CRAVING FOR ALCOHOL: AN INFORMATION-PROCESSING ANALYSIS

Tania Murray

NDARC Technical Report No. 8

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An Information-Processing Analysis

Tania Murray
La Trobe University

Recipient of the 1989 Syd Lovibond Prize

National Drug and Alcohol Research Centre

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Craving for Alcohol: An Information-Processing Analysis is the eighth in a series of Technical Reports published by the National Drug and Alcohol Research Centre. The series includes reports of research conducted by Centre staff and independent collaborators on basic social, psychological and biological processes in the addictive behaviours. Technical Report signifies that researchers in the drug and alcohol field are the intended audience. However, to facilitate dissemination of research findings to the wider drug and alcohol treatment community, each report is preceded by a preface which explains in non-technical terms the questions that prompted the research, the methods used, the major findings, their implications for future research and their possible relevance to the treatment of persons with drug and alcohol dependence. On this occasion the preface is contributed by Dr Janet Greeley.

Nick Heather
Director

Preface

Janet Greeley
Lecturer, NDARC

"Craving" is a concept under much dispute in the addictions field. In part, the problem is one of semantics, in that there is no agreed-upon operational definition of what craving is (Kozlowski & Wilkinson, 1987). The major difficulty is, however, one of theory. Some would argue that craving reflects the very essence of addictive behaviour (Ludwig & Stark, 1974), while others discount it as a phenomenon of any explanatory value (Mello, 1972). The truth probably lies somewhere between these two extremes.

The information processing analysis of craving presented in the following paper by Ms Tania Murray is a positive contribution towards increasing our understanding of the phenomenon of craving and of its potential role in the explanation of addictive behaviour. Craving has been closely linked with the phenomenon of relapse in that it has been suggested that craving precipitates many episodes of relapse. If this is true, then knowing how craving is brought about and how it might be modified are important pieces of information in the development of strategies of relapse prevention.

According to the information processing analysis of craving for alcohol presented here, craving is defined as an affective state (or feeling) which is integrated into our cognitions (or thoughts) by associations which form between these feelings and thoughts in a kind of network. Activation of these different elements of the network can be triggered by internal and external events and activation of one element can lead to the spread of activation to other elements. Thus, by activating a feeling, an associated thought might also be triggered. If we can link our thoughts to our actions, then the activation of drug-related thoughts and feelings would seem an important factor to consider in a study of addictive behaviour.

By manipulating the cuing conditions which a group of alcohol-dependent inpatients received, the researcher was able to affect their self-reported desire for alcohol, the kinds of words the patients were later able to recall, and the speed with which they recognised different kinds of words. This capacity for certain types of events to predispose a person's feelings and thoughts to be directed in such a way is an intriguing finding. It is particularly interesting given that these thoughts and feelings were relevant to alcohol, the substance to which these patients had been diagnosed as dependent.

More research is needed to develop this information processing account of craving and to elucidate the potentially important implications of this view for theory and treatment of addictive behaviours.

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The Syd Lovibond Prize

The Syd Lovibond Prize was instituted by the National Drug and Alcohol Research Centre in 1989, and carries an annual award of $1000. Its aim is to encourage young scientists (under 30) to submit quality work in the field of drug and alcohol issues, in the form of original research, a critique of theory and/or methodology or a review of literature on a specific topic in this area of research.

Submissions take the form of an essay of approximately 5000 words, and may come from a variety of disciplines, such as anthropology, medicine, physiology, psychology and sociology.Entries are judged by a panel convened and chaired by Emeritus Professor Syd Lovibond, and the winning entry for each year is published by NDARC.

The inaugural winner of the Prize in 1989 was Tania Murray from La Trobe University, who was presented with her award at the Fifth International Conference on Treatment of Addictive Behaviours. Tania is currently studying full-time at La Trobe University, completing a Master of Psychology. Prior to this, she was part of the research team at Pleasant View Centre, a drug and alcohol treatment centre in Preston, Victoria. Her current work involves further research on the development of information-processing models of craving and cue-exposure treatment.

Craving for Alcohol: An Information-Processing Analysis

Tania Murray

The past decade has witnessed increased attention by clinicians and researchers within the area of alcohol dependence to the phenomenon of craving. Recent advances in the clinical treatment of craving implicate the potential of cue-exposure to be a particularly effective intervention strategy (Heather & Greeley, 1990). These developments, however, have not been paralleled by developments in the theoretical understanding of craving or of the underlying mechanisms that effect therapeutic change. Although conditioning and social-learning approaches to relapse have contributed to the understanding of craving, the theoretical and conceptual inadequacies of these perspectives have been recognised (Heather & Stallard, 1989; Marlatt, 1978). Accordingly, the adoption of a cognitive approach to urges has been suggested to be potentially productive in enhancing this development (Baker, Morse & Sherman, 1987). The present investigation is concerned with the application of this approach to craving.

The concept of craving, as used here, refers to an affective state with psychological, physiological and behavioural response correlates (Baker et al., 1987; Sherman, Jorenby & Baker, 1989). It has recently been suggested that these components of craving may be cognitively represented as schemata or associative networks (Baker et al., 1987). Associative network models of affective states provide explanatory frameworks from which the cognitive processes of craving can be examined.

Bower (1981) has incorporated affective states into an associative network and spreading activation model of memory (Bower & Cohen, 1982; Bower, Gilligan & Monteiro, 1981; Gilligan & Bower, 1984). An affect is depicted as a central unit or node in a semantic network that is linked to propositions, including words, themes and perceptual categories, that describe events from an individual's life during which that state was aroused (Bower et al., 1981). Events are recorded in memory by the establishment of new associative linkages among instances of the concept which are strengthened by contiguities of experience.

Affect nodes and propositions can be activated or primed by internal or external stimuli, and since nodes and propositions are interlinked, activation spreads from one concept to another or from one proposition to another. Conscious thought is reflected by concepts and propositions whose activation level has exceeded a threshold level. If sufficiently raised the threshold for access to relevant events associated with the affect may be lowered (Bower, 1981).

Two hypotheses that derive from the theory which are of most relevance to craving and cue-exposure are those of state-dependent retrieval and mood congruity. State-dependent retrieval refers to the enhanced recall of memories when encoding and retrieval moods are the same, irrespective of the content of the information recalled. Mood congruity refers to enhanced recall of information which is similar in affective content to current mood state,

irrespective of mood at encoding (Bower, 1981). The retrieval of information from memory is dependent on a construct's accessibility, or its readiness to be utilized in information processing, and availability, which refers to individual differences in the particular kinds of constructs that are actually present in memory to be used for processing social input (Higgins, King & Mavin, 1982).

Investigations of construct accessibility in affective states have supported cognitive theories of emotional disorders, and in particular have contributed to the theoretical and clinical understanding of depression (Bargh & Tota, 1988; Strauman, 1989). Cognitive theories of depression propose that depressed individuals possess maladaptive cognitive structures that represent contributory causal factors in the onset and maintenance of depression (Beck, 1967, 1976; Kovaks & Beck, 1978). The suggestions that depressed individuals differ from non-depressed persons by way of greater accessibility of negative constructs, and that depressed individuals access negative constructs more readily than positive constructs have generally received support (Gotlib & McCann, 1984).

Advances in the treatment of depression have arisen from the specification of guidelines for schematic change. This is proposed to occur when an individual encounters information discrepant with current affective content which is undeniable (Fiske & Taylor, 1984). Evidence of lower relapse rates for patients treated with cognitive therapy suggests that these strategies are effective in modifying the negative thought processes of depressed individuals (Hollon, Evans & DeRubeis, 1987; Simons, Murphy, Levine & Wetzel, 1986).

If craving is considered to be an effect analogous to depression, the adoption of this approach for craving might also lead to clinical and theoretical advances. From a clinical standpoint, the persistence of the desire to drink following periods of abstinence may reflect the reactivation of an existing cognitive representation. This reactivation in turn may inhibit the activation of newly stored features acquired as a result of therapy. Most importantly, this analysis offers an explanation of the mechanisms underlying craving and hence, of how cue-exposure techniques effect emotional change. By elucidating the contents of the craving structure, the implementation of individualized treatment strategies that provide information discrepant to that of craving cognitions may be achieved.

An information-processing approach may also aid in clarifying the role of craving in the relapse process. If craving, like depression, is thought of as a product of activation of cognitive schemata, then a set of validated methodologies become available for studying its causal role in relapse.

Empirical support for the causal role of schematic structure depends on three important features of the experimental paradigm employed. First, the procedure needs to include a priming condition which employs stimuli of sufficient salience to activate the structure, to ensure that subsequent responses will occur under schematic control (Power & Champion, 1986).

Second, the use of a procedure which is capable of determining whether individual elements of the structure are organised with a high degree of interrelation is required. This is shown if an element within the structure, when primed by expectation, motivation or stimulus salience, is found to increase the accessibility of interconnected proximal elements, thereby demonstrating a state-dependent retrieval effect. The demonstration of a mood congruity effect does not support the existence of a cognitive structure as it does not allow consideration of the functional relation among elements (Blaney, 1986; Coyne & Gotlib, 1983). Instead, the view that cognitive distortions are trait-like variables that are implicated in the etiology of the emotional disorder is supported (Bargh & Tota, 1988; Gotlib & Cane, 1987).

The final feature which is necessary to demonstrate the causal role of a cognitive structure is the employment of tasks and dependent variables which provide an index of automatic

information processing in the absence of an individual's intent or control (Bargh, 1982, 1987; Posner, 1978; Posner & Warren, 1972). Conscious processing of information may arise as a result of a response strategy adopted by the subject to facilitate performance of the response demanded in the experimental situation. Interference from these effects should therefore be avoided.

Laboratory studies of depression have employed a variety of experimental analogues of state-dependent retrieval and mood congruity that are of relevance to craving. Each of these studies is characterized by methodological problems that rarely allow unambiguous interpretation of results. Gotlib and McCann (1987) used a modification of the Stroop (1935) technique to examine mood congruity in each of 50 depressed, neutral and manic content adjectives in students, induced to be depressed and non-depressed. Subjects in the depressed group took longer to colour-name depressed words than neutral or manic words thereby providing support for construct accessibility effects. However, the presence of a cognitive structure with interrelated elements could not be determined due to the lack of a priming procedure. Although consistent with the notion of the existence of an organised structure, the longer response latencies may have been activated by mood rather than by associated constructs.

Segal et al. (1988) used a modification of the Stroop Colour Naming Task to investigate the organisation of cognitive schemata in clinically depressed, anxious and normal control subjects. Stimuli consisted of a target word, either related or unrelated to subjects, which was paired with a prime word that was positive, negative or neutral. Target and prime words together were presented on slides; the subjects' task was to read the prime word to themselves, name the colour of the target word and then recall the prime. Results supported the notion of a depressive self-schema in depressed individuals. Self-referent target words were associated with longer recognition latencies when primed by a self-referent word compared with a word that was not self-descriptive. As Segal et al. (1988) note, however, conclusions regarding the existence and causal role of the proposed cognitive structure cannot be drawn without comparison groups belonging to matched populations.

These studies failed to employ paradigms which independently assessed both state-dependent retrieval and mood congruity effects, thereby limiting the inference of a causal mechanism. The present study employs a paradigm in which a cue-elicitation technique primes an hypothesized cognitive structure associated with craving. It is anticipated that input of information related to craving will result in enhanced activation and encoding. Words constructed to be craving congruent and craving incongruent in content respectively are then presented to subjects. This paradigm is capable of assessing the hypothesized relationship between elements of a cognitive structure by use of recognition latency, an automatic measure of information processing. Mood is then reinstated and the words are presented once more, with explicit instructions to attend to the information, thereby requiring controlled thought processes. Incidental recall of words is then tested. Accordingly, state-dependent retrieval and mood congruity effects are independently assessed.

The primary aim of this investigation is to examine the affective state of craving by evaluating construct accessibility in alcohol dependent inpatients. A further goal is to ensure the potency of the cue-elicitation procedure in eliciting a craving response.

Three hypotheses are examined. At post-treatment, subjective craving ratings for the subjects in the craving cue-elicitation treatment condition are predicted to be significantly greater than for subjects in the neutral cue-elicitation treatment condition. In addition, subjects in the craving cue-elicitation treatment condition are hypothesized to demonstrate faster recognition latencies for craving congruent words compared with craving incongruent words, and are expected to display faster recognition latencies for craving con-

gruent words than subjects in the neutral cue-elicitation treatment condition. Correspondingly, subjects in the craving cue-elicitation treatment condition are hypothesized to recall a greater number of craving congruent words compared with craving incongruent words, and are anticipated to recall a greater number of craving congruent words than subjects in the neutral cue-elicitation treatment condition.

Method

Design.

A 2 (cue-elicitation condition) x 3 (word type) mixed design was used in this study. Subjects were randomly assigned to each of two independent cue-elicitation treatments. These comprised a craving cue-elicitation condition and a neutral cue-elicitation condition. The repeated factor of word type consisted of three levels: craving congruent words, craving incongruent words and neutral words. Dependent variables included a self-report measure of subjective craving, and measures of word recognition and recall.

Subjects.

Forty-eight male inpatients undergoing treatment for alcohol dependence at Pleasant View (n = 25) and Gresswell (n = 23) treatment centres commenced participation in the study. Inclusion criteria included (a) written consent, (b) abstinence from alcohol for at least 10 days, (c) adequate visual and literacy skills, (d) absence of psychotropic medication and (e) no upper respiratory impairment. Subjects evidencing verbal memory deficits (a score of <1 SD below Australian age norms provided by Ivison, 1977) as assessed by the Paired Associate Learning Subtest of the Wechsler Memory Scale (WMS; Wechsler, 1945) were excluded from the study. Subject attrition (n =7) and failure to meet inclusion criteria (n = 10) resulted in data for 31 subjects to be analyzed.

Subjects' age, number of days off alcohol, number of previous inpatient treatments, daily alcohol consumption rate (Drinking History Questionnaire; DHQ), severity of dependence as assessed by the Alcohol Dependency Scale (ADS; Skinner & Horn, 1984) and scores on the WMS were recorded to provide demographic data on subjects within each treatment condition. The mean scores of these indices are reported in Table 1.

Table 1

Mean scores, standard deviations, t-values and probability levels of demographic variables by Condition.

Variable	Condition	Mean	Standard Deviation	df	t-value	p
Age	Craving	32.0	9.8			
	Neutral	31.3	11.2	29	1.31	0.612
Days off alcohol	Craving	28.6	18.1			
	Neutral	31.2	30.1	29	-0.29	0.777
Previous inpatient treatment	Craving	2.3	4.1			
	Neutral	1.4	2.5	29	0.74	0.465
ADS	Craving	30.3	6.9			
	Neutral	28.7	8.1	27	0.55	0.588
DHQ	Craving	538.5	153.5			
	Neutral	471.5	233.7	29	0.94	0.359
WMS	Craving	14.1	1.6			
	Neutral	14.5	2.6	29	-0.48	0.639

Administration of the Millon Clinical Multiaxial Inventory-II (MCMI-II, Millon, 1986) provided an index of psychopathology for the sample. The profile of the sample's mean Base Rate scores is presented in Figure 1.

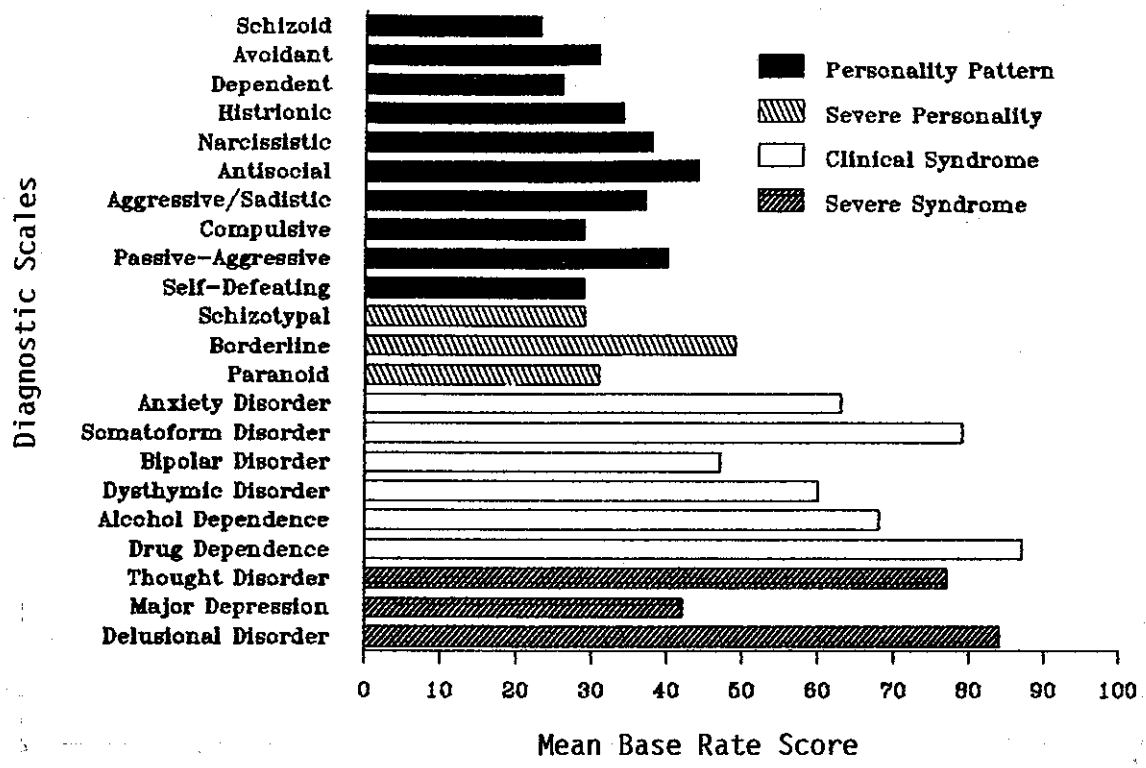

Figure 1. Profile of mean MCMI-II Base Rate Scores for the sample

Materials and Equipment.

The stimuli used in this investigation were 54 words which comprised three stimulus sets; 18 craving congruent words (e.g., hotel, drink, thirst), 18 craving incongruent words (e.g., church, avoid, sober) and 18 neutral-content words (e.g., table, build, west). Each stimulus set further consisted of 6 words from each of the categories of objects, behaviours, and thoughts and feelings to control for the differential effects on recall and recognition of words varying on the dimension of abstractness-concreteness (Paivio, 1971, 1983). Stimulus sets were matched on frequency of occurrence (Kucera & Francis, 1967), word length, and number of syllables.

The craving stimulus sets were developed in a previous study. A Craving Word Questionnaire was developed and administered to inpatients and clinicians who rated a pool of words having craving attributes according to their reported relevance in a craving state. Using a summated scaling design stimulus sets were refined and subjected to psychometric analyses which indicated them to comprise two internally consistent, externally valid, non-overlapping categories. Neutral-content words were selected from word lists developed by Kucera and Francis (1967).

Stimuli were presented in lower case (0.5 cm height) on a Microbee computer monitor (model SV-1290X), controlled by a Microbee computer (model SBC-02). Subjects responded verbally into a microphone, which was connected to the Microbee computer by means of a voice-operated switch. The computer measured the subject's response latency to within 1 msec. The computer was also linked to a Brother printer (model M-1109) which enabled recognition latencies to be printed after the subject had completed the session. A Sony stereo cassette recorder (model CFS-1000S) was used with RPG stereo headphones (type

PH-100) to play the pre-recorded cue-elicitation scripts to subjects, and cassette tapes were used to record subject's responses in the incidental recall task.

Cue-Elicitation Treatments.
Two taped scripts of equivalent word length, affective tone and presentation time, developed by the experimenter, and in-vivo cues were used to elicit craving and neutral mood states. In the first part of the cue-elicitation scripts (lasting three minutes), subjects were requested to recall a past experience and to focus on what they saw, did, thought and felt in this situation. The script for the craving cue-elicitation treatment requested subjects to think back to a time when they "really had to have some of their favourite alcoholic beverage", whilst the script for the neutral cue-elicitation treatment requested subjects to recall a time when they "really had to use some of their preferred laundry detergent".

The second part of the cue-elicitation treatments lasted for a further three minutes. The same taped script was used for both cue-elicitation procedures, and instructed subjects to lift a box under which craving cues (subject's favourite alcoholic drink and glass) or neutral cues (a packet of 'Surf' laundry detergent and washing cup) was placed. Subjects were required to look at, pick up, and smell the stimuli for one minute each. After the first 30 seconds of the in-vivo cue-elicitation script, the experimenter opened and poured the drink or washing powder into the glass or washing cup. Care was taken to ensure that no words on the taped script were included in the stimulus sets.

Procedure.
Interview Phase. Prior to participating in the study, each subject was interviewed and details concerning the inclusion criteria and subject's favourite alcoholic drink were recorded. The DHQ and WMS were completed and the rationale of the study was explained. If the subject agreed to take part in the study, the research consent form was signed and an appointment for the experimental session was made. The subject was given the ADS and MCMI-II to complete and return prior to this time. Subjects failing to meet the inclusion criteria of the study were only required to complete the interview.

Recognition Phase. Subjects participated in individual sessions. The rationale and aspects of the procedure were outlined to the subject, the subjective craving scale (a 10-point Likert scale with three anchor points) was explained, and a baseline index of subjective craving was obtained. Throughout the procedure, none of the words to be presented was vocalized by the experimenter, nor was the conceptual category to which they belonged. To ensure that the subject understood the requirements of the word recognition task, 10 word recognition practice trials with neutral-content words were presented. Instructions displayed on the computer monitor requested subjects to recognize the word as quickly and accurately as possible when it came onto the screen, by saying the word clearly and loudly into the microphone. Instruction was provided until subjects responded in the appropriate manner. The subjects then positioned the headphones and participated in the 6 minute cue-elicitation treatment according to the group to which they were assigned. Following this, subjects rated their desire for alcohol on the craving rating scale, and immediately commenced the word recognition task.

The 54 stimulus words were randomly presented independently for each subject. Each trial consisted of a 2-sec fixed presentation of the stimulus word. Onset of the stimulus started the timer, which was stopped by the subject's vocal response. Each stimulus remained in view for a constant time of 2 sec, regardless of the subject's reaction time. If subjects failed to respond to the stimulus, the next word was automatically presented. The interval between stimulus presentations was constant at 500 msec. Throughout the trial, incorrect responses and vocal interferences were recorded manually by the experimenter.

Recall Phase. Following the word recognition task, the three minute in-vivo cue-elicitation treatment was repeated, and a third index of

subjective craving was obtained. The same 54 stimulus words were randomly presented once again to each subject at a constant presentation rate of 3 sec, with a constant interval time of 500 msec between word presentations. Instructions displayed on the computer monitor required subjects to read each word carefully by concentrating on its meaning. To avoid a recency effect, on completion of the stimuli presentations, subjects engaged in an interference task of approximately 10-15 sec duration, which required them to count backwards slowly from 10 to 1. Following this, subjects participated in the incidental recall task.

The incidental recall task required subjects to verbally recall, in any order, as many words as they could remember that were previously presented on the computer monitor, in three minutes. Recalled words were recorded on the cassette recorder and were noted after the experimental session. Subjects were fully debriefed, and were not permitted to leave the session unless the subjective level of craving had decayed to a rating of less than 5 on the 10 point scale at more than 30 minutes post-experiment. Subjects were then thanked for their participation in the study.

Results

Subjective Craving.

The subjective craving levels for subjects in the craving and neutral cue-elicitation treatment conditions are displayed in Figure 2. Results of planned comparisons revealed that the level of subjective craving of the craving cue-elicitation condition compared with the neutral cue-elicitation condition was significantly greater prior to the recognition phase ($t(29) = 6.83$, $p<.01$) as well as the recall phase ($t(29) = 6.55$, $p<.01$).

It can be seen from Figure 2 that at pre-treatment, the subjective craving level of subjects in both cue-elicitation procedures were similar. Following the first cue-elicitation treatment the subjective craving of subjects exposed

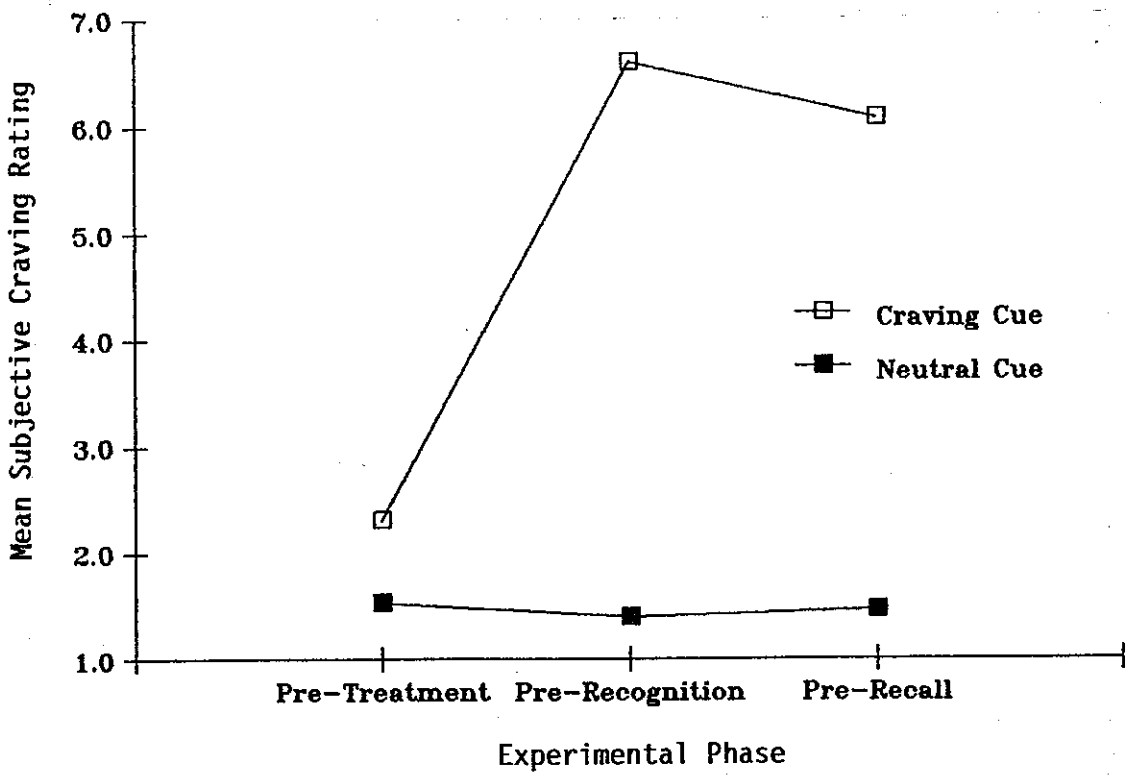

Figure 2. The effect of the cue-elicitation procedures on subjective craving (range = 1-10) at Pre-Treatment, Pre-Recognition and Pre-Recall phases.

to the craving cue elevated sharply, and slightly declined on the second exposure. In contrast to this, the subjective craving level of subjects in the neutral cue-elicitation condition was maintained at a low level across the two exposure periods. Results suggest that the two cue-elicitation procedures were differently effective in eliciting and maintaining high craving and low craving.

Recognition Phase.

Recognition errors included incorrect responses to stimuli and verbal interferences (e.g., the subject coughing or stuttering). The percentage of errors for the two treatment groups was 3.82% for the craving cue-elicitation group and 3.83% for the neutral cue-elicitation group. As the percentage of trials on which errors occurred was low, constant across conditions, and typical of error rates reported for reaction time experiments (Srull, 1984), they were excluded from further analyses.

The effect upon recognition latency of word type and cue-elicitation condition is shown in Figure 3. A significant main effect of word type ($F(2,58) = 4.18$, $p<.05$) and a significant word type x condition interaction effect ($F(2,58) = 5.50$, $p<.01$) were found. The main effect of word type indicates that, in general, craving words were recognised faster than neutral words and craving incongruent words. The significant interaction between condition and word type reveals that the two groups responded differently to each of the three word types. Planned comparisons indicate that for the craving cue-elicitation group, craving congruent words were recognised significantly faster than craving incongruent words, ($t(15) = -2.86$, $p<.01$). Craving congruent words were also recognised faster by subjects in the craving cue-elicitation condition than those in the neutral cue-elicitation condition, although this difference failed to reach significance ($t(29) = -0.96$, $p>.05$). This result may be due to large variance in each of the groups (craving cue-elicitation, SD = 113.6; neutral cue-elicitation, SD = 105.4).

Examination of Figure 3 shows that recognition latencies of both cue-elicitation groups were faster for craving congruent words than for neutral words. Recognition latencies of neutral words relative to craving incongruent words were not significantly different for either treatment condition.

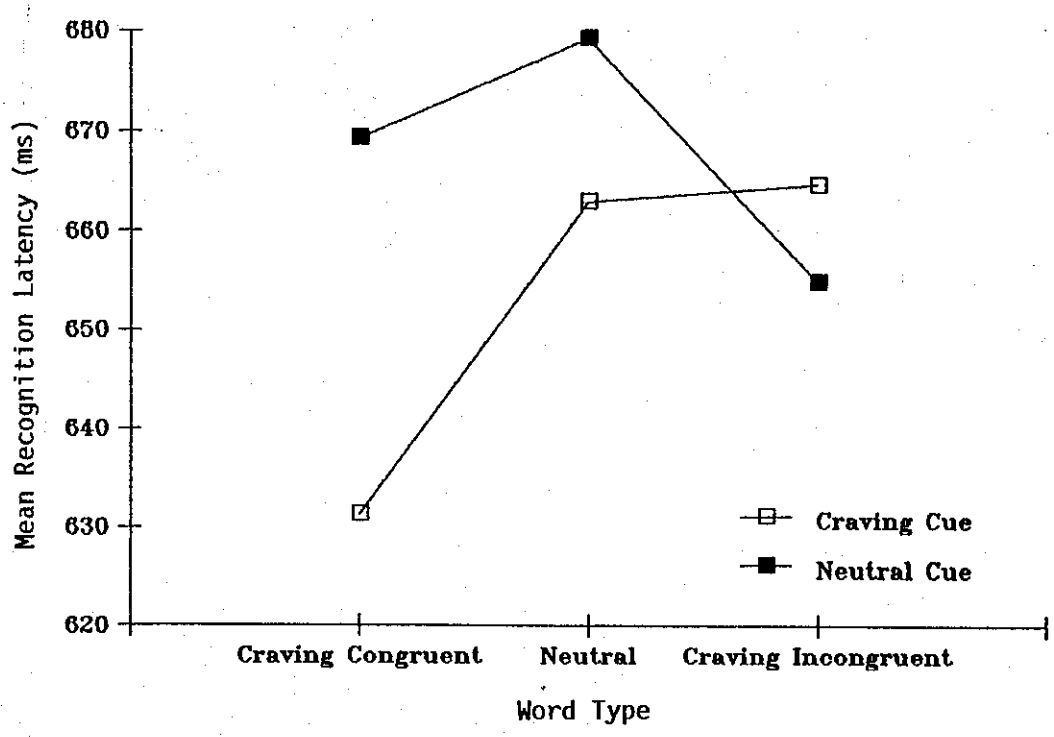

Figure 3. The effect of word type and condition on recognition latency.

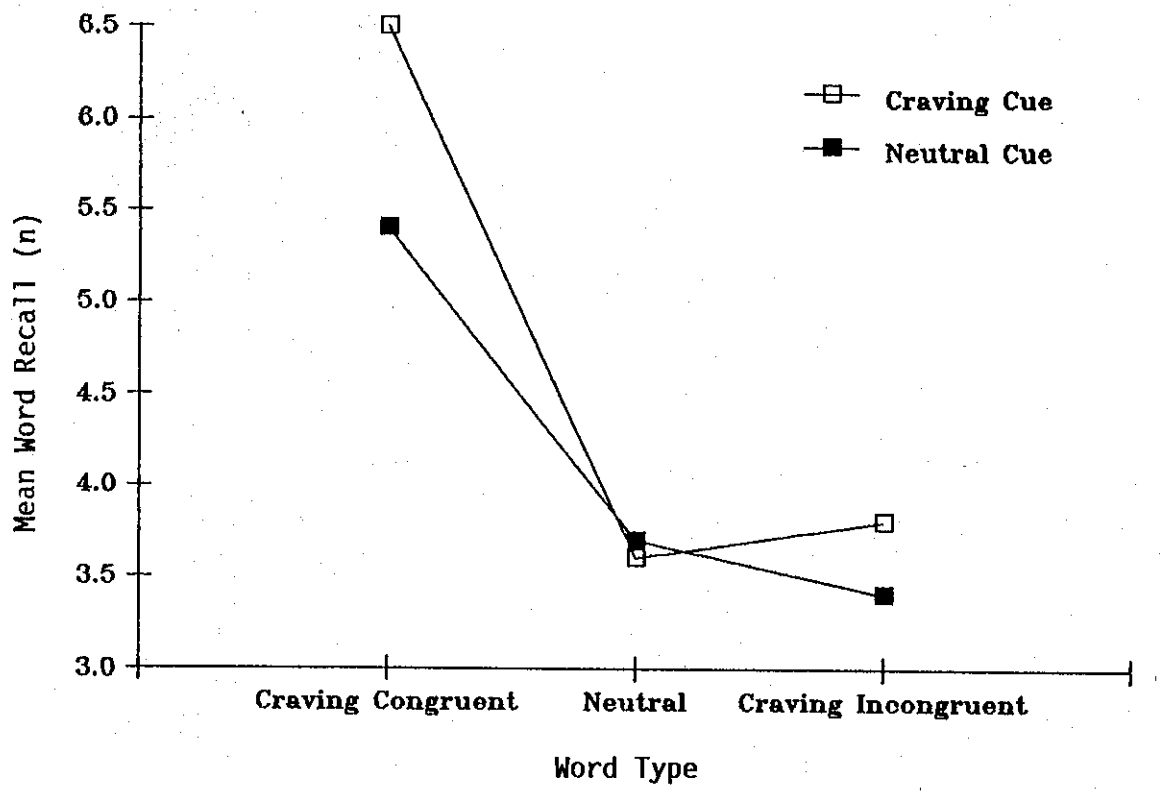

Figure 4. The effect of word type and condition on word recall.

Word Recall.

Errors in recall performance included repeated mentions of a list item (double recalls) and the production of items not on the presented list (intrusions). For the craving cue-elicitation condition, the percentage of double recalls and intrusions were 2.3% and 1.3%, respectively, and for the neutral cue-elicitation group were 1.9% and 1.7%. Recall errors did not differ significantly across conditions. Consistent with accepted practice (Murphy & Puff, 1982), errors arising from double recalls and intrusions were ignored. Only correct data, defined as the first mention of any item in the presented list, were included in the analysis.

The effect of word type and condition on word recall is displayed in Figure 4. Analysis revealed a significant main effect of word type [$F(2,58) = 15.19$. $p<.01$], indicating the presence of differences in recall performance due to one or more levels of word type. Planned comparisons demonstrated a significant difference ($t(15) = 4.18$, $p<.01$) between the number of craving congruent and craving incongruent words recalled by the craving cue-elicitation group. Although data reflect a trend in the predicted direction, the number of craving congruent words recalled by the craving cue-elicitation group compared with the number recalled by the neutral cue-elicitation group failed to reach significance ($t(29) = 1.57$, $p>.05$).

Discussion

Evidence was found to support construct accessibility effects in craving. The craving cue-elicitation treatment group recognized craving congruent words significantly quicker than craving incongruent words, and recognized craving congruent words quicker than the neutral cue-elicitation group, although this difference was not significant. For incidental recall of words, the craving cue-elicitation treatment group recalled a significantly greater number of craving congruent words than neutral and craving incongruent words. Subjects in this condition also recalled a greater number of craving congruent words than those in the neutral cue-elicitation treatment condition, although this difference

was not significant. Finally, subjective craving ratings for subjects in the craving cue-elicitation group were significantly greater than those of the neutral cue-elicitation group following implementation of the cue-elicitation procedures.

The Associative Network Model of Affect (Bower, 1981) implies that differences in word recall and recognition latency indices for craving congruent and craving incongruent cognitions result from differences in the extent to which these cognitions have been accessed in a craving state. The recognition latency findings suggest that when in previous craving states, the craving congruent words used in the present study were frequently accessed. According to Network Theory, as a result of the cognitive structure's reactivation by salient stimuli, expectation or motivation, these constructs lower the subthreshold activation of proximal associated elements resulting in quicker recognition of these words in a craving, compared with a neutral mood state. These findings may be interpreted as reflecting a state-dependent retrieval effect, thereby supporting a notion of craving as a cognitive schema which has a causal role in the etiology of a craving response.

However, whether craving constructs were primed by affect per se or the effects of a cognitive structure associated with mood is a complex issue. It is possible that the craving elicitation procedure induced craving mood, which in turn accessed the craving-linked constructs as a result of their affectively valanced content. This may have occurred as a result of the craving cue-elicitation's potency which cued the recall of mood labels, or activated the craving structure itself. If so, mood per se would be responsible for construct accessibility effects, thereby reflecting a mood congruity effect. Although possible, there are several reasons why an alternative cognitive-structure priming account is equally plausible. First, the craving cue-elicitation procedure was effective in eliciting craving due to the use of salient stimuli, a factor which primes cognitive networks. Second, the craving script was constructed with emphasis on the activation of proximal constructs with subjects being explicitly required to recall the thoughts, feelings and behaviours associated with a past craving experience. Third, the cue-elicitation procedure was deliberately constructed without the inclusion of mood labels, and the mood label of 'craving' was not mentioned by the experimenter throughout the experimental session. Fourth, subjects were unaware of the aims of the study which reduced the possibility of subject compliance with the experimental task. Fifth, the recognition latency results provide support for the notion that constructs are interrelated in an organised fashion. The craving cue-elicitation group recognised craving congruent words significantly faster than craving incongruent words and recognised craving words faster than the neutral cue-elicitation group. Finally, as well as stimulus salience being responsible for this effect, it is likely that subjects' positive outcome expectancies contributed as well. There is strong evidence in support of the role of expectancies in eliciting a craving response (Marlatt & Gordon, 1985). Given these factors, interpreting the accessibility of constructs as reflecting priming due to a cognitive structure which is associated with mood, thereby implicating a causal role to craving in relapse is a reasonable position to adopt.

It may be argued that these findings are a function of the particular stimuli employed in this investigation. However, as the craving stimuli sets used in the study comprised two non-overlapping categories of words with high fidelity that were differentially relevant to alcohol dependent inpatients with respect to craving, this is unlikely. Although the generally small differences found between neutral words and craving incongruent words for both recognition and recall indices may indicate that these word groups were not sufficiently distinct for the purposes of this investigation, this lack of distinction has only an indirect bearing on the hypotheses of interest. Nonetheless, the disparate findings of the present study and investigations of depression that generally demonstrate significant differences between neutral and other word categories may be explained by dissimilarities between the emotional intensity of induced craving and induced depression (Bower,

1981). An alternative explanation of this divergence may lie in differences in the dimensionality of the depression and craving constructs. Depression may be thought of as a bipolar construct with poles of positive and negative traits. In contrast, craving may be characterized as a unidimensional construct with craving incongruent traits being similar to neutral attributes. The results of the present study lend support to this notion. Although it has been argued that the present findings are unlikely to be due to the particular stimuli employed, further normative data by replication with clinical samples would help to resolve this issue (Anastasi, 1982; Nunnally, 1970).

Finally, strong support for the potency of the cue-elicitation treatments was also demonstrated, with significant between-treatment differences in self-reported craving being found. Although group differences in construct accessibility were not significant for recognition and recall data, trends in this direction were found. The convergence between indices of craving demonstrates the utility and potential for construct accessibility to serve as a reliable index of craving, and the power of associative network models to provide an explanation as to the underlying mechanisms of craving. The ability of the in-vivo cue-elicitation technique employed in the present study to prime craving constructs and effect cognitive change highlights the potential of, and the need for further development of effective cue-elicitation techniques and cue-exposure strategies. Viewed together, the findings suggest the ability of the present approach to enhance the theoretical and clinical understanding of the concept of craving.

Future Directions for the Analysis of Craving

Investigation of the components of craving may identify and clarify the relative strengths of certain interoceptive and exteroceptive cues and their association. Insight into the structural organisation of the elements of craving may be achieved by the use of free recall measures. By use of techniques that index category clustering, for example, the adjusted ration of clustering method, the proximal distance and hence the associative strength of elements within the construct may be determined (Gerjuoy & Spitz, 1966; Roenker, Thompson & Brown, 1971). Such a technique may be applied to the data obtained in the present study.

By using an information-processing approach, the development of a cognitive model of craving may reconcile the conditioning and social-learning approaches to craving and relapse. The development of a multifaceted model appears as an appropriate alternative to the poor explanatory power of models that aim to account for the complexity of craving phenomena from unidimensional perspectives.

The demonstration of construct accessibility effects in replication studies utilising sufficient sample sizes is important to confirm findings of this study. Further refinement and validation of craving stimulus sets is also required. If state-dependent retrieval and mood congruity were found to be robust effects, at least two research directions of clinical significance would ensue.

First, examination of the covariance of physiological, behavioural and cognitive indices of craving would allow elucidation of the interaction among these elements. This research may lead to direct implications for a causal account of craving and relapse to drug use, and the development of more sensitive indices of change in alcohol dependent individuals. Focus on the role of cognitive elements of craving such as positive outcome expectancies and self-efficacy would help to illuminate the contributions of these factors to craving. Attention to the precipitants of a craving episode that lead to cognitive shifts would aid the development of effective therapeutic strategies.

Second, identification of individuals who, once out of the treatment centre, are at greatest risk for relapse to drug use would contribute to the goal of secondary prevention. This focus shifts the emphasis away from historical factors and attempts to understand the cognitive processes

associated with relapse regardless of what led to craving and drug use in the first place. This research would enhance the development of a cognitive model of craving and relapse. In sum, the development of a cognitive model and the refinement of methodologies for examining construct accessibility hold promise for providing a greater understanding of the influence and elusive nature of craving.

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