Context and Retrieval Effects on Implicit Cognition for Substance Use

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Abstract: This chapter reviews context effects on substance use and substance-use associations. We interpret these ubiquitous effects as a natural consequence of memory retrieval processes that influence the accessibility of substance-use associations. Further, accessibility of memories about substance-use outcomes and behaviors potentially mediates substance-use behaviors by determining what behavioral options are considered and what outcomes are anticipated. Context effects may have unconscious influences and impact on implicit memories about substance use. The implicit memory effects of context may be uniquely relevant to developing more effective prevention and intervention approaches by encouraging procedures that reduce or replace the retrieval of substance-use memories that influence behavioral decisions.

Context has its roots in the Latin word, contextus, literally meaning to weave together. In psychology, context refers to the tapestry of external or internal events interwoven around a target behavior or cognitive process. Context shapes our experience, is encoded in our memories, and sets the options for our thoughts and actions. In the true sense of its Latin meaning, context is the ubiquitous background integrated with the foreground of our interest. The impact of context is twofold. First, it provides the setting for current thoughts and actions. Second, context wraps our memories in a rich array of detail that is often the means of memory retrieval and the material of meaning. Context is most important when meaning is ambiguous: a word with multiple meanings, a subtle shading of intention, or the choice point in a maze. Context implicitly reduces ambiguity, defines the options, and forces choices. This chapter explores how context influences memories, associations, and expectancies about substance use, with the goal of improving our understanding of the cognitive processes underlying substance-use behavior.

Before reviewing the role of context in substance use, it is useful to distinguish between content and context. In studying memory processes, researchers often focus on a defined content item and measure
performance against that item. For example, an individual may read a word and respond with a “free” associate. This may appear to be an isolated task, tapping into the association between two words in memory, but contextual background is always part of the equation: What kinds of words were seen before the current word, are you happy or sad, who is listening? The content is the focus, but it cannot be divorced from its background setting. Moreover, the content is only the arbitrary locus of attention. One could examine the situation from a different angle with a different lens; content defines the question of interest, whereas context provides the interpretive setting. The content focus of the present chapter is substance use, specifically cognitions (expectancies and associations) that predict current and subsequent substance use (Goldman et al., 1999; Krank et al., 2005; Stacy, 1995, 1997).

When applied to substance use, context includes the myriad of social, cognitive, affective, and environmental events that might be associated with substance use. Specific contextual features are not necessarily intrinsic to substance use. Indeed, the context of substance use may be quite idiosyncratic; some smokers never smoke in their car, whereas others smoke immediately when they are behind the wheel. Some people drink when upset; others do not. The result is that context affects substance-use cognitions in two main ways that combine to influence the gist of substance use itself. First, current context provides the setting, the stimulus conditions, and the tone for current behavior. The choices and resources available are largely determined by the individual’s current setting (Vuchinich & Tucker, 1988, 1996). Second, context may be an integral part of memory processing (Smith & Vela, 2001) and be encoded as part of memory representation of substance-use cognitions. That is, contextual features will often be processed and encoded with information about substance use. Indeed, the principle of encoding specificity purports that such contexts will be important to memory retrieval (Tulving & Thomson, 1973). Thus, context influences the retrieval and accessibility of the substance-use content focus. Context can determine when and what content is retrieved from memory. Most important, context assists in defining content. In this second and critical role, memory retrieval is the means for context effects; interpretation of meaning is the outcome.

Careful observation and research indicate that context influences substance use, dependence, and treatment. This should not be surprising as context is a defining feature of psychological and social functions. Context may influence substance use directly in a number of plausible ways, including the availability of drugs and alternative activities, social support systems, and social influence (Maddux & Desmond, 1982; Tucker et al., 2002). Our focus in this chapter, however, is on the second effect of context, the psychological impact of context on memory processing (Smith & Vela, 2001). In short, the evidence that context-dependent memory retrieval modifies the accessibility of both implicit and explicit substance-use associations will be reviewed and it will be argued that this accessibility provides an explanation for many of the effects of context on substance-use behavior and the effectiveness of treatment.

**CONTEXT AND MEMORY RETRIEVAL**

Many theories of memory are guided by two main principles: encoding specificity (Tulving & Thomson, 1973) and similarity-based retrieval (Hintzman, 1986, 1988; Roediger, 1990). The key notion in encoding specificity is that memory representations comprise specific details about the cognitive elements
encoded at the time of learning. Retrieval of these memories involves the partial reinstatement of the cognitive conditions that were present during encoding. The more similar the retrieval conditions, the more likely an individual memory representation will be retrieved. The types of context shown to influence memory retrieval include environmental (Smith & Vela, 2001), social (Von Hecker, 2004), mood (Bower & Forgas, 2001), drug state (Weingartner et al., 1995), and cognitive processing (Roediger, 1990) conditions. Each of these conditions may be associated with substance use and social learning about substance use. Substance use often occurs in unique physical settings (bars) and social occasions (with friends, at a party), in emotional or mood states (sad, angry, or celebrating), unique drug states, or with a specific cognitive set or expectations. In each case, the context may not only modify the experience of substance use, but also may be encoded in the memory representation.

From a memory perspective, the main impact of context on content is determining when and what is retrieved from memory. If contextual features form part of the substance-use memory representation, then they will influence the retrieval of substance-use cognitions. Models of encoding specificity and similarity-based retrieval are important to understanding addictive behavior because they predict the accessibility of associative memories relevant to substance use. Such accessibility may be critical to when and what we think about substance use. Critically, such memory retrieval provides the mechanism for interpreting meaning and reducing ambiguity. The interpretation arises from the retrieval of specific substance-use memory associations. Our contention is that the accessibility of particular substance-use and competing associations defines the context and influences substance-use choice behavior.

We propose that retrieval factors such as context determine when and which behavioral associations are accessed and that this in turn determines behavioral choice. Specifically, retrieval of positive substance-use associations would increase the likelihood of choosing substance-use behaviors. Conditions that reduce such retrieval or enhance the retrieval of negative associations or positive associations with alternative behaviors would reduce the selection of substance-use behaviors (for a discussion of substance use and behavioral choice, see Krank & Goldstein, Chapter 28). In direct support of cognitive mediation of substance use, Palfai et al. (2000) used reaction time as an indicator of positive alcohol outcome expectancy accessibility and demonstrated that accessibility mediated college students’ consumption levels on a taste-rating task. Although many studies have shown context effects on substance use, only a few studies have shown that context influences substance-use cognitions and these cognitions mediate higher levels of consumption (see Krank et al., 2005, for one recent example).

**Implicit Cognition and Context**

Before reviewing the evidence for context effects on substance use and substance-use cognitions, it is worth considering how context effects relate to implicit memory. We have not restricted our review of data supporting context effects to studies that meet stringent criteria for implicit memory because our goal here is to demonstrate the range of context affects on memory accessibility and substance use. Some of the studies reviewed measured context effects on implicit measures, others measures effects on more explicit measures such as outcome expectancies. The studies of implicit measures are obviously relevant to implicit cognition. Certain context manipulations such as mood induction are also likely to be implicit. These observations indicate that context and retrieval effects are relevant to implicit memory. Given the powerful nature of context
effects and the unique contribution of implicit memory associations to understanding substance use, our hope is that the studies reviewed here will set the stage for research delimiting (1) the range of context effects on implicit memories for substance-use associations, and (2) the extent that these effects represent unconscious influences.

CONTEXT AND SUBSTANCE ABUSE

Evidence showing the effects of environmental context on substance use and relapse to substance use comes from both animal and human experimental studies, as well as natural studies of spontaneous remission of substance use. In animal research, environmental contexts associated with drugs elicit conditioned responses that increase incentive or drug-seeking behaviors, elicit withdrawal symptoms and, most important, increase the likelihood of drug-taking behavior (Berridge & Robinson, 1995; Krank, 1989; Krank & O’Neill, 2002; Krank & Wall, 1990; Siegel, 1999; Stewart et al., 1984; see Crombag & Robinson, 2004 and Krank, 2003 for recent summaries). The conditioning approach has also been applied extensively in human cue-reactivity research revealing a variety of physiological and motivational effects of drug-associated cues, such as the taste, smell, or physical features of alcoholic beverages, or contexts, such as simulated bars (Niaura et al., 1988).

Siegel (1999) reviewed several lines of evidence of environmental context effects on addictive behavior. Perhaps the most dramatic example is the Vietnam experiment. The number of U.S. soldiers stationed in Vietnam that used heroin was so great that concerns were raised about how to deal with addiction on their return home. Although Vietnam veterans suffered many problems on their return, heroin addiction did not materialize at the feared level. Siegel (1999) argues that this is because the change in context reduced the effect of past learning. Maddux and Desmond (1982) followed 248 opiate addicts for 20 years, also demonstrating the role of context in remission from addiction to heroin. Physical relocation supported levels of abstinence three times greater than treatment or correctional interactions. Moreover, 81 percent of abstinent individuals relapsed within one month of return to the location of past drug use. Tucker and her colleagues (Tucker et al., 2002) also argue that environmental context, defined by the mix of positive and negative life events, influences the success of spontaneous abstinence and interacts with intervention success. Finally, Marlatt and Gordon (1985) describe a number of high-risk situations for relapse to substance use following a period of abstinence. Emotional contexts including both negative and positive affective states were among the most frequent relapse triggers. The general importance of situational antecedents has been documented by Turner et al. (1997).

Distinctive contexts may be associated with substance use and abstinence success for several reasons. Some of the effects of context include the attainability of drugs and alcohol, options for alternative activities and reinforcers, and social expectations such as peer influence. From a cognitive processing perspective, context may also selectively retrieve or activate past associations related to substance use. In the present discussion, Pavlovian conditioning can be viewed as a special case of retrieval effects where the condition stimulus (e.g., environmental context) is a retrieval cue for memory of the unconditioned stimulus (see Rescorla, 1988). Conditioning is a special case of memory retrieval as its effects are measured in changes in behavior and physiology. Memory retrieval, however, provides a broader umbrella for context effects that extends to substance-use associations, in general, and implicit...
cognitions, in particular. Context-based memory retrieval processes will be particularly important to addiction under the following conditions: (1) Context is processed with and influences the retrieval of substance-use cognitions, and (2) retrieval of substance-use cognitions influences behavioral choice. The next section describes initial evidence for the first condition that context does influence the retrieval of substance-use cognitions. The second condition remains more speculative, but deserves attention given the growing linkage between substance use and cognitive measures of substance-use associations and expectancies.

CONTEXT EFFECTS ON SUBSTANCE-USE COGNITION

The range of context variables that affect substance-use associations parallels the range of retrieval conditions studied in cognitive studies of context effects on memory. Most of the available studies have used alcohol as the target, but a few have also considered marijuana use and smoking. With respect to alcohol, physical and socially defined locations, induced mood, and cognitive processing manipulations modify the accessibility of outcome expectancies and implicit memories of alcohol associations (Krank et al., 2005). Generally, context enhances the accessibility of alcohol- and drug-related associations. To date, however, this line of inquiry is in its infancy. Of the limited work that has been done, evidence in support of memory-based explanations of substance use has been found.

Social and Physical Context Determinants

Cognitions regarding alcohol vary when individuals are either categorized according to where and with whom they usually drink (Brown, 1985; Sher, 1985) or when they are presented with vignettes that vary along social and physical dimensions of drinking (Levine & Goldman, 1989; MacLatchy-Gaudet & Stewart, 2001). Employing an unrelated studies paradigm, Roehrich and Goldman (1995) found that undergraduate women undergoing implicit priming of alcohol-related cues (i.e., videotaped bar setting and alcohol expectancy word primes) consumed more placebo beer, in comparison to their female counterparts who were presented with control primes. Using similar methodology, Stein et al. (2000) found that male undergraduates consumed significantly more alcoholic beer when they were exposed to alcohol expectancy word primes. Consistent with current learning and memory-based conceptualizations of alcohol outcome expectancies, this priming effect was greatest among undergraduates with heavy, as opposed to light, drinking histories.

In one of the first investigations involving exposure to environmental cues associated with alcohol use, Fromme and Dunn (1992) found no evidence to support the effect of context on explicit measures of alcohol-related cognitions. More recent research suggests, however, that when individuals are exposed to naturalistic barroom cues, they endorse more positive cognitions in a laboratory context, and they tend to evaluate alcohol-related outcomes more positively in this naturalistic drinking environment (Wall et al., 2000). Alcohol-related cognitions are also more readily accessed from memory in the presence of naturalistic barroom cues (Wall et al., 2001). In keeping with our conceptualization of context, retrieval, and drinking behavior, the ease with which alcohol-related cognitions are accessed mediates higher consumption patterns in naturalistic bar settings (Krank et al., 2005). This effect is moderated by gender and drinking history and requires further study.
Affective Influences

With respect to both alcohol- and smoking-related cognitions, individuals’ affective states serve as a context that influences the retrieval of specific expectations. Using a musical induction procedure, Goldstein et al. (2004) found that the accessibility of specific cognitions about alcohol varied as a function of mood state with positive mood inductions leading to greater accessibility. Using similar methodology, Birch et al. (in press) report similar results; however, unlike Goldstein et al., these investigators demonstrated that the effect of affective context on the retrieval of alcohol-related cognitions was moderated by individual differences in drinking motives. They classified drinkers into enhancement-motivated, drinking to enhance positive outcomes, and coping-motivated, drinking to reduce negative affect. Positive inductions increased retrieval of implicit alcohol related cognitions in enhancement-motivated drinkers and, somewhat surprisingly, in coping-motivated drinkers. As expected, negative mood induction increased implicit memory accessibility only in coping-motivated drinkers. Among women, the accessibility of specific beliefs about the positive effects of smoking are increased as a function of positive mood state induction (McKee, et al., in press).

Cognitive Procedures That Prime or Bias Memory Processing

Cognitive manipulation of retrieval factors can be accomplished by several methods. For example, written vignettes can be used to describe settings either associated with substance use or not. Such vignettes can be presented in advance of a measure as an unrelated task to effectively enhance the accessibility of alcohol-outcome expectancies (Levine & Goldman, 1989; MacLatchy-Gaudet & Stewart, 2001). Similarly, verbal or imagined situational contexts associated with alcohol use increase the accessibility of alcohol associations (Stacy et al., 1994). As Schwarz and Sudman (1994) have argued convincingly for survey research methods, engaging in one kind of cognitive task sets the context and biases memory for subsequent tasks. For example, Krank and Johnson (1999) asked adolescents to complete a survey that included implicit measures of alcohol associations and explicit outcome expectancies. They prefaced this survey with a brainstorming task designed to bias autobiographical memories about alcohol effects by listing either the positive or negative effects of alcohol on themselves or others. They found that biasing toward self-referent negative events increased the endorsement of negative outcome expectancies. Although positive expectancies were not affected, implicit alcohol responses to outcome associates or ambiguous words were more likely following biasing toward positive alcohol events.

Vignettes can also be used to set the context more explicitly by framing the question itself. We asked college students a series of open-ended alcohol-outcome expectancy questions, where each question was immediately preceded by a scenario that varied in its association with alcohol: low, medium, or high. The low associates were situations that would not normally be associated with alcohol (e.g., studying for a test), the medium associates were situations where some student would drink (on a date), and the high associates were situations where many students would drink (at a party with friends). In addition to listing three or four expected effects of a moderate amount of alcohol, the students were asked to indicate whether they would like or not like the effect. Our primary dependent variable was the alcohol outcome likability score. This score represents the number of responses endorsed as like outcomes (range 0 to 4).
Figure 19.1 shows the mean alcohol outcome likability score as a function of the alcohol-associated context of the question. In addition, the students were divided into two groups, heavier and lighter drinkers, based on a median split. As the degree of alcohol association increased, the percentage of expectancy liking score also increased. Not surprisingly, heavier drinkers had higher liking scores than lighter drinkers. Heavier drinkers, however, were more affected by the context manipulation with a steeper slope of change than lighter drinkers.

The differential effect of vignette association on this measure of outcome expectancy is important for two reasons. First, it supports the retrieval interpretation of context effects. Retrieval manipulations should only be effective if the memory is present. Consistent with this view, expectancy liking scores increase more with alcohol association in drinkers who generally hold stronger positive outcome expectancies. Second, the results suggest a practical implication: Alcohol-context effects should improve the predictive value of alcohol cognitions. That is, assuming that alcohol cognitions predict future alcohol use (Krank et al., 2003, 2005; Stacy, 1997), then to the extent that context supports better retrieval of preexisting alcohol associations, the better these measures should predict current and future drinking behavior. In a recent symposium, we presented data from a longitudinal study of adolescents showing precisely this effect (Krank et al., 2005). Using a variation on cognitive biasing, we measured implicit memory associations (behavioral associate or ambiguous word associates) either before or after questions about alcohol and drug use. We found that the context manipulation increased the number of alcohol associations produced. In addition, both implicit measures predicted alcohol use over and above demographic variables not only on the immediate survey (concurrently) but also when tested a year later (prospectively). Directly relevant to the present argument, both the concurrent and prospective predictive powers of the implicit measures were improved by obtaining the measure after setting an alcohol context.

Media Effects

Observation of substance use in the popular media provides both a vicarious learning experience and another potential source of context effects. Settings involving alcoholic beverages are common in television advertisements. References to drinking, smoking, and illicit drug use are also common in movies and music. Media portray more frequent and more positive alcohol use than is true in real life (Grube, 1993; McIntosh et al., 1999), and exposure to such media portrayals is a significant risk for substance use (Villani, 2001). Analyzing natural exposure patterns, Stacy and colleagues (2004) provide evidence that cognitive changes predictive of substance use in youth are influenced by the messages in popular media (see also Fleming et al., 2004). Consistent with a context analysis where alcohol advertisements are viewed as retrieval cues, experimental studies are also beginning to demonstrate that advertising can have a direct effect on the accessibility of alcohol-related cognitions. Dunn and Yniguez (1999) have reported evidence showing that exposure to alcohol advertisements increases positive outcome expectancies in fourth- and fifth-grade students. In addition, Krank and Kreklewetz (2003) found that exposure to alcohol advertisements in grades six and ten students increased alcohol responses on both the behavioral associate and ambiguous word associate tasks. Moreover, consistent with the pattern shown in Figure 19.1, only drinkers were affected by the exposure. This finding also supports a retrieval interpretation of advertising priming effects.
In summary, a variety of contextual manipulations influence the accessibility of alcohol cognitions. These manipulations run the gamut of variables used to demonstrate context effects on memory retrieval. In addition, context selectively enhances alcohol associations in heavier drinkers. Given that evidence shows that heavier drinkers have more underlying alcohol-memory associations, this finding also supports a retrieval interpretation. Finally, contextual enhancement of alcohol associations improves their predictive value. This outcome is a natural consequence of retrieval-based enhancement with potential applications to prevention and treatment of substance abuse.

**Implications for Substance Abuse Intervention**

In our review of context effects on substance use, we present evidence that substance-use context is associated with greater relapse to substance use. Although there are several plausible sources for these effects, our analysis of context effects on substance-use cognitions suggests that memory retrieval is one outcome that bears attention. As there is a strong predictive link between substance-use associations and substance use and a strong theoretical link to incentive motivation and behavioral choice theory (see Krank & Goldstein, Chapter 28), these
observations indicate that context-induced accessibility of substance-use cognitions, especially implicit cognitions, is a risk factor for initiating an episode of substance use. Context variables, therefore, should be front and center in identifying high-risk situations both for prevention of and treatment for substance abuse. This observation also suggests that effective interventions should target drug-associated contexts to assist the user to prepare for or replace memory retrieval of these risky associations. This approach would be similar to expectancy challenge studies that explicitly target alcohol-related cognitions within a drinking-related environment (e.g., see Darkes and Goldman, 1993, 1998; Dunn et al., 2000; Jones et al., 2001; Wiers et al., 2003). Implicit memory measures may also be used diagnostically to target the level and nature of intervention used (Krank & Goldstein, Chapter 28). In this capacity, context may be a stimulant to more effective memory retrieval analogous to a more powerful diagnostic microscope. Finally, understanding the role of memory-retrieval processes in substance use may lead to more effective interventions employing cognitive processes to support alternative memories and behavioral choices.

**Future Directions**

The future directions pointed to by this chapter are guided by the assumption that the expression of addictive behavior is largely mediated by enduring cognitive representations. This cognitive expression must be viewed as part of an overall complex of biological and environmental risk factors (Goldman, 2002). Genetic, personality, and social factors are all important to determining the relative risk of acquiring an addictive pattern of behavior toward any given substance, but the learned associations and expectancies stored in memory lay down the paths that guide future behavior. Context is one of many variables that may influence the selection of a particular path. Context is a common form of retrieval cue for selecting which memory representations are active and when. The result is that the path ahead is lighted and the choice becomes clear. Unfortunately, in addiction the maladaptive and self-destructive paths become all too clear and well-worn. The choices not taken become obscure and unseen. Fully appreciating the potential role of cognitive processing in general, and retrieval in particular, should reveal alternative and more adaptive paths and create new avenues of escape from the ruts of addiction.

**REFERENCES**


