 1971) externality theory of obesity, did find general support for the notion that distraction can disinhibit eating, although the results must be interpreted with caution as the complete study has never appeared in published form (portions of it appeared in Ross, 1974a). Moreover, the participants were classified as obese and nonobese rather than restrained and unrestrained.

Thus, in the studies reported here, we sought to investigate whether a simple attentional manipulation—one involving neither a motivated escape from self-awareness nor a strong emotional state—could succeed in releasing a restrained eater's dietary inhibitions. In particular, could a simple cognitive load focus a dieting individual's attention away from monitoring, and thus result in reduced adherence to personal dieting standards?

Alcohol Myopia

One source of relevant data has been provided by research in another domain in which an escape from self-awareness can occur without any emotional or motivational antecedent. Research by Steele and his colleagues on the effects of alcohol has suggested that disruptions in cognitive processing can sometimes lead to disinhibition (see Steele & Josephs, 1990, for a review). According to this research, alcohol impairs an individual's ability to engage in effortful cognitive processing and narrows attention to the most salient internal and external cues, producing *alcohol myopia*, "a state of shortsightedness in which we process fewer cues less well" (Steele & Josephs, 1988, p. 197). The researchers have argued that alcohol is likely to disinhibit only those responses that are normally under high inhibitory conflict, that is, responses subject to both strong instigating and strong inhibiting pressures. In particular, if the behavior in question is subject to strong instigating pressures, but would ordinarily be inhibited by a sober individual, alcohol's narrowing of attention to those instigating pressures will produce a disinhibited response when the individual is intoxicated. On the other hand, if instigating and/or inhibiting pressures governing a sober individual's response are weak to begin with, then alcohol should produce effects that differ little from those exhibited under sobriety.

We reasoned that the eating behavior demonstrated by restrained eaters might also be under high inhibitory conflict, particularly in the presence of appealing, high-calorie food. For restrained eaters, instigating pressures would include the salience and tastiness of the food as well as the inherent attractiveness of something that individuals typically deny themselves (see Brehm, 1966). Inhibitory pressures would include self-imposed dietary rules and restrictions prohibiting the consumption of certain high-calorie foods. We further reasoned that high cognitive load, like alcohol, might impair cognitive processing and narrow attention to strong instigating pressures at the expense of inhibiting pressures. According to this hypothesis, restrained eaters would exhibit disinhibited eating behavior when under high cognitive load, as they would no longer be capable of evaluating that eating in terms of their normal dietary restrictions.

Study 1

In Study 1, we exposed restrained eaters to a situation in which appetizing, high-calorie food was made available while either a high cognitive load or low cognitive load occupied some of their attention. In particular, high cognitive-load participants watched a series of art slides in anticipation of a recognition-memory test and, at the same time, periodically responded to a reaction-time measure intended to serve as a manipulation check (for related dual-task procedures, see Britton & Tesser, 1982; Josephs & Steele, 1990). Low cognitive-load participants simply responded to the reaction-time measure. We hypothesized that high cognitive-load participants would be less able to monitor their internal diet rules (especially with regard to their current behavior) and, consequently, would engage in more disinhibited eating than participants in the low cognitive-load condition.

For comparison purposes, we also included unrestrained eaters in the study. Again drawing on the alcohol myopia model, we reasoned that the eating behavior of these individuals would be

under weak inhibitory conflict; that is, whereas some instigating pressures (such as the attractiveness of the available food) would be present, few inhibitory pressures would exist. Accordingly, we hypothesized that cognitive load would not disinhibit eating among unrestrained eaters because there would be no inhibitory pressures from which to divert attention.

Method

Participants

The Dietary Restraint Scale—Revised (Herman et al., 1978) was administered to participants during a prescreening session held several weeks before the study. The scale, which was included in a packet of unrelated measures, assessed attitudes toward eating, frequency of dieting, and weight fluctuations. It has attained satisfactory levels of test-retest reliability, as well as construct and criterion validity, when used with nonobese participants (Ruderman, 1986). In accord with past research (Polivy, Herman, & Howard, 1988), those participants who scored 16 or above on the scale were classified as restrained eaters, whereas those who scored 15 or below were classified as unrestrained.

A total of 30 restrained (mean restraint score = 21.27, $SD = 3.73$) and 30 unrestrained (mean restraint score = 9.17, $SD = 3.53$) female undergraduates participated in exchange for either credit toward an introductory psychology experiment requirement or monetary compensation of \$5. An additional participant, who was visibly obese, was excluded from analysis, as controversy exists over whether the Dietary Restraint Scale is psychometrically sound when used with obese participants (Heatherton, Herman, Polivy, King, & McGree, 1988; Ruderman, 1986). In addition, obese dieters have been hypothesized to respond differently than nonobese dieters to manipulations designed to disinhibit eating (Heatherton et al., 1988). Through random assignment, half of the restrained and unrestrained eaters participated in the high cognitive-load condition; the remaining half participated in the low cognitive-load condition.

Procedure

Participants took part in individual sessions. In an effort to obtain individuals who were experiencing similar levels of hunger, all sessions were conducted between the hours of 2 p.m. and 4 p.m. When entering the laboratory, participants were told by an experimenter that they were to take part in a study of the effects of mood on a particular performance task. In particular, those in the high cognitive-load condition were told that the study was investigating the effects of "mood on memory," whereas those in the low cognitive-load condition were told that the study concerned the effects of "mood on reaction time." All participants were then informed that while performing the task, they would be asked to consume good-tasting food as a means of manipulating mood. Specifically, the experimenter told each participant the following: "While past studies have relied on such mood manipulations as pleasant music or even pleasant odors, we have something you might like a little better: pleasant-tasting food." Although participants were free to draw their own conclusions from the cover story, they were provided with no further information concerning putative mood effects in the study.

High cognitive-load condition participants were told that the task would involve memorizing a series of art slides in preparation for a recognition test. They were also told that they would be required to respond to a reaction-time measure "as an indication of how involving the memorization task is." Low cognitive-load condition participants were told simply that the performance task would involve responding to a reaction-time measure. Participants in both conditions were then shown a plate of Doritos nacho chips, a bowl of M&M's candies, and a plate of chocolate chip cookies. Unbeknownst to the participants, the chips and candies had been weighed, and the cookies counted, prior to their arrival. All items were of

sufficient quantity that an individual could eat substantial amounts without producing any obvious visual indication of consumption. Each individual was provided with approximately the same quantity of food, and analysis of covariance (ANCOVA) confirmed that the results reported below were unaffected when initial food amount was treated as a covariate. Accordingly, this variable receives no further discussion.

Initial questionnaire. Participants next completed a questionnaire probing their current hunger and mood levels. Both were assessed on 7-point Likert-type scales. The hunger scale ranged from 1 (*not hungry at all*) to 7 (*extremely hungry*), whereas the mood scale ranged from 1 (*extremely negative*) to 7 (*extremely positive*).

Reaction-time measure. After completing the questionnaire, all participants were given the opportunity to practice responses to the reaction-time measure. Reaction time was measured as the time required by the participant to respond to a short beep emitted by a computer in the room. To permit individuals to use both hands for food consumption, participants were instructed to step on a foot button as soon as they heard the beep. The computer recorded five practice trial reaction times and thus provided a baseline against which each participant's performance during the actual task could be compared.

Cognitive-load manipulation. High cognitive-load participants were then informed that they were to watch a series of art slides, which they were to memorize in preparation for a recognition test to be administered later in the session. It was stressed that the test was not evaluative of innate ability but was merely intended to reveal any effects of mood on memory. High cognitive-load participants were also reminded to respond to the reaction-time beep during the slide-viewing task, but it was recommended that they devote the bulk of their attention toward viewing and remembering the slides. Low cognitive-load participants were simply instructed to respond as quickly as possible to the reaction-time measure. Both high and low cognitive-load participants were instructed to eat as little or as much as they wanted from any of the provided food items during their respective tasks, with the one stipulation that they should consume something during the task "for purposes of the mood manipulation." The experimenter then left the room, and the performance task began.

Performance task. In both conditions the task lasted 10 min. All participants were required to respond with the foot pedal to a beep emitted by the computer at random intervals averaging 30 s (range = 500 ms to 60 s). The computer recorded response latencies as well as the interval length between beeps. In addition, high cognitive-load participants were presented with 60 slides, each projected automatically for 10 s. After 10 min, the experimenter reentered the room and administered a posttask questionnaire.

Posttask questionnaire. After completing the performance task, participants rated it on five 7-point scales (simple-complex, uninteresting-interesting, difficult-easy, involving-uninvolving, fun-not fun at all). They also indicated how much stress they had felt while performing the task on a scale from 1 (*extremely calm/relaxed*) to 7 (*extremely stressed*) and again reported their current mood.

The experimenter then debriefed participants, which included informing those in the high cognitive-load condition that they would not be tested on their recall of the art slides. After participants left the room, the experimenter weighed the chips and M&M's and counted the cookies to determine how much food had been consumed during the performance task.

Results

Initial Measures

Two-way analyses of variance (ANOVAs; Restraint Status \times Cognitive Load) were performed on participants' initial ratings of hunger and mood. For the hunger measure, the analysis revealed a significant main effect for restraint status, with unrestrained participants reporting greater hunger levels ($M = 3.37$, $SD = 1.19$)

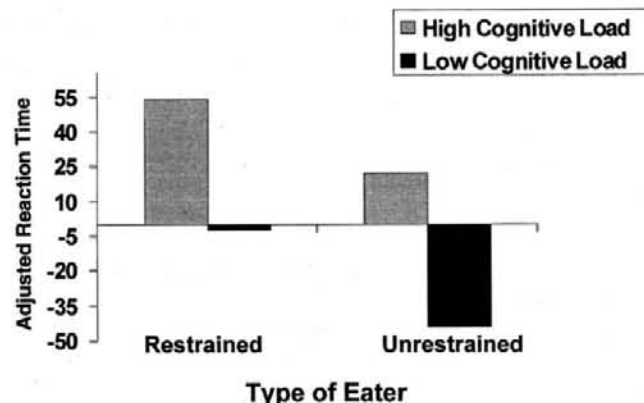


Figure 1. Mean adjusted reaction time (milliseconds) as a function of restraint status of eater and cognitive-load condition.

than restrained participants ($M = 2.60$, $SD = 1.33$), $F(1, 56) = 5.96$, $p < .02$. In addition, however, there was an interaction between the two variables, $F(1, 56) = 4.97$, $p < .05$. In the low cognitive-load condition, restrained and unrestrained participants differed markedly in their reported initial hunger levels (restrained $M = 2.07$, $SD = 0.96$; unrestrained $M = 3.53$, $SD = 1.13$), whereas in the high cognitive-load condition, the two groups of eaters differed only slightly (restrained $M = 3.13$, $SD = 1.46$; unrestrained $M = 3.20$, $SD = 1.26$). Accordingly, analysis of the primary dependent measure (reported below) was conducted with initial hunger level serving as a covariate. No main effects or interactions emerged from the analysis of the initial mood ratings.

Manipulation Check

To ensure that the slide viewing did in fact impose a cognitive load on participants, reaction times in the high cognitive-load condition were compared with those of participants in the low cognitive-load condition. Because reaction times tend to vary greatly between individuals, a mean difference was calculated by subtracting each participant's mean reaction time for the five practice trials from her mean reaction time during the task. As predicted, participants in the low cognitive-load condition responded faster to the beeps generated by the computer than did those in the high cognitive-load condition, $F(1, 54) = 7.73$, $p < .01$.² In fact, on average, low cognitive-load participants responded faster during the task than they had during the practice trials, perhaps reflecting a practice effect, whereas high cognitive-load participants were substantially slowed by the demands of the task (see Figure 1). In both cognitive-load conditions, unrestrained eaters responded faster than restrained eaters, and although the difference failed to reach conventional levels of significance, $F(1, 54) = 2.76$, $p < .11$, a similar pattern of impaired cognitive processing in restrained eaters has been found in several studies (Green et al., 1994; Herman et al., 1978).

² Because of technical problems, the reaction times of 2 participants, both in the high cognitive-load condition, were not recorded. One was a restrained eater; the other, an unrestrained eater.

Primary Dependent Measure

To determine how much food each participant ate during the performance task, a composite measure was formed, summing the total amount (grams) of chips, M&M's, and cookies consumed.³ A 2×2 ANCOVA (Cognitive Load \times Restraint Status; initial hunger level as a covariate) performed on the composite revealed a significant interaction, $F(1, 55) = 5.03, p < .05$.⁴ Whereas unrestrained eaters consumed more food in the low cognitive-load condition ($M = 59.67$ g, $SD = 26.50$) than in the high cognitive-load condition ($M = 43.60$ g, $SD = 24.04$), restrained eaters did the opposite, eating less food in the low cognitive-load ($M = 37.98$ g, $SD = 19.53$) than in the high cognitive-load condition ($M = 52.53$ g, $SD = 25.46$). This "crossover effect" can be seen clearly in Figure 2.

Additional Measures

Participants in the high cognitive-load condition, regardless of restraint status, rated the slide-viewing task as more complex, interesting, difficult, and involving than did participants in the low cognitive-load condition (who rated the reaction-time task alone; all $ps < .02$). No significant condition difference emerged on the ratings of how fun the respective tasks were, $F(1, 56) = 1.93, p > .10$. In addition, there were no main effects for restraint status, and no interactions with cognitive-load condition, for any of these five measures (all $ps > .19$).

High cognitive-load participants reported feeling significantly more stress during the task ($M = 2.87, SD = 1.55$) than did low cognitive-load participants ($M = 2.07, SD = 1.28$), $F(1, 56) = 4.65, p < .05$, although neither group's mean response exceeded the point on the 7-point Likert scale labeled 3 (*slightly calm/relaxed*; recall that the scale ranged from 1 [*extremely calm/relaxed*] to 7 [*extremely stressed*], with 4 labeled *neutral*). Once again, no main effect for restraint status or interaction with load condition was found. Finally, when asked to describe their current mood, participants in the high cognitive-load condition ($M = 5.14, SD = 0.95$) did not differ significantly from those in the low cognitive-load condition ($M = 5.03, SD = 1.25$), nor did re-

strained participants ($M = 5.07, SD = 1.07$) differ from unrestrained participants ($M = 5.10, SD = 1.16$; both $F_s < 1$). In addition, despite the cover story presented to participants, a comparison between premood and postmood ratings revealed that the food did not succeed in significantly altering the mood of restrained or unrestrained eaters in either cognitive-load condition.

Discussion

Consistent with our hypothesis, restrained eaters engaged in more disinhibited eating when performing an attentionally demanding task than when performing a task that minimally taxed attentional resources. Unrestrained eaters, in contrast, actually ate less food in the high cognitive-load condition than in the low cognitive-load condition. In fact, the effect of cognitive load on the eating of unrestrained eaters was as large in magnitude (but in the opposite direction) as the disinhibition effect observed for restrained eaters. Similar results have been obtained with unrestrained eaters in studies involving high-calorie preloads (e.g., Herman & Mack, 1975) and ego threats (e.g., Heatherton, Polivy, Herman, & Baumeister, 1993; Heatherton, Strieppe, & Wittenberg, 1998).

It seems likely that for unrestrained eaters in this study, the high cognitive load served to distract attention somewhat away from the provided food (though not entirely, as all participants knew they were required to eat something during the session). In terms of our proposed model, the instigating force of the food was weakened for unrestrained eaters who were asked to watch and remember art slides. No corresponding weakening effect on inhibitory forces was observed, of course, because no inhibitory pressures had existed to begin with. For the restrained eaters, it seems that any potential weakening of the promoting pressures to eat in the high cognitive-load condition was more than offset by the putative diversion of individuals' attention away from less salient inhibitory pressures.

It is perhaps surprising that on the initial questionnaire restrained eaters did not report greater hunger than unrestrained eaters. After all, constant dietary deprivation should produce increased hunger (cf. Nisbett, 1972). It is possible, however, that restrained eaters were unwilling to admit to us, or for that matter to themselves, that they were currently experiencing great hunger. Alternatively, it is possible that they were not experiencing strong sensations of hunger, as attempts to diet are often accompanied by food-thought suppression that, at least temporarily, may provide relief from hunger (Herman & Polivy, 1993). For our purposes, all that was required was that the available food constitute an effective temptation to eat, either by satisfying hunger or by representing a normally forbidden, and hence desirable, commodity. Indeed, more than one restrained eater spontaneously mentioned that the available food items, though appealing, were not ones they typically would indulge in.

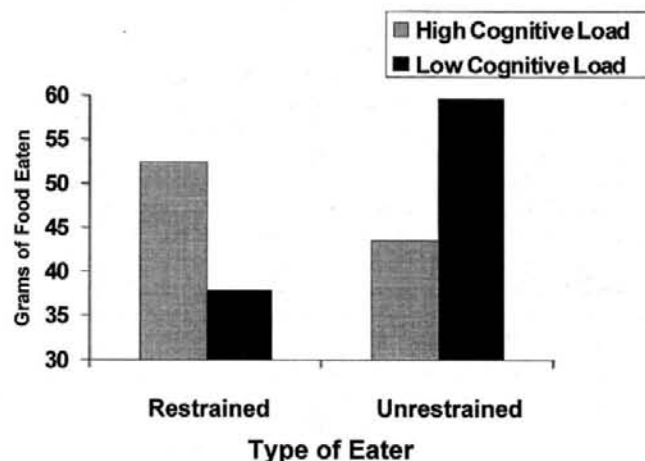


Figure 2. Mean amount of food eaten (grams) as a function of restraint status of eater and cognitive-load condition.

³ The weight of consumed cookies was calculated by multiplying the number of cookies eaten by 16 g, the mean weight of a single cookie.

⁴ The same ANCOVA indicated that hunger itself was not a significant covariate, $F < 1$. In addition, an analysis conducted without hunger as a covariate revealed the same general pattern of results, that is, a significant interaction between restraint status and cognitive load, $F(1, 56) = 6.09, p < .05$.

Although our favored hypothesis is that the high cognitive load succeeded in narrowing restrained eaters' attention away from normally present inhibitory pressures (in the form of dietary prohibitions against consuming high-calorie food), alternative explanations for the disinhibition effect must be considered. First, despite assurances from the experimenter that the slide-viewing task was not intended as a measure of innate ability, participants in the high cognitive-load condition rated the task as more stressful than did participants in the low cognitive-load condition. Although average stress levels in the high cognitive-load condition never rose above the *neutral* midpoint of our self-report scale, and although restrained eaters did not report higher stress levels than unrestrained eaters, it seemed possible that stress might have differentially affected the two groups of eaters. In particular, it is possible that the restrained eaters in our study were those individuals who were especially likely to overeat when under stress—a tendency not shared by unrestrained eaters. Past research has suggested a link between certain types of stress and overeating by dieters (Greeno & Wing, 1994), and consideration of this alternative explanation for our findings seemed warranted.

Second, although we have argued that high cognitive load prevented restrained eaters from appreciating the full implications of their behavior in light of their diet, another related explanation also fit the data. Polivy, Herman, Hackett, and Kuleshnyk (1986) showed that dieters who were required to count how many cookies they ingested during a taste test were able to restrain their eating, even after consuming a high-calorie preload—a preload that disinhibited the eating of dieters who were not required to engage in this monitoring task. Perhaps restrained eaters under cognitive load in our study were simply unable to keep track of how much food they had consumed and were thus unaware of a behavior that they would otherwise have judged to be incompatible with their dieting standard. This possibility also warranted further study.

Finally, past research has found that individuals who attempt to suppress certain thoughts often fail, ironically producing the very thought they had tried to suppress (Wegner, 1994). In one study, participants who were asked to not think about a white bear were generally unsuccessful, admitting to occasional thoughts of the bear during the 5-min suppression period (Wegner, Schneider, Carter, & White, 1987). Moreover, when the suppression period ended and participants were free to think of a white bear, they reported more thoughts of the bear than did participants who had been asked to think about a white bear from the outset. Such a failure of mental control, which often results in an "ironic rebound" of the to-be-suppressed thought, is particularly likely to occur when individuals are under cognitive load (Wegner, 1994).

In terms of the present investigation, it seemed possible that the restrained eaters in Study 1 might have attempted to suppress thoughts about the tempting food before them. To the extent that the high cognitive-load manipulation made suppression of food thoughts especially difficult, perhaps restrained eaters in this condition experienced an ironic rebound of those thoughts, resulting in disinhibited eating. Although the relationship between food-thought suppression and disinhibited eating by dieters may not be straightforward (Herman & Polivy, 1993), this alternative explanation also seemed worthy of further investigation. Accordingly, we conducted Study 2 to address these alternative possibilities and provide reliable evidence for the disinhibition effect. As our focus

was on elucidating the mechanism underlying this effect, unrestrained eaters were not included.

Study 2

In Study 2 restrained eaters were presented with a situation similar to that of Study 1: Participants were asked to perform a high or low cognitive-load task while consuming appetizing food. Once again we measured self-reported stress and attempted to persuade all participants that the performance task was not designed to produce great stress. In addition, we included two new measures. The first, a word-fragment completion task, was administered immediately after the performance task and was intended to assess whether ironic rebound of food-related thoughts had occurred for those participants under high cognitive load. The second, intended to gauge behavioral awareness, was administered near the end of the study and asked participants to estimate how much food they had eaten.

Method

Participants

As in Experiment 1, individuals who attained a score of 16 or higher on the Dietary Restraint Scale—Revised (Herman & Polivy, 1980), administered several weeks prior to the beginning of the study, were classified as restrained. A total of 29 female restrained eaters (mean restraint score = 21.67, $SD = 3.64$) participated in exchange for introductory psychology course credit or monetary compensation of \$5. Restrained eaters were randomly assigned to a high cognitive-load condition ($n = 14$) or to a low cognitive-load condition ($n = 15$). An additional participant, who was visibly obese, was omitted from the analyses.

Procedure

The procedure for Study 2 was initially the same as that used in Study 1. Participants completed preexperimental measures of mood and hunger and then, in the high cognitive-load condition, watched a series of art slides in preparation for a memory test. At the same time, high cognitive-load participants sampled from an assortment of cookies, chips, and M&M's (again portrayed as a mood manipulation), and responded to a random-interval reaction time beep. As in Study 1, to reduce potential stress levels we emphasized that the memory test was not intended as an assessment of native ability. Low cognitive-load participants sampled from the same food items and responded to the reaction-time measure. Immediately following completion of the performance task, however, all participants in this study were asked to fill out a word-fragment completion task, patterned after Steele and Aronson (1995; see also Gilbert & Hixon, 1991). The task was introduced as "a new measure being pretested for a future study." Next, participants were asked to complete a behavioral-awareness measure (described to participants as an attempt "to assess the strength of the mood manipulation") that asked them to estimate how much food they had eaten. Finally, participants filled out the same postexperimental questionnaire as in Study 1, assessing their perceptions of the performance task and their stress level while performing the task, along with their current mood. Following completion, they were debriefed and thanked for their participation. After participants had left the room, the experimenter determined how much of each food item had been consumed.

Word-fragment completion. This measure has been shown to measure cognitive constructs that have recently been primed (Steele & Aronson, 1995). It was administered directly after completion of the performance task because Wegner et al. (1987) found that ironic rebound of suppressed thoughts occurred immediately after suppression instructions had been

lifted. We reasoned that to the extent that restrained eaters had tried and ultimately failed to suppress thoughts about the available food and/or their diet, this failure would manifest itself as heightened accessibility of food and diet-related words immediately following completion of the performance task. Accordingly, we presented participants with 24 word fragments with missing letters denoted as blank spaces (e.g., FO__). Pretesting on a large group of undergraduates ($n = 110$) revealed that seven of these fragments could be completed with one or more food- or diet-related words. The list included CH__ (CHEW, CHIP), DI__(DIET), _AT (FAT), FO__ (FOOD), SC___ (SCALE), SN___ (SNACK), and WE_____ (WEIGHT). These target fragments were interspersed with 17 other filler items (e.g., JU__), with each target separated by at least two filler items and no more than three target fragments per page, to prevent participants from discerning the purpose of the measure.

Behavioral-awareness measure. Participants were then asked to estimate the amount of each food item they had consumed. For the cookies, participants simply wrote down the number they had eaten. For the chips and M&M's, they were provided with two 7-point Likert scales on which to estimate the number they had eaten, ranging from 1 (*less than 5*) to 7 (*more than 35*). Participants were instructed to write in 0 if they had not eaten any chips or M&M's.

Results

Preliminary Measures

Participants in the high cognitive-load condition did not differ from their peers in the low cognitive-load condition on preexperimental measures of mood or hunger, both $ts < 1$, and these variables receive no further discussion.

Manipulation Check

As in Study 1, reaction times of participants under high and low cognitive load were compared to ensure that the high cognitive-load task had indeed taxed participants' attention. Reaction times were again "corrected" by subtracting each individual's mean performance during the practice trials from her mean performance during the actual task. There was a clear effect of cognitive load, with participants in the high cognitive-load condition slowed by the demands of the task ($M = 69.90$ ms, $SD = 93.90$), whereas those in the low cognitive-load condition improved their performance relative to the practice trials ($M = -50.00$ ms, $SD = 117.00$), $t(27) = 3.04$, $p < .01$.

Primary Dependent Measure

Once again, a composite measure of food consumption was formed, summing together the amount of cookies, chips, and M&M's eaten by each participant. As in Study 1, restrained eaters under high cognitive load consumed significantly more food ($M = 71.60$ g, $SD = 35.30$) than did restrained eaters under low cognitive load ($M = 46.70$ g, $SD = 29.00$), $t(27) = 2.09$, $p < .05$.

Word-Fragment Completion

An analysis of the target word fragments revealed that participants in the high cognitive-load condition did not produce significantly more food- or diet-related completions ($M = 0.79$, $SD = 0.89$) than did low cognitive-load participants ($M = 0.60$, $SD = 0.63$), $t < 1$. However, inspection of all completions (independent of condition) generated seven additional words that, in our

judgment, could be considered food-related, despite the fact that they had not been produced by the pretested undergraduates. These additional completions were *creams*, *creamy*, *drink*, *fork*, *prune*, *scone*, and *soup*. A reanalysis of the fragment completions that included the seven additional targets again, though, yielded no significant difference between the high cognitive-load ($M = 1.29$, $SD = 1.07$) and low cognitive-load ($M = 1.07$, $SD = 0.96$) participants, $t < 1$. In terms of individual participants, 64% of those in the high cognitive-load group and 67% of those in the low cognitive-load group generated at least 1 of the 14 target completions.

Behavioral Awareness

To compare participants' estimated consumption with their actual consumption, we converted their Likert-scale estimates to grams, based on the known weight of each food item. A composite measure of estimated consumption was then formed by summing the estimated weight of M&M's, chips, and cookies. Our standard of comparison was each group's mean ratio of estimated to actual food consumption, a measure that controls for the presumed difficulty of accurately estimating high levels of consumption (Kirschenbaum & Tomarken, 1982). This analysis revealed that whereas low cognitive-load participants were more accurate in estimating how much food they had consumed ($M = 1.04$, $SD = 0.55$, where a mean of 1.00 = perfect accuracy) than were high cognitive-load participants ($M = 0.85$, $SD = 0.29$), the difference between the two groups did not approach statistical significance, $t(26) = 1.15$, *ns*. Moreover, neither the low cognitive-load group's slight overestimation nor the high cognitive-load group's underestimation significantly differed from an accurate ratio of 1.00, both $ps > .05$.

Additional Measures

Analyses of responses to the postexperimental questionnaire revealed that participants in the high cognitive-load condition rated the slide-viewing task as more complex, interesting, difficult, and involving than low cognitive-load participants rated the reaction-time task (all $ps < .05$). Participants did not differ in how fun they found the task ($t < 1$), in self-reported mood ($t < 1$), or on a measure of mood change from pre- to postexperiment ($t < 1$). Regression analyses based on Baron and Kenny (1986) indicated that only ratings of interestingness appeared to mediate the disinhibition effect. However, similar analyses performed on these same ratings provided by restrained eaters in Study 1 were less revealing (in particular, interest ratings did not correlate significantly with food consumption, $r = .28$, $p > .10$), casting some doubt on the mediational role played by task interest in these studies, despite its seeming relatedness to cognitive load.

Finally, on the measure of self-reported stress, participants did not significantly differ, with high cognitive-load participants ($M = 3.43$, $SD = 1.45$) reporting themselves to be only slightly more stressed than low cognitive-load participants ($M = 2.80$, $SD = 1.52$), $t(27) = 1.14$, *ns*. Moreover, correlational analyses revealed that stress was negatively associated with amount of food consumed by restrained eaters under cognitive load, both in this study ($r = -.11$) and, especially, in Study 1 ($r = -.59$). For restrained eaters under low cognitive load, the relevant correlation

was slightly positive in this study ($r = .15$) and negative in Study 1 ($r = -.49$).

Discussion

The results of our second study provide further support for the hypothesis that cognitive load disinhibits the eating of restrained eaters. Restrained eaters consumed more food while performing a cognitive task intended to monopolize their attention than while performing a task that did not tax their attention. In addition, this experiment did not provide support for three alternative mechanisms of disinhibition. With regard to the first alternative, the results suggest that the effect of cognitive load on eating was not mediated by the stress level of participants. Special efforts were taken to prevent participants from becoming stressed during the cognitive-load task, and indeed there was no reliable difference in the degree of stress reported by participants in the two experimental conditions. Moreover, as in Study 1, the overall level of reported stress was very low, and for high cognitive-load participants there was a negative correlation between stress level and amount of food eaten.

The results also suggest that impairments in behavioral awareness did not mediate the effect of cognitive load. Participants in the two conditions did not significantly differ from each other in the accuracy of their estimated food intake. Although there was a trend for participants in the high cognitive-load condition to underestimate their intake, this effect also failed to reach conventional levels of statistical significance. Of course, even if cognitive load had interfered with restrained participants' awareness of their consumption in these studies, that does not mean that monitoring of dietary standards was not also disrupted. Indeed, we would not be surprised to learn that an exceptionally high cognitive load can impair both monitoring and behavioral awareness, despite the apparent relative effortlessness of the latter process. The present data, however, suggest that cognitive load did not exert a significant impact on behavioral awareness, and thus the role of reduced awareness of consumption in the observed disinhibition effects appears to have been negligible.

Finally, these results do not support the hypothesis that cognitive load disinhibits eating by causing participants who are attempting to suppress food thoughts to fail, leading to an ironic rebound of those thoughts, as might be predicted by some theories of mental control (e.g., Wegner, 1994). Using a word-fragment-completion measure designed to assess primed thoughts, we found no difference between restrained eaters under high cognitive load and those under low cognitive-load in terms of how many diet- or food-related thoughts they reported. This result is consistent with the results of at least one prior study (Harnden, McNally, & Jimerson, 1997), in which dieters did not show a rebound of a previously suppressed thought concerning the desire to weigh themselves. Moreover, the current result is perhaps not surprising, given that participants were never instructed to suppress food thoughts in either condition—an instruction that may be critical to an ironic rebound of food-related thoughts. Indeed, past studies demonstrating ironic rebound effects have generally included explicit directions to participants to attempt suppression of a particular thought (e.g., "try not to think of a white bear"; Wegner et al., 1987). In the present studies such suppression attempts may have

been untenable, given the salient food and specific request from the experimenter to consume some of it.

It should be acknowledged, as well, that even if participants had experienced a "boomerang" of food-related thoughts resulting from a failure to suppress those thoughts, it is not at all clear that such a rebound would have produced disinhibited eating. To date, no study has demonstrated a definitive link between ironic rebound and disinhibited eating, and some researchers have questioned whether results from other domains can be meaningfully extrapolated to questions of eating behavior (Herman & Polivy, 1993).

Our own recent data address this issue directly (Mann & Ward, in press). In one study, participants were either forbidden from eating a particular food for 5 days or not forbidden from eating it. After 5 days, all participants were permitted to eat the food. No "rebound" eating was observed, and, in fact, participants ate less of the forbidden food once they were allowed to eat it than they had during a premanipulation baseline period. This same pattern of results was found in a within-subjects version of the study in which participants were forbidden from eating one of three provided foods. Relative to a premanipulation baseline, participants did not exhibit increased consumption of the forbidden food once they were allowed to eat it, nor did they eat more of it (once eating was permitted) than the two foods that had not been forbidden.

General Discussion

The current studies show that simple cognitive load—involving neither a motivated escape from self-awareness nor a strong emotional state—can disinhibit the eating of restrained, but not unrestrained, eaters. In both studies, restrained eaters who performed a cognitive task that consumed their attention ate more than restrained eaters who performed a task that did not consume their attention. This disinhibition effect was hypothesized to result from attentional narrowing brought about by resource-consuming cognitive activity. In a process similar to alcohol myopia, high cognitive load was predicted to limit an individual's attention to whichever force—instigating or inhibitory—was more salient in the immediate situation. For restrained eaters, we hypothesized that high cognitive load would succeed in narrowing participants' attention to strong instigating pressures to eat (e.g., instructions to consume salient, tasty food) while reducing attention to inhibitory proscriptions against consumption. In other words, cognitive load would serve to limit participants' capacity for monitoring of dietary standards, with the effect that restrained eaters would engage in eating without regard for the dietary implications of that behavior.

It should be acknowledged that although restrained eaters (and unrestrained eaters) behaved in a manner consistent with our predictions, no direct test of the hypothesized mechanism was provided in these studies. We believe that the results of Study 2 rule out several plausible alternatives (including stress, impaired behavioral awareness, and ironic rebound), lending support to an account that includes degraded monitoring as a likely mechanism for the disinhibition effect. Nevertheless, without direct evidence for the proposed mechanism, a precise explanation of the chain of events that produced the disinhibited behavior observed in these studies must remain speculative.

One study did attempt to document disrupted monitoring as a mechanism underlying disinhibited eating (Jansen, Merckelbach,

Oosterlaan, Tuiten, & Van Den Hout, 1988). In that study, restrained eaters were asked to provide a running narration of their thoughts during an eating task by speaking into a tape recorder. The tapes were then coded for instances of monitoring or for the recognition that monitoring was failing. The researchers found, however, that when asked to describe their thoughts and feelings during a task that typically produces disinhibited eating (i.e., the administration of a high-calorie preload), restrained eaters did not overeat. In light of the present findings, it is perhaps not surprising that a manipulation that presumably heightened self-awareness and, consequently, monitoring, did not succeed in producing disinhibited eating. It is also possible that the presence of the tape recorder inhibited the eating behavior of restrained eaters in the Jansen et al. (1988) study. Restrained eaters are unlikely to engage in disinhibited eating in the presence of noneating others, even when those others cannot be seen (Polivy, Herman, Younger, & Erskine, 1979). At any rate, it is evident from the Jansen et al. study that it is difficult to investigate failures of monitoring without causing participants to engage in monitoring and/or without causing normally disinhibited participants to inhibit their eating.

Behavioral Awareness Versus Monitoring

A lingering question concerns the effects of behavioral awareness on eating by restrained eaters in the present studies. If restrained eaters were able to keep track of how much they had eaten, even when under high cognitive load, why did this intact awareness not serve to prevent disinhibited eating? After all, noticing what one eats has been posited to be an effective strategy for controlling dietary consumption (Herman & Polivy, 1993). A study conducted by Polivy et al. (1986) has addressed this question and sheds light on the relationship between awareness and monitoring.

In the study, restrained eaters who had consumed a high-calorie preload were instructed to eat individually wrapped candies for a taste test under one of two levels of external monitoring. Half of the participants were told to leave the candy wrappers on the table in front of them until the end of the eating session, whereas the other half were given a partly full garbage can to put their wrappers in as they ate. Participants who had the candy wrappers in front of them did not show disinhibited eating, whereas participants with the available garbage can did. However, 98% of participants in the study correctly estimated how many pieces of candy they had eaten, suggesting that the visible candy wrappers had not served primarily as a counting aid for how much candy had been consumed. Instead, Polivy et al. (1986) argued that the candy wrappers that remained visible "must have functioned prescriptively to induce adherence to regulatory norms Paying attention to how much one is eating may reintroduce diet consciousness and weight concerns" (p. 1259). In a sense, the authors are arguing that the visible candy wrappers, although ostensibly an "inventory" cue, actually functioned as a monitoring aid, reminding participants not only of how much they had consumed but of their dieting standard as well.

Thus, it is reasonable to assume that in many instances, behavioral awareness effectively curbs overeating to the extent that it helps engage monitoring strategies. Indeed, the results of both our studies and those of Polivy et al. (1986) suggest that behavioral awareness will function as an effective diet aid only when it is

linked with monitoring. The simple act of tallying portions consumed without realizing the implications of that consumption is unlikely to produce dietary restraint (see Kirschenbaum & Tomarken, 1982).

Alcohol and Eating

The conceptual analysis reported here drew principally on a theory (Steele & Josephs, 1990) that has offered an intriguing account of the effects of alcohol on certain attitudes and behaviors, including helping behavior (Steele, Critchlow, & Liu, 1985), responses to stress (Steele & Josephs, 1988; Steele, Southwick, & Pagano, 1986), attitudes about drunk driving (MacDonald, Zanna, & Fong, 1995), intentions toward condom use (MacDonald, Zanna, & Fong, 1996), and others (for a review, see Steele & Southwick, 1985). In light of the present research, it is instructive to consider the effects of alcohol on disinhibited eating. At first glance, it seems logical to assume that alcohol should produce much the same effect as cognitive load. That is, in the presence of highly salient, appetizing food, the myopia produced by alcohol should cause a dieting individual to pay increased attention to instigating pressures to eat, to the neglect of inhibitory pressures such as diet rules. Indeed, there is some evidence that alcohol disinhibits the eating restraints of dieters (Baumeister et al., 1994). However, some have argued that the effects of alcohol on restrained eaters' behavior are more complex (Ruderman, 1986).

The two studies that have investigated these effects (Polivy & Herman, 1976a, 1976b) have indeed reported results that are somewhat difficult to interpret. In one study, restrained eaters actually consumed less ice cream 15 min after drinking three ounces of vodka than after having drunk a placebo. However, participants were not told they had received alcohol (which was masked by 12 ounces of tonic water), leading the authors to conclude that alcohol may disinhibit the eating of restrained eaters only when they know they have consumed it, a prediction that was confirmed in a second study. Polivy and Herman (1976a) have argued that their results support a cognitive-pharmacological interaction model of alcohol's effects: Without a label, alcohol elevates mood (decreasing consumption for restrained eaters), but with a label, alcohol leads to intoxication, which provides a disinhibitory "excuse" for restrained eaters. The results, though, are further complicated by the fact that alcohol may have either acted as a high-calorie preload (particularly in the condition in which restrained eaters knew they were receiving it) or directly affected gastric secretions, which could potentially affect hunger perception (Ritchie, 1965). Moreover, some researchers (Steele & Josephs, 1990) have argued that the Polivy and Herman studies used very low doses of alcohol and allowed insufficient time for absorption, accounting for the "weak alcohol effects in these studies" (p. 925). In any event, it seems likely that the effects of alcohol on eating may very well be complicated by alcohol's effects on mood and appetite, regardless of restraint status, and are deserving of further research.

Additional Applications

Further research should also be devoted to exploring the potentially far-reaching implications of the theoretical framework offered here. For example, it is intriguing to consider other domains

in which cognitive load might produce disinhibited behavior through its narrowing of attention to salient instigating forces. Toward that end, we are currently investigating whether individuals asked to perform a cognitive activity are more likely to smoke, cheat, lie, or engage in other behaviors that ordinarily would be inhibited. It is also tempting to consider other manipulations that might succeed in narrowing attention to salient situational pressures. For example, arousing stimuli, such as strong emotions (Easterbrook, 1959) or the presence of others (Zajonc, 1965), could serve to narrow attention, as could fatigue, and thus produce disinhibited behavior under the right conditions (see Diener, 1979). Thus, the speaker who makes an off-color remark or the coworker who lashes out at the boss could be responding to instigating forces that, perhaps because of situational factors, manifested themselves (at least to the perpetrator) as stronger or more prominent than accompanying inhibitory pressures.

Finally, it is interesting to ponder when cognitive load, or other attention-narrowing manipulations, might produce behavior that appears to be more inhibited than normal. Future studies might vary situational pressures in such a way that inhibitory forces are stronger than instigating forces, producing a state of affairs in which individuals with narrowed attentional focus behave in an excessively inhibited manner. Indeed, it is perhaps the case that socially inhibited individuals (i.e., introverts) are those among us who are especially attuned to salient inhibitory pressures, possibly because of abnormally high basal arousal levels (Eysenck, 1991).

Conclusion

The studies reported here represent the first conclusive evidence for the "highly popular but never empirically tested clinical impression that distraction from diet (e.g., by cognitive loading) leads dieters to overeat" (Boon et al., 1997, p. 325). As such, they further illustrate the perils associated with restrained eating. When cognitively engrossed, such as while watching TV, working on a computer, reading, being engaged in a heated debate, or simply socializing, dieting individuals risk overindulging whenever salient, appetizing food is present. Under those circumstances, a dieter is unlikely to mind eating, as his or her mind is likely to be elsewhere.

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