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A Review of the Effects of Perceived Drug Use Opportunity on Self-Reported Urge

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Abstract

Although persons addicted to drugs reliably report experiencing cravings or urges during drug cue exposure, less is known about factors that may moderate this effect. This article reviews cue exposure studies with people who smoke, are dependent on alcohol, or are addicted to cocaine or opiates. Perceived drug use opportunity is found to affect urge ratings. Specifically, people who are addicted to substances and who perceive an opportunity to consume their drug of choice report higher urges than do those who do not anticipate being able to use the drug. This factor was proposed to explain why those in treatment for substance dependence report urges that are about half the strength of those in nontreatment settings. The impact of perceived drug use opportunity on urge is considered from a variety of perspectives, including conditioning theories, a cognitive appraisal framework, and motivated reasoning theory. Conceptual and methodological implications of perceived drug use opportunity are addressed.

Drug craving remains a significant concern among persons addicted to drugs as well as counselors and researchers. In recent years literature on substance abuse and dependence has included a burgeoning interest in craving from a host of biological and psychological perspectives (e.g., see special issue of *Addiction*, 2000, devoted to craving). There has also been a focus on methodological issues, such as the manipulation and assessment of craving (Sayette et al., 2000; Tiffany, 1992).

Approaches to manipulating craving include drug deprivation, drug use imagery, and the administration of stressors (Rohsenow, Childress, Monti, Niaura, & Abrams, 1990-1991; Sayette et al., 2000). In one especially popular approach, drug cue exposure, those with drug addictions are presented with their particular drug cues (Carter & Tiffany, 1999; Niaura et al., 1988). Sometimes participants view the drug; at other times they may hold and smell it. In rare cases, a small “priming” amount of the drug actually is administered. These studies, using a variety of substances and populations of drug users, reveal significant effects on measures of cue reactivity (Carter & Tiffany, 1999).

A wide range of measures have been developed to assess craving (Sayette et al., 2000). Self-reports of craving or urge have been especially sensitive to the effects of drug cue exposure (Carter & Tiffany, 1999). However, there is no perfect, “gold standard” measure of urge (Sayette et al., 2000). Even self-reports under conditions in which strong urges would be expected (e.g., when drug-deprived persons with addiction are exposed to drug cues) often do not reveal high levels of craving. Urge reports recorded in the natural environment also are lower than one might expect. A recent study conducted with palm-top computers to permit near real-time assessment found relatively low (i.e., compared to pre-quit levels) cigarette urge

reports on the hours and days immediately following quitting (Shiffman et al., 1997). Other research has found an association between scores on a measure of response bias and self-reported urge (e.g., Sayette & Parrott, 1999). Nevertheless, self-report arguably provides the richest information and remains the most popular measure of urge responding.

One factor that may affect urge ratings but that has received relatively little attention among investigators is drug use opportunity. On the one hand, craving is often described as a state associated with frustration (Tiffany, 1990). Accordingly, one might expect craving to be more intense during “frustrating” manipulations in which drug use is prevented, compared with experimental situations in which drug use is possible (Niaura et al., 1988). On the other hand, drug use opportunity may enhance the experience of craving, compared with situations in which drugs are off-limits. It has been observed, for instance, that Orthodox Jewish smokers, who are forbidden from smoking on the Sabbath, report little difficulty abstaining (Schachter, Silverstein, & Perlick, 1977).

The definition of *drug use opportunity* is itself complex. In the simplest analysis, the term refers to whether or not a drug is available for use. There may be circumstances, however, in which physical availability of a drug may not signal imminent use. A drug could be available without a perceived opportunity to use it, as in the Sabbath smoking prohibition example. Tiffany (1990) identified two types of situations in which craving might occur. In *abstinence-seeking* situations, individuals do not intend to use the substance because they are trying to quit. Though the drug technically may be available for them to use, they are motivated to avoid its use. In *abstinence-avoidance* situations, an addict’s typical drug use routine is interrupted (e.g., no more beer in the refrigerator) and the aim is to regain access to, and then use, the drug. Some researchers have expanded the domain of drug use opportunity to include perceived opportunity to experience drug effects. Meyer, Mirin, Altman, and McNamee (1976), for example, allowed addicts to use heroin. In some cases, however, these participants also were administered a drug antagonist, which effectively blocked the heroin effects. Thus, the perceived opportunity to experience drug effects was absent. In the present review, we use the term *perceived drug use opportunity* to reflect drug availability, intention to use the drug, and the expectation of experiencing the drug’s effects, assuming at least a minimal desire for drug use. Our definition does not encompass situations in which the potential user has absolutely no desire to use the drug and consequently does not perceive a drug use opportunity.

This article examines cue exposure studies that address the importance of perceived drug use opportunity on self-reported urge. Several types of studies are considered. Because most craving research has not explicitly addressed perceived drug use opportunity, this factor typically is not manipulated within a study. Nevertheless, some investigations have led participants to either perceive or not perceive an opportunity to use a drug. For instance, continuing smokers participating in a cue exposure study for course credit who explicitly indicate that they are not interested in quitting understand that they are free to smoke at the end of the study, which is sometimes as soon as 30 min after cue exposure (e.g., Sayette & Parrott, 1999). In contrast, those with drug addiction who enter an inpatient drug program following initial detoxification presumably do not anticipate being able to use the drug during their hospitalization. Accordingly, we first examine samples of drug users who intended to continue using the drug after the experiment. In this case, perceived drug use opportunity is considered high. Second, we review studies that included patients being treated for drug problems. In this case, perceived drug use opportunity is considered low. Patients were seeking drug treatment and presumably were motivated to achieve abstinence, and most of the participants in these studies were hospitalized and could not physically gain access to the drugs.

The third and fourth groups of studies contrasted an inpatient group with alcoholism to a nonaddicted, social-drinking control group. To address the effects of perceived drug use

opportunity, we examine studies that involved consumption of alcohol as part of the experimental procedure (Group 3) separately from studies that prohibited consumption (Group 4). The fifth group of studies manipulated opportunity to use the drug or experience the drug's effects within a single study and provided the most direct test of the importance of perceived drug use opportunity. Finally, we discuss the findings and consider potential mechanisms underlying the effects on craving of perceived drug use opportunity.

Selection of Studies

Both formal and informal approaches were used to search the literature. First, we examined the studies included in Carter and Tiffany's (1999) review of drug cue reactivity.¹ Additional articles were identified with computer database searches (PsycLIT and Medline) as well as through inspection of reference lists from published journal articles and books. The general criteria for inclusion in the review sample were that (a) the study included a sample with addiction of some type (i.e., alcoholism, smoking, heroin or cocaine addiction); (b) self-reported urge was assessed during a drug cue exposure manipulation; and (c) group means were reported by averaging absolute scores on a self-report urge or craving scale, either in text or figure form. Studies were excluded from the review if participants were taking a medication to reduce cravings (e.g., Hutchison, Monti, et al., 1999; where a medication group was compared to a placebo group, only data from the placebo group were included in the present review, e.g., Kranzler & Bauer, 1992.) Studies also were excluded if they did not describe the numerical endpoints of the urge scale, reported only inferential statistical results without group means, or reported only change scores for self-report urge without the absolute group mean scores. Finally, certain studies (e.g., Monti et al., 1993a; Sayette & Hufford, 1995) were excluded from the review if the self-report urge data were also published in another article already included in the review.

Self-report urge measures often use different terms, such as *urge*, *craving*, *want*, or *desire* (cf. Kozlowski & Wilkinson, 1987; Sayette et al., 2000). For the purposes of this article, *self-reported urge* or *urge ratings* are used to refer to whichever of these items or sets of items were used in each study. In order to compare across studies, urge scores were converted to a percentage of the maximum value of the particular scale (Turkkan, McCaul, & Stitzer, 1989).

Self-Reported Urge Among Continuing Drug Users

Table 1 includes self-reported urge scores during cue exposure for studies involving drug users not seeking treatment at the time of the study. This group of studies includes samples of cigarette smokers, as well as those with active alcoholism and heroin use who were not in treatment. Though the drug was not consumed during the cue exposure manipulation, nothing prevented participants from using their drug immediately following the experiment, which was often less than an hour after cue exposure. As can be seen in Table 1, participants reported robust urges, averaging more than two thirds (69.2%) of the scale maximum. Each study reported mean urge ratings on the top half of its scale.

¹There were several differences in selection criteria between the present article and that of Carter and Tiffany (1999). Their focus was specifically on drug cue-elicited reactivity rather than craving per se. Consequently, they required studies to include both neutral and drug cue exposures to partial out any reactivity due to general cue exposure. In addition, they did not include studies that compared addicted with nonaddicted groups. In the present review, the focus was on self-reported urge rather than cue-elicited reactivity. We relied on absolute urge scores during or immediately following cue exposure. The selection of an absolute urge score rather than a score that is adjusted for pre-cue levels is complex (see Sayette et al., 2000). Sometimes an initial urge rating is not a true baseline because certain manipulations (e.g., drug abstinence, perceived drug use opportunity) have already been introduced. For example, we found recently that merely providing deprived heavy smokers with a consent form indicating that they either would or would not be able to smoke during the experiment led to significantly different initial, pre-cue exposure urge ratings, with higher ratings for those perceiving an opportunity to smoke during the study (Sayette, 1999).

Reported Urge Among Hospitalized Drug Users Attempting Abstinence

Table 2 presents studies involving drug users in abstinence treatment programs. For these participants, perceived drug use opportunity is considered absent due both to the patients' putative motivation to maintain abstinence and to their difficulty acquiring drugs in the hospital setting. Patient samples include those with alcoholism as well as those with opiate and cocaine addiction. As depicted in Table 2, participants' reported urges during drug cue exposure were relatively modest, averaging 37.2% of the scale. Although these samples comprised recently detoxified people with addiction, 12 of the 16 studies reported mean urge scores less than half of the scale maximum, and none reported means in the upper third of the urge scale during drug cue exposure.

Findings from Tables 1 and 2 are consistent with the hypothesis that self-reported urges are higher for people with addiction who have access to the drug following the experiment than for those who do not. Although perceived drug use opportunity appears to influence self-reported urge scores, there are several alternative explanations for the differences found in Tables 1 and 2. First, urge ratings across these two tables may be partly a function of type of addiction. Smoking urge ratings tended to be higher than other types of drug urge ratings. Because smokers participated only in studies listed in Table 1, perceived drug use opportunity is confounded by drug type. Likewise, consistent with Carter and Tiffany's (1999) conclusions, Table 2 indicates that alcoholic samples reported urges about half as strong as those of the other addict samples. With one exception, alcohol studies were only represented in Table 2. Second, the addicts in treatment settings represented in Table 2 may already have been benefiting from addiction treatment. That is, treatment, rather than perceived drug use opportunity, may have led to lower reported urge scores for those participants. In most cases, though, drug cue exposure data were recorded very early in treatment, often during an initial assessment phase before active treatment commenced (Rohsenow et al., 1994; Rubonis et al., 1994). Third, participants who are enrolled in abstinence treatment programs may be reluctant to report strong urges to use the drug. Participants may fear, for example, that a high urge score might cause clinicians, family members, or employers to worry that the participants will fail to maintain abstinence. The next two sets of studies examine these alternative explanations.

Reported Urge: Those With Addiction Versus Controls

Several studies have compared urge reports of addicted and nonaddicted control participants in response to the same drug cues. Tables 3 and 4 compare those with addiction who perceived that they were free to use the substance during the study with those who did not have access to the drug during or following cue exposure. All but one study in Tables 3 and 4 included as the sample people with addiction who were then in treatment.

Table 3 lists studies in which both those with alcoholism and social drinkers believed that they could drink alcohol following cue exposure. In each study, the alcoholic group reported higher urges to drink than did the nonalcoholic control group. This finding is consistent with most urge theories, which posit that drug use history affects urge strength (e.g., Ludwig, Wikler, & Stark, 1974; Robinson & Berridge, 1993; Siegel, 1983; Solomon & Corbit, 1973; Stewart, de Wit, & Eikelboom, 1984). From a conditioning perspective, for example, heavy drinkers pair alcohol cues with consumption more often than do lighter drinkers and thus are more susceptible to conditioned withdrawal (craving) during a cue exposure manipulation (Ludwig, Wikler, & Stark, 1974). Similar to the data reported in Table 1, the average urge ratings for those with alcoholism expecting to drink was two thirds (67.0%) of the scale maximum. Table 3 shows that when those with alcoholism perceived an opportunity to drink, their urge reports were higher than those of social drinkers, even if the people with alcoholism were receiving treatment.

In contrast to the findings from Table 3, Table 4 shows that when there was not a perceived opportunity to drink (i.e., alcohol could not be consumed following cue exposure), inpatients with alcoholism did not consistently report higher urges to drink than nonalcoholics. In these studies, only the nonpatient control drinkers had a perceived opportunity to use alcohol following the experiment. Only one of the six studies in Table 4 reported significantly higher urge scores for participants with alcoholism than for controls, whereas one study (Cooney, Gillespie, Baker, & Kaplan, 1987) actually found the opposite pattern, with controls reporting higher urges than participants with alcoholism. These findings run counter to prevailing theories (e.g., Ludwig et al., 1974; Robinson & Berridge, 1993; Siegel, 1983; Solomon & Corbit, 1973; Stewart et al., 1984), which posit that people with alcoholism should experience greater cravings than nonaddicted drinkers. Unlike the studies listed in Table 3, the mean reported urge score for those with addiction in Table 4 fell on the lower half (48.5%) of the urge ratings. These findings with people with alcoholism suggest that differences in Tables 1 and 2 are not due exclusively to smokers' reporting high urges or participants with alcoholism reporting low urges. Table 3 clearly shows that being in treatment does not preclude strong urge ratings. Indeed, the mean urge ratings for the alcoholic samples in Table 3 were similar to those for the nonpatient samples listed in Table 1.

Taken together with the findings from the first two tables, Tables 3 and 4 suggest that perceived opportunity to use a drug affects urge ratings. Nevertheless, the studies examined were not designed specifically to test the impact of perceived opportunity to use on reported urge. Moreover, not all data from Tables 1-4 conformed to our predictions. For example, although both alcoholic groups in Tables 2 and 4 were unable to drink, their urge ratings differed. Especially relevant to the present analysis were studies that experimentally manipulated perceived drug use opportunity within a single experiment.

Reported Urge in Studies That Manipulated Perceived Drug Use Opportunity

Table 5 lists experiments that manipulated perceived opportunity to use. These studies were especially relevant to the importance of perceived drug use opportunity because they held constant factors such as treatment status, type of drug, and motivation to quit. In three of the studies, perceived drug use opportunity was a between-subjects variable. In the perceived drug use opportunity conditions, participants in these studies expected to use or experience the drug's effects during the experiment, whereas in the no-opportunity conditions they were unable to use or experience the drug for at least several hours. The remaining two studies (Carter & Tiffany, 2000; Dols, Willems, van den Hout, & Bittoun, 2000) employed a within-subject design in which perceived drug use opportunity was manipulated across multiple cue exposure trials. All five studies found significantly higher drug urges when there was a perceived opportunity to use the drug than when there was not. In conjunction with the studies listed in Tables 1-4, these experiments support the proposition that perceived drug use opportunity affects self-reported urge.²

Urge Versus Urge Report

The data reviewed thus far suggest that perceived drug use opportunity affects self-reported urge. Although it is customary to assume that craving can be indexed through self-report measures, such ratings do not provide a direct readout of a person's craving state. That is, a self-report instrument is unlikely to provide a one-to-one mapping of verbal report to

²An investigation by Droungas, Ehrman, Childress, and O'Brien (1995) was one of the first explicit tests of drug availability and cue reactivity with smokers. This study was not included in Table 5 because absolute urge ratings were not reported. Nevertheless, perceived opportunity to smoke during the experimental session affected change in urge ratings, with participants who perceived a smoking opportunity reporting greater increases in urge during cue exposure than did those who did not expect to smoke.

hypothetical internal state (Sayette et al., 2000). Craving instead may be viewed as a construct best understood through multidimensional assessment (Baker, Morse, & Sherman, 1987; Rankin, Hodgson, & Stockwell, 1979). Examination of nonverbal indices in cue exposure studies provides a means for assessing the scope of the impact of perceived drug use opportunity. Specifically, it is important to determine whether response modalities other than self-report suggest that cue reactivity is strengthened when addicts perceive an opportunity to use the drug following cue exposure.³

Both nonverbal and self-report measures detect significant increases in reactivity during drug cue exposures (see Carter & Tiffany, 1999). Although the studies listed in Tables 2 and 4 revealed lower than expected urge ratings, nearly all (91%) of them still showed significant increases from baseline. In Tables 1-4, the importance of perceived drug use opportunity emerges in the percent maximum of scale. Scores of nonverbal measures of cue reactivity, unlike those of self-report, are not readily transformed to a percentage of a scale maximum. For instance, the knowledge itself that a particular cue exposure manipulation led to a significant increase in heart rate for one group is hard to interpret. Nonverbal measures can be evaluated, however, if a study is explicitly designed to manipulate perceived drug use opportunity.

Only three studies manipulating perceived drug use opportunity included nonverbal measures. Two employed psychophysiological measures and one relied on a cognitive performance measure. The former provided evidence that perceived drug use opportunity led to generally greater psychophysiological reactivity than when drug use opportunity was not perceived (Carter & Tiffany, 2000; Laberg, 1986). In contrast, the study using a cognitive performance measure (secondary response time latency to an auditory probe) found response time to be greater when participants did not have a perceived drug use opportunity than when they did (Juliano & Brandon, 1998). This latter study is also of interest in that self-reported urge was greater among the smokers who perceived an opportunity to smoke than those who did not. More research is needed to determine with confidence which measures, along with self-report, are sensitive to perceived drug use opportunity.

Urge Versus Cue-Specific Urge

Researchers often examine cue reactivity by partialing out responses during a control cue before examining drug cue reactivity (Carter & Tiffany, 1999). Whether to adjust for urge ratings during control cue exposure before interpreting urge ratings during drug cue reactivity is a complex issue, and in some cases adjusting may not be the most appropriate way to assess the effects of craving manipulations (Sayette et al., 2000). Whether or not the effect of perceived drug use opportunity is specific to drug cues may depend on the experimental design. If the drug use opportunity manipulation is provided prior to control cue exposure, then urge ratings may differ even during control cue exposure. For instance, among studies in Tables 1 and 2, in which perceived drug use opportunity was understood from the outset, urge rating differences emerged during control exposure (mean urge ratings were 46% and 15% of scale maximum, respectively, for those who did and those who did not perceive the opportunity to use). Similar conclusions can be drawn from the studies in Tables 3 and 4 that included control cues. Specifically, when drinking was permitted, participants with alcoholism reported greater urges than did social drinkers during control exposure (McCaul, Turkkan, & Stitzer, 1989). In addition, among the six studies in Table 4, in which drug use was prevented, reported urge

³Alternatively, nonverbal measures may provide little information relevant to this study's hypothesis. Some have argued that nonverbal measures of cue reactivity are only weakly related to drug motivation and may not reflect the same processes controlling craving (see Tiffany, 1990).

during control exposure was similar for those with alcoholism ($M = 26\%$) and social drinkers ($M = 23\%$).

In contrast, the two studies in Table 5 that included control cues suggest perceived drug use opportunity effects are enhanced during drug cue exposure. In one, control cue urge ratings, recorded as change from baseline, increased by .40 in the expect-to-smoke condition and by .18 in the expect-not-to-smoke condition (Juliano & Brandon, 1998). This study also found, however, that the effect of perceived drug use opportunity was greater during drug cue exposure. Likewise, Carter and Tiffany (2000) reported that the effect of drug availability was specific to drug cue. Future research is needed to clarify the conditions under which the effect of perceived drug use opportunity on urge ratings is specific to drug cue exposure manipulations.

Potential Mechanisms Underlying Effects of Perceived Drug Use Opportunity

Conditioning

Several explanations derived from conditioning theory may account for the effect of perceived drug use opportunity on craving. First, information indicating an opportunity to use a drug may become part of a compound stimulus associated with drug response (McCaul, Turkkan, & Stitzer, 1989; Powell, 1995). Stimuli associated with drug use, such as a pack of cigarettes or a preferred drink, are paired with unconditioned drug effects only when drug consumption actually occurs. The perceived opportunity to use the drug therefore may be a necessary component of the stimulus complex for drug cues to produce conditioned responses. Drug cues may have little or no effect on conditioned responding when a user realizes that there is no opportunity to consume the drug; a significant part of the cue is absent. Even Pavlov recognized that animals needed to anticipate actual feeding for food cues to elicit conditioned responses (see Zinser, Fiore, Davidson, & Baker, 1999). From an operant perspective, perceived drug use opportunity may serve as a discriminative stimulus, or occasion setter (Ross & Holland, 1982) signaling that the drug cues are associated with the drug response (Juliano & Brandon, 1998).

Second, information regarding the absence of perceived drug use opportunity may inhibit conditioned responding to drug cues (Juliano & Brandon, 1998; Zinser et al., 1999). When opportunity for drug use exists, conditioned responses such as urge ratings and psychophysiological reactivity typically follow cue presentation. Knowledge that drug use will not ensue, however, may act as an inhibitory stimulus, resulting in decreased responding to the drug cues (Rescorla, 1985).

Third, the perception of being able to use a drug may itself serve as a conditioned stimulus. Cognitions such as anticipating drinking a beer can serve as internal stimuli that elicit physiological and behavioral responses (Juliano & Brandon, 1998). Bradizza, Stasiewicz, and Maisto (1994) proposed that environmental cues come to elicit cognitions (conditioned responses) about drug use that contain information regarding drug use opportunity. These cognitions eventually become conditioned stimuli, which by themselves serve to increase motivation for drug use, as indexed by affective, behavioral, and physiological responding. Thus, thoughts regarding opportunity to use a drug (e.g., "If I walk home the other way, I can grab a beer at the pub") may result in conditioned responses. This account differs from the compound cue explanation because thoughts can trigger conditioned responses even in the absence of physical drug cues. Consistent with this perspective, recent data indicate that prior to drug cue exposure, smokers told they could smoke during the study reported significantly higher urges than did those told they could not smoke (Sayette, 1999).

Although these conditioning explanations are distinct conceptually, because they lead to similar predictions, they are difficult to tease apart empirically. Specifically, these theories point to two hypotheses that are not mutually exclusive: (a) Perceived drug use opportunity will strengthen urge ratings and (b) lack of perceived drug use opportunity will inhibit or weaken urge ratings. Carter and Tiffany (2000) contrasted smoking cue exposure urge ratings during 0%, 50%, and 100% smoking probability conditions. Compared with the 50% condition, smokers reported greater urges when the probability was 100% and weaker urges when it was 0%. It is hard to know if the 50% condition represents a neutral perception of drug use opportunity. Nevertheless, if this probability condition approximates a neutral condition, these data suggest that perceived drug use opportunity could be linked to both an augmentation and attenuation of urges. We also have collected data in which smokers were told they would, would not, or might (pending a coin toss) be able to smoke (Wertz & Sayette, in press). Consistent with Carter and Tiffany (2000), among those who smoked at least 10 cigarettes per day ($n = 82$), urge ratings differed significantly between those who could and those who could not smoke, with the “maybe” group falling in between.

Two-Affect Model of Urges

Baker, Morse, and Sherman (1987) proposed a model in which drug availability should affect urge, though not uniformly. Baker et al.'s two-affect model proposes that information signaling drug use opportunity is coded into a positive affect urge network, whereas information concerning the lack of opportunity, including deprivation, is thought to be coded on the negative affect urge network. Accordingly, expecting to use a drug should be especially likely to enhance urge when individuals are in a positive affective state but should inhibit urge when in a negative affective state. Baker et al. also posit that under some circumstances, lack of perceived drug use opportunity can increase craving (see also Carter & Tiffany, 2000; Toneatto, 1999). The data reviewed here suggest, however, that even deprived drug users report higher urges when perceiving an opportunity for drug use. Because the studies reviewed here were not designed to test this model, however, perceived drug use opportunity often was imprecisely manipulated. Thus, these studies do not provide an optimal test of the model.

Stress, Appraisal, and Coping

Lazarus and Folkman's (1984) model of stress appraisal may provide a framework for considering perceived drug use opportunity and craving. Rather than viewing stress as an external stimulus or as a physiological response, these authors proposed a transactional approach to the conceptualization of stress in which the cognitive appraisal of a stressor determines the response. This approach accommodates the observation that people often respond differently to the same stressors. Like the appraisal of stress, the appraisal of craving includes an appreciation for how one would cope with drug cues, which can sometimes lead to a distortion of reality, or self-deception (Lazarus & Folkman, 1984). When one is craving, perceived drug use opportunity may contribute to the particular coping mechanisms one considers. For instance, one could choose to cope with (or resist) a smoking urge by eating a carrot when one does not perceive drug use opportunity or by eliminating the urge through drug consumption when one perceives drug use opportunity. In the first example, the goal of the coping strategy may be to attenuate the perceived negative effects of craving. In the second example, the motivation may be to distort (i.e., inflate) the perception of the urge to justify drug use, such that the urge appears irresistible and the ensuing drug use is blameless (Baumeister, Heatherton, & Tice, 1994). Although Lazarus and Folkman's (1984) model provides a framework for understanding how perceived drug use opportunity could affect the strength and affective valence of urges, its application to craving remains speculative.

Motivated Reasoning

Kunda (1990) proposed that a delicate balance exists between desire to engage in gratifying behaviors and desire to view oneself as rational. When motivated to engage in a particular behavior, one must provide a reasonable justification for the action. The goal is to be able to engage in a particular behavior while holding onto the notion that the decision was reasonable, not foolish. Kunda (1990) has found that such motivated reasoning can influence the way people both generate and evaluate relevant information. Coffee drinkers, for example, are more critical of the facts and less convinced than nondrinkers by an article showing coffee to be a health risk, whereas they are more persuaded than nondrinkers when the article suggests coffee is salutary (Kunda, 1987).

Kunda's (1990) theory may explain how perceived drug use opportunity could affect craving. If abstinence-seeking addicts are motivated to reduce their urge (because they perceive they will be unable to satisfy it), they ought to selectively generate and evaluate information to permit a rational appraisal of the issue in a manner more suitable to their motives. Consequently, they may report their urge as being lower than it is when they anticipate being able to satisfy their urge. It would be expected that the continuing user who is craving and whose motivation to use is not tempered by motivation to remain abstinent would process relevant drug information in a manner that facilitates use. For instance, current smokers generated more positive attributes of smoking while craving than they did when they were not craving (Sayette & Hufford, 1997). Whether this effect would be reduced among smokers attempting to quit awaits empirical scrutiny. Kunda's work, as well as that of Lazarus and Folkman (1984), suggests new directions for considering the relationship between cognitive processing and urge.

Conclusions

There is little doubt that drug cue exposure leads addicts to report strong increases in craving (Carter & Tiffany, 1999). It also appears that perceived drug use opportunity contributes to the degree of craving reported. Specifically, perceived opportunity to use enhances urge reports, though circumstances may exist in which the reverse could be true (Baker et al., 1987; Carter & Tiffany, 2000). Perceived drug use opportunity often has been neglected in cue exposure experiments. Appreciation for the importance of this factor may prove useful across a number of research domains. For example, with increasing interest in the neurobiology of craving (e.g., Breiter & Rosen, 1999), imaging studies may reveal different patterns of neural activity depending on perceived drug use opportunity of the participants.

Investigators interested in personality variables should consider craving a rich concept for investigation (e.g., Bradizza et al., 1999). Our use of the concept of perceived drug use opportunity, rather than drug availability, raises questions about which individual difference factors might influence drug cue appraisal during exposure studies. Lazarus and Folkman (1984) propose that differences in people's commitments (what is important to them) and beliefs (e.g., about personal control) influence stress appraisals, and these person-level factors also may affect appraisals of craving. Measurement of craving may even include an implicit assessment of coping appraisal; that is, appraisal of craving may reflect an appraisal of what one plans to do about it. The experience of urge may be stronger if one anticipates consuming the substance than if one does not.

Perceiving an opportunity to use a drug may also dictate qualitatively different craving experiences (Baker et al., 1987). Comparing urge ratings of addicts before and after quitting, for example, may require greater sensitivity to the meaning of craving at each period, which may help interpret the apparently counterintuitive finding that cravings prior to quitting tend to be higher than those experienced after quitting (Shiffman et al., 1997). More generally, this

review makes clear that clinical researchers should not be surprised by their patients' relatively low urge reports.

Increased attention to perceived drug use opportunity presents methodological challenges. With a few exceptions, participants in cue-exposure studies do not perceive that they will have an opportunity to consume the drug. Even when availability exists, the procedure typically is arranged such that drug use does not occur for at least several minutes. Carter and Tiffany (2000) distinguish between local and distal availability, the former referring to opportunity for drug use during a cue exposure session and the latter, to drug access following the experiment. Although the boundaries between local and distal availability are open to interpretation, this distinction is likely to produce meaningful differences in evaluating the experience of craving. Recent efforts (e.g., Carter & Tiffany, 2000; Dols et al., 2000) permit manipulation of local availability by exposing those with addiction to repeated trials of drug or neutral cues; for example, sometimes participants are free to use small amounts of the substance (e.g., one cigarette puff) during cue exposure, whereas at other times drug access is uncertain or prohibited. The development of such protocols, which permit local availability while allowing adequate time for craving assessment, remains an important area for research.

Progressive ratio reinforcement schedules also have been used to gauge drug use motivation under multiple conditions during a single session (Rusted, Mackee, Williams, & Willner, 1998). In this paradigm, participants perform a specified amount of work (e.g., engaging in a repetitive computer task) to earn access to the drug, such as a cigarette puff. With each reinforcement, the amount of work required increases progressively. Thus, access to the drug changes continually (becoming more difficult), which arguably permits further evaluation of the importance of perceived drug use opportunity, if urge is assessed during each trial. A potential concern with cue exposure designs that involve repeated opportunities for drug use (e.g., the progressive ratio experiments and Carter and Tiffany's, 2000, cue availability paradigm) is that initial opportunities to use the drug during the experiment may alter motivation for the drug in subsequent trials (Sanders, 2000). For example, if smokers already have been able to receive six puffs of a cigarette, by the seventh trial they may be less eager to smoke. Such a concern has led some to modify the progressive ratio design so that no drug use occurs until the end of the study (Grobe & Perkins, 1999). This modified progressive ratio design does not permit local availability.

One reason that local availability has rarely been manipulated in cue-exposure studies is that it may be difficult to execute, particularly if the cue reactivity measures take a while to complete. It is unclear how long those with addiction who are informed they will be able to use the drug soon can be exposed to drug cues before they become impatient or frustrated because "soon" is not soon enough. Nevertheless, the importance of examining perceived drug use opportunity from both local and distal perspectives mandates efforts to develop new experimental paradigms. Research to develop ways to extend the duration of local availability, for example, would be useful. Such approaches promise to improve understanding of the role of perceived drug use opportunity in urge responding and, in turn, should promote greater appreciation for the role of drug craving in addiction.

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Table 1
Participants Not Seeking Treatment: Self-Reported Urge During Drug Cue Exposure

Study	Sample	N	% of Urge Scale
Greeley, Swift, Prescott, & Heather (1993) ^a	Alcohol	21	52
Burton & Tiffany (1997)	Cigarettes	60	63
Cepeda-Benito & Tiffany (1996; Study 1)	Cigarettes	36	66
Cepeda-Benito & Tiffany (1996; Study 2)	Cigarettes	40	63
Drobes & Tiffany (1997)	Cigarettes	100	63
Elash, Tiffany, & Vrana (1995) ^a	Cigarettes	36	68
Hutchison, Niaura, & Swift (1999) ^a	Cigarettes	26	78
Legarda, Bradley, & Sartory (1987)	Cigarettes	6	88
Maude-Griffin & Tiffany (1996) ^a	Cigarettes	100	58
Rickard-Figueroa & Zeichner (1985)	Cigarettes	48	74
Sayette & Hufford (1994—Study 1; Deprived Group)	Cigarettes	40	87
Sayette & Hufford (1994—Study 1; Nondeprived Group)	Cigarettes	40	60
Sayette & Hufford (1994—Study 2; Deprived Group)	Cigarettes	31	80
Sayette & Hufford (1994—Study 2; Nondeprived Group)	Cigarettes	31	55
Sayette & Parrott (1999)	Cigarettes	58	83
Tiffany & Drobes (1990) ^a	Cigarettes	60	65
Warren & McDonough (1999)	Cigarettes	20	58
Legarda, Bradley, & Sartory (1987)	Opiate	6	74

Note. *M* = 69.2; *SD* = 11.5.
^aUrge scores were estimated from a figure.

Participants in Treatment: Self-Reported Urge During Drug Cue Exposure

Study	Sample	N	% of Urge Scale
Corty, O'Brien, & Mann (1988)	Alcohol	10	9
Eriksen & Gotesiam (1984)	Alcohol	16	36
Jansma, Bretelet, Schippers, De Jong, & Van der Staak (2000)	Alcohol	40	21
Litt, Cooney, Kadden, & Gaupp (1990) ^a	Alcohol	8	5
Monti et al. (1999) ^a	Alcohol	38	21
Monti et al. (1993b)	Alcohol	40	40
Rohsenow et al. (1994)	Alcohol	45	44
Rubonis et al. (1994)	Alcohol	57	45
Weinstein, Lingford-Hughes, Martinez-Raga, & Marshall (1998)	Alcohol	14	23
Kranzler & Bauer (1992)	Cocaine	20	53
Reid, Mickalian, Delucchi, & Berger (1999) ^a	Cocaine	23	37
Satel, Krystal, Delgado, Kosten, & Charney (1995)	Cocaine	25	53
Dawe et al. (1993) ^a	Opiate	43	44
Powell, Gray, & Bradley (1993)	Opiate	21	45
Powell et al. (1990) ^a	Opiate	17	55
Sherman, Zinser, Sideroff, & Baker (1989)	Opiate	35	66

Note. M = 37.2; SD = 17.2.

^aUrge scores were estimated from a figure.

Self-Reported Urge During Drug Cue Exposure With Perceived Drug Use Opportunity: Patients versus Controls

Table 3

Study	Drug studied	Sample	N	% of Urge Scale	
				Those with addiction	Controls
Dolinsky et al. (1987) ^{a,b}	Alcohol	Inpatients with alcoholism vs. controls	8 9	70	56
Kaplan, Meyer, & Stroebe (1983) ^{a,b}	Alcohol	Inpatients with alcoholism vs. controls	16 16	82	64
McCaul, Turkkan, & Stitzer (1989) ^{a,c}	Alcohol	Nontreatment individuals with alcoholism vs. controls	12 12	49	19

Note. M for those with addiction = 67.0; SD for those with addiction = 16.7. M for controls = 46.3; SD for controls = 24.0.

^aUrge scores estimated from a figure.

^bIndicates a significant difference between those with addiction and controls.

^cSignificance test for difference between those with addiction and controls was not reported.

Self-Reported Urge During Drug Cue Exposure Without Perceived Drug Use Opportunity: Patients versus Controls

Study	Drug studied	Sample	N	% of Urge Scale	
				Those with addiction	Controls
Abrams et al. (1991) ^b	Alcohol	Inpatients with alcoholism vs. controls	31 22	48	32
Cooney, Gillespie, Baker, & Kaplan (1987) ^{a,b}	Alcohol	Inpatients with alcoholism vs. controls	49 26	52	63
Kaplan et al. (1985)	Alcohol	Inpatients with alcoholism vs. controls	59 26	61	77
Monti et al. (1987; Study 2)	Alcohol	Inpatients with alcoholism vs. controls	37 23	56	39
Newlin, Hotchkiss, Cox, Rauscher, & Li (1989) ^d	Alcohol	Inpatients with alcoholism vs. controls	15 15	36	46
Pomerleau, Fertig, Baker, & Cooney (1983) ^d	Alcohol	Inpatients with alcoholism vs. controls	8 10	38	10

Note. M for those with addiction = 48.5; SD for those with addiction = 9.9. M for controls = 44.5; SD for controls = 23.6.

^aUrge scores were estimated from a figure.

^bIndicates a significant difference between those with addiction and controls.

Table 5
Self-Reported Urge During Drug Cue Exposure in Studies Directly Manipulating Perceived Drug Use Opportunity

Study	Drug studied	Sample	N	% of Urge Scale	
				Available	Unavailable
Laberg (1986) ^{a,c}	Alcohol	Inpatients with alcoholism and controls	20 10	24	15
Carter & Tiffany (2000) ^{a,b,c}	Cigarettes	Smokers (<i>M</i> = 28 cigs/day)	60	61	56
Dols, Willems, van den Hout, & Bittoun (2000) ^{a,c}	Cigarettes	Smokers (>10 cigs/day)	40	45	35
Juliano & Brandon (1998) ^{b,c}	Cigarettes	Smokers (<i>M</i> = 27 cigs/day)	132	62	57
Meyer, Mirin, Altman, & McNamee (1976) ^{a,c}	Heroin	Those with heroin addiction	6	90	25

Note. *M* for available = 56.4; *SD* for available = 24.3. *M* for unavailable = 37.6; *SD* for unavailable = 18.6. Cigs = cigarettes.

^aUrge scores were estimated from a figure.
^bSignificance test conducted on change scores, not raw data.
^cIndicates a significant difference between drug available and unavailable groups.