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Applications of Cusp Catastrophe Models to the Relapse Process

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An M.A. Thesis Presented at the University of Montana

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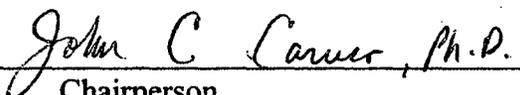
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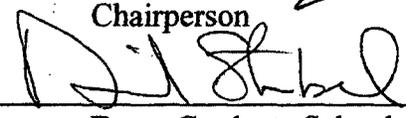
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Catastrophe theory, a subset of nonlinear dynamical systems theory, has potential in psychology for modeling behaviors that are poorly predicted by linear models. A specific type of catastrophe model, the cusp, may be useful when gradual changes in the environment correspond with abrupt changes in behavior. This type of catastrophic change is often observed in human behavior and researchers in the social sciences have begun to apply catastrophe theory to psychological phenomena. The relapse process in alcoholics is an example of a complex psychological phenomenon that may be better understood using a catastrophe model. One hallmark of this process is that minor changes in some risk factor often result in a quick return to active alcohol dependence, or relapse. Addictive behaviors researchers have struggled to understand the relapse process using traditional linear models, which are not designed to predict such abrupt change. Three methods for analyzing cusp catastrophe and linear models were applied to an extensive alcohol treatment outcomes database [Project Matching Alcoholism Treatments to Client Heterogeneity from the National Institute of Alcohol Abuse and Alcoholism]. The suitability of each of these methods, in the prediction of relapse, was evaluated. Based on the interpretability of the results, polynomial regression appears to provide the most reasonable method for measuring the fit of a cusp catastrophe to the observed data, as compared to competing models. The results from this analysis suggested that the cusp model fit the data better than a linear model. The implications of these findings for the treatment of alcoholism and recommendations for future research are discussed.

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Introduction

During the past 40 years several fields of science have benefited due to information gathered from an increased understanding of nonlinear and dynamic processes (Gleick, 1987). Nonlinear dynamical systems theory stems from mathematical reasoning about the stability and instability of systems (Guastello, 1995). A dynamical system can be defined as a set of interacting variables with properties of continuity, determination, and infinite duration (Abraham, 1995a). The mechanisms of a dynamical system include: bifurcations, transformation of a system from one type to another; sensitivity to initial conditions (or divergence; small changes in the initial level of a system lead to large differences in the outcomes of the system); and self-organization (emergent structure in the behavior of a system; Abraham, 1995b; Schuldberg, 1999). Nonlinear dynamical systems theory has provided the physical, mathematical, and social sciences with new theoretical insights and modeling strategies to predict and understand behavior better. It is the aim of this study to examine the applicability of nonlinear dynamics to the relapse process in alcoholics.

History of Nonlinear Dynamical Systems Theory in Psychology

The history of the nonlinear analysis of systems in psychology dates back to the mid-1930s when Lewin (1936) proposed that the concepts of dynamical processes and divergence be applied to topics in social psychology. Bateson (1972) developed the double-bind theory of schizophrenia, which incorporated a dynamic understanding of familial relationships, as well as theories for the formation of emergent behavioral structures. Rashevsky (1968) developed a theory of bifurcation, which he applied to the complexity and divergence of human behavior. He stated: "A change in behavior of a

single individual, no matter how small, may precipitate in an unstable social configuration, a process that leads to a finite, sometimes radical change" (Rashevsky, 1968, p. 199). The theories proposed by these individuals suggest that human behavior cannot be observed through a single lens: various factors may influence the actions and reactions of a person. Although these factors remain unnoticed to the behaving human or the observer, they may play a major role in the behavioral outcome. If every motivation were accounted for, then the seeming randomness of human interaction would become a discernible pattern of complex exchanges.

Catastrophe Theory

Bifurcation theory, as proposed by Rashevsky (1968), was further developed through the application of the work of mathematician René Thom. Thom (1972) provided the complete proof for the existence of seven elementary catastrophes, which he termed, in order of complexity, the fold, cusp, swallowtail, butterfly, elliptic umbilic, hyperbolic umbilic, and parabolic umbilic. Catastrophe theory is derived from topology, a field of mathematics that studies the properties of surfaces in numerous dimensions (Thom, 1972). Mathematical topology has typically focused on those problems that can be described with reference to smooth surfaces. The topological problems proposed by Thom (1972), however, focused on the complexities of uneven surfaces, specifically, surfaces with divergences. Thom (1972) observed that objects in nature (including humans) can often be described by smooth surfaces in equilibrium, but changes in the equilibrium of the surface will result in the discontinuities that Thom called "catastrophes." Catastrophe theory may be applied to situations where gradual changes in the environment correspond with abrupt changes in the expressed behavior (Stewart &

Peregoy, 1983). Because of this psychologists have applied catastrophe theory to a variety of human behaviors. The cusp catastrophe is one of the seven elementary catastrophes that has been the most widely applied catastrophe in the behavioral sciences (Stewart & Peregoy, 1983; Zeeman, 1977).

According to Zeeman (1977) a cusp catastrophe model has five qualities:

1. Bimodality: the behavioral outcome is partitioned into two modes.

2. Quick transitions: the transition from one mode of behavior to the other may happen rapidly.

3. Hysteresis: the change between modes of behavior is asymmetrical for the same individual; therefore the transition from one mode to the other mode does not occur at the same place on the surface.

4. Inaccessibility: between the two modes behavioral expression is highly unlikely, given the input parameters.

5. Divergence: relatively small changes in the input parameters leads to dramatic changes in behavior.

As shown in Figure 1, the cusp catastrophe model is defined by the five qualities described above.
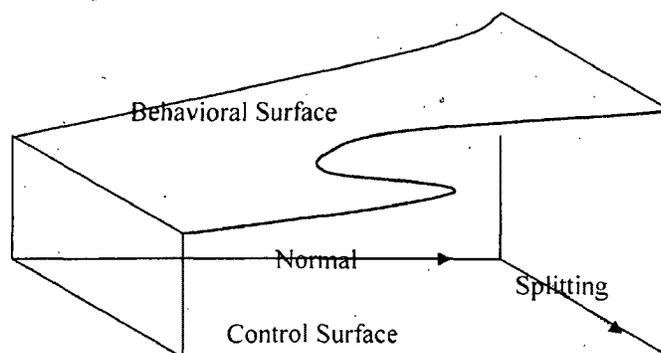
Figure 1. Cusp Catastrophe Model.

The vertical axis is considered the behavioral surface. This axis provides a measure of the possible behavioral expressions (outputs) based on the levels of the control parameters (inputs). The horizontal plane, called the control surface, is a basic plot of the input control parameters. Every point on the control surface has at least one corresponding point on the behavioral surface, which indicates that a certain behavior, based on the input parameters, has a certain probability of occurring. Two control parameters are included in the model, the "normal" and "splitting" parameters. The value of the normal parameter increases and decreases gradually, and behavior is linear when the value of the splitting parameter is low. However, as the value of the splitting parameter increases, the value of the normal parameter diverges, and there are two behavioral expressions for each value of the normal parameter. Behavioral expression between the two modes of behavior is highly unlikely, defined by the property of inaccessibility. The position of the normal parameter determines the path of the trajectory after the system bifurcates. The relative position of the bifurcation will be different for every individual, depending on the values of the normal and splitting parameters.

Consider the example of anorexia nervosa shown in Figure 2.
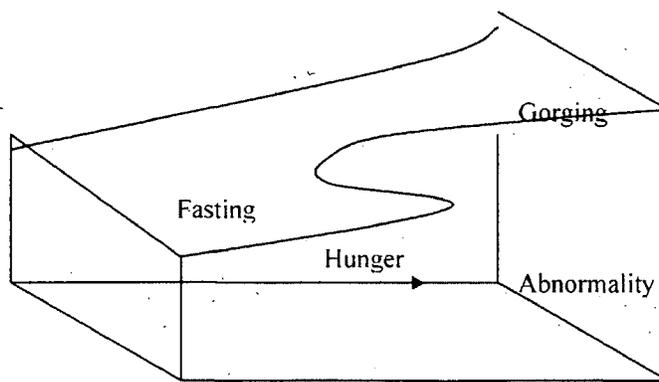
Figure 2. Cusp Catastrophe Model Applied to Anorexia Nervosa.

In this example, hunger is the normal parameter and abnormality of attitudes toward food is the splitting parameter. When the person's attitudes toward food are not particularly abnormal, the person exhibits behavior related to hunger in a linear fashion (e.g., the person feels hunger and the person seeks food to be consumed). As the person's attitudes toward food become more abnormal there is a bifurcation of behavior, when the person is hungrier the behavioral response is gorging and when the person is satiated the behavioral response is fasting.

Zeeman (1976) suggests that if any one of the qualities outlined above is observed in a behavior, then the phenomenon should be tested within a cusp model. Zeeman (1977) applied catastrophe models to voting, military expansion, anorexia, and anger-aggression in children. Callahan and Sashin (see Callahan, 1982; Callahan & Sashin, 1987), following Zeeman (1977), tested catastrophe models of treatment for anorexia nervosa and affect-response. More recently, catastrophe models have been applied to adolescent substance use, stress and health, decision-making, goal attainment, accidents, organizational development, and bipolar disorder (see Clair, 1995; Guastello, 1992; Guastello, 1995; Guastello & McGee, 1987; Scott, 1985).

Catastrophe modeling in psychology. Researchers in the field of psychology have attempted to derive appropriate statistical methods to determine the predictive abilities of the cusp catastrophe model. These methods, as well as catastrophe theory in general, have received a number of criticisms (Alexander, Herbert, DeShon, & Hanges, 1992; Kolata, 1977; Sussman & Zahler, 1978). Sussmann and Zahler (1978) claimed that several proposed catastrophe models are merely hypothetical, and few have any mathematical basis. Furthermore, those catastrophe models that are empirically based are often the

least parsimonious alternatives for modeling the behaviors that are being described. Yet, several authors in the field of psychology have also demonstrated the utility of catastrophe modeling in gaining a better understanding of complex questions (see Clair, 1995; Guastello, 1995; Zeeman, 1977). Guastello (1995) presents a review of several empirical investigations that have used catastrophe models in comparison to linear models.

The statistical modeling of discontinuity and non-linearity from combinations of observed variables may be very useful for increasing our understanding of psychological problems. Zeeman (1977) eloquently describes the importance of catastrophe theory modeling in the social sciences:

> The method has the potential for describing the evolution of forms in all aspects of nature, and hence it embodies a theory of great generality; it can be applied with particular effectiveness in those situations where gradually changing forces or motivations lead to abrupt changes in behavior (p. 65).

There have been numerous theoretical applications of catastrophe theory to clinical psychology (see Burlingame, Fuhriman, & Barnum, 1995; Callahan & Sashin, 1987; Gentry, 1995; Scott, 1985). Many psychological phenomena may be more adequately modeled using these methods, rather than methods that are based on the general linear model. In particular, research within the field of clinical psychology is frequently unable to account for substantial amounts of variance based on linear predictions. Stewart and Peregoy (1983) highlight the ability of catastrophe theory to capture the important information that may be lost using linear models: "catastrophe theory takes over when

functional relationships between the dependent and independent variables break down"
(p. 336).

Methods for analyzing catastrophe models in psychology. Three separate
methods for analyzing a catastrophe have been proposed: the method of maximum
likelihood for estimation of parameters (Cobb & Zacks, 1985), the generalized
multivariate method (Oliva, Desarbo, Day, & Jedidi, 1987), and the polynomial
regression method (Guastello, 1992).

- Cobb (1981) proposed that human behavior is not deterministic, and therefore he
created a stochastic, or probabilistic, method for fitting a cusp catastrophe surface. Cobb
(1978) realized the problems of statistical modeling arising from linear definitions, and in
response developed a multimodal probability density function. With this model, the
surface of the cusp is considered to represent the most expected expressions of the
criterion variable given the combinations of the predictor variables. In order to determine
the probability of the expressed criterion variable, the parameters in the model have been
estimated using maximum likelihood estimation (Guastello, 1995).

Oliva and colleagues (1987) employed a multivariate technique for estimating
latent normal and splitting parameters from observed variables. These authors have
developed a software package called the General Multivariate Methodology for
Estimating Catastrophe Models (GEMCAT) for analyzing catastrophe models. This
package allows for several variables to be entered as either the normal or the splitting
parameter, or both, and the criterion variable can also be determined from multiple
variables. Any variable entered into GEMCAT can receive either a fixed weight (i.e.,
user specified), or a free weight (i.e., determined from the data). At least one of the

variables in the model must be fixed, and the experimenter should have some a priori knowledge of the weight for the fixed variable. Because of this requirement, the GEMCAT method may be most useful when confirmatory estimation of a model is needed (Lange, Oliva, & McDade, in press).

The GEMCAT method allows for multivariate definitions of several indicator variables and has been criticized for its susceptibility to Type I error (Alexander, et al., 1992). Lange and colleagues (in press) used simulated data to determine the likelihood of "false positives" and to test the reliability of indicators. They found that with sample sizes less than 100 the weights of the indicators were largely overestimated, and this effect increased as the reliability of the indicators decreased. The authors reported that Type I error was not an issue because they were able to "reliably spot" (p. 23) false positives because the algorithm produced negative goodness of fit indices (Pseudo-R^2's).

The polynomial regression method (Guastello, 1982) applies Cobb's parameter estimation theory with the addition of dynamic difference equations. The dynamic difference equation is used to assess the level of change between two assessments of the criterion variable (Y). After transforming all variables in the model by location and scale, the variables are entered into a regression equation using the dynamic difference equation (e.g., Y_2-Y_1) as the criterion variable. The Y_1 values are then cubed and squared and used as predictors in the cusp model. These polynomial terms, as well as the splitting parameter multiplied by Y_1, and the normal parameter, characterize the regression equation. Guastello (1995) proposes that if the cusp catastrophe model explains significantly more variance than a traditional linear model, then it is possible to assume that the processes underlying the phenomena are not smooth and continuous.

The polynomial regression method has been the most widely used method of analyzing catastrophes in the field of psychology.

One example of a process in psychology that may be appropriately modeled by catastrophe theory is the " 'falling off the wagon' of an alcoholic" (Schuldberg, 1999, p. 262). Many alcoholics return to problem drinking within a year after receiving treatment, but the circumstances that beset the return to drinking are not related in a linear fashion (Hore, 1971; Sutton, 1979).

The Relapse Process

In a metaphor of relapse, Brownell, Marlatt, Lichtenstein, and Wilson (1986) describe a person standing close to the edge of a cliff: "The slightest disruption can precipitate a fall from which there is no return." (p. 766). Addictive behaviors researchers have made several attempts to operationalize, understand, and prevent the "edge of a cliff" phenomenon (Hore, 1971; Litman, 1980; Marlatt, 1979) with limited success (Kadden, 1996).

An agreed upon definition of relapse remains elusive in the psychological literature. Miller (1996) remarked that defining relapse as a concrete state of drinking drastically oversimplifies the dynamic state phases that underlie behavioral changes. Edwards and Gross (1976) considered the process of a reinstatement of alcohol dependence, after the person has maintained a period of abstinence, as an essential element in the definition of alcoholism. More concretely, some propose that a lapse is the act of taking a drink after a period of abstinence (Brownell, et al., 1986). A relapse has been defined as a lapse that is either quantitatively (Marlatt, 1996) or qualitatively (Litman, 1986) more severe. That is, relapse is generally considered to be the resumption

of a harmful pattern of heavy alcohol consumption that is more temporally stable and psychologically pernicious than a lapse.

One finding that has been consistently identified in both the research and clinical literature is that relapse is a frequent outcome for patients with alcohol dependence (Connors, Maisto, & Zywiak, 1996). Litman (1980) described alcoholism as a "relapsing condition," and the empirical research supports this conception. Investigations conducted within the last decade have found relapse rates ranging from 28% to 86% (Cooney, Litt, Morse, Bauer, & Guapp, 1997; Greenfield, et al., 1998, Hall, Havassy, & Wasserman, 1990; Jones & McMahon, 1994; Monti, et al. 1993, Powell, et al., 1992; Rychtarik, Prue, Rapp, & King, 1992; Solomon & Annis, 1990). In short, relapse is often the modal outcome of addiction treatment (Brownell et al., 1986).

Besancon (1993) collected retrospective data from a small group of subjects with alcohol dependence and found that 28 out of the 31 subjects relapsed within the first month after treatment. The average amount of time for those subjects who relapsed to their pre-abstinence level of dependence was approximately nine days. Sutton (1979) determined that relapse curves show that long-term abstinence is unlikely in those patients who drink shortly after receiving treatment. Thus, the behavioral sciences continue to struggle to predict who will relapse and the timing of relapse.

Models of Relapse

Relapse is a complex process. The course of drinking after a period of abstinence cannot be fully explained using single variable models, and several researchers have supported models that incorporate multiple determinants of relapse. Hore (1971) proposed that relapse to drinking could be predicted from a change in internal mood

states, such as an increase in anxiety level, or from a significant life event. He tested this hypothesis with a group of 22 patients diagnosed with alcoholism. Only one patient who relapsed reported a change in his mood, and 50% of the 14 patients who relapsed noted a significant life event, such as interpersonal problems, loss of employment, or a death in the family. Hore (1971) points out that the most notable observation was the intensity of the return to drinking after abstinence, which occurred suddenly.

Litman, Eiser, Rawson, and Oppenheim (1979) proposed a model of the relapse process that incorporates three mechanisms for the initiation of a relapse: the person's perceptions of dangerous (i.e., high-risk) situations, the availability of coping responses to deal with dangerous situations, and the individual's level of self-efficacy (the person's self-perception of being capable of coping) in view of the situation. The hypothesized relapse model was investigated with a sample of 120 patients following treatment for alcohol dependence. The findings indicated that relapse precipitants and coping mechanisms were predictive of relapse. The abstaining patients reported fewer dangerous situations and greater flexibility and effectiveness in coping behaviors than the patients who relapsed.

Litman (1986) later considered whether the changes in an individual's locus of control during treatment for alcohol use disorders and perceptions of social support might exert influence within her original model. She hypothesized that as patients experience mastery while engaged in treatment their perceptions of success and failure will evolve from external attributions to internal credibility. The results suggest the existence of a complex interaction between perceptions of dangerous situations, coping behaviors, and perceptions of effectiveness of coping behaviors. The abstainers applied more coping

behaviors and perceived fewer situations as dangerous. Furthermore, they perceived their coping behaviors to be effective in managing the dangerous situation. Litman's work highlights the importance of understanding the relationship between relapse precipitants and an individual's affective and coping responses.

Marlatt (1985) based a relapse taxonomy on retrospective data obtained from a sample of 70 chronic alcoholics at a follow-up interview three months after discharge from inpatient treatment. He used four structured questions to obtain qualitative information about the patient's experiences of relapse precipitants, including frustration and anger, social pressure, intrapersonal temptation, and negative emotional states. Based upon this qualitative information Marlatt (1985) and Marlatt and Gordon (1985) propose two determinants, interpersonal and intrapersonal, which are further divided into eight subcategories: coping with negative emotional states; coping with negative physical factors; enhancement of positive emotional states; testing personal control; giving in to temptations; coping with interpersonal conflict; social pressure; and enhancement of positive emotional states.

The two determinants can also be arranged hierarchically. Level 1 consists of the interpersonal and intrapersonal/environmental determinants, which can be characterized primarily by intra-individual factors and internal reactions to environmental or interpersonal events. Level 2 builds on level 1 by emphasizing the interpersonal factors that may impact the individual and the individual's coping responses. Level 2 also incorporates the interaction between the individual and his or her environment.

Anecdotal evidence provides support for the utility of Marlatt's taxonomy. In response to the clinical acceptance and application of Marlatt's taxonomy the National

Institute of Alcohol Abuse and Alcoholism (NIAAA) requested proposals for an extension and replication of the taxonomy (Kadden, 1996). The resulting Relapse Replication and Extension Project (RREP) is described in great detail in the 1996 Supplement of the journal, *Addiction*. RREP did not find empirical support for the reliability or validity of Marlatt's taxonomy, or for his coding systems (Kadden, 1996). In particular, the Marlatt taxonomy was not found to predict drinking outcomes reliably, nor the time to relapse (Stout, Longabaugh, & Rubin, 1996). Despite the apparent inability of Marlatt's model to predict relapse, clinicians maintain that the model does provide a heuristic for understanding particular characteristics of the relapse process (e.g., Kadden, 1996).

The value, and downfall, of Marlatt's model may reside in the complexity of the proposed system. Marlatt's taxonomy has been praised for its clinical utility and generalizability. However, as noted, it has also been questioned because of its inability to predict relapse in the RREP. In response to the studies produced from the RREP Marlatt (1996) criticized the researchers for considering the distal baseline measures to be fixed predictors of relapse at follow-up, "thereby depriving them of their dynamic and fluid role as proximal determinants in the relapse process " (p. 148). Hore (1971), Litman (1986), and Marlatt (1996) all recognized the need for a relapse model that encompasses several precipitating variables and complex interactions between the person and his or her environment. These researchers are beginning to understand that behavior should not be interpreted within a snapshot, and linear predictions do not provide a complete assessment of the dynamic system that underlies behavioral change.

Shiffman's (1989) model of relapse precipitants consolidates much of Litman's and Marlatt's work. Shiffman proposes a model of relapse that incorporates three classes of relapse determinants: personality characteristics, background variables, and relapse precipitants. Personality characteristics provide a measure of the stable qualities of the individual, such as extraverted or obsessive-compulsive personality types. Background variables relate to the person's history and past experiences. These variables may be considered to provide a cumulative risk for the person, such as level of alcohol dependence or family history of alcoholism. Relapse precipitants are transient events that create an extremely high probability for relapse. Intense alcohol cues, immediately stressful situations, or social pressure to drink may be precipitating factors. Personality characteristics and background variables are considered predisposing variables, also referred to as distal risk factors. These variables may increase the probability that relapse will occur. The relapse precipitants are episodic, and are also known as proximal risk factors, and they actualize a statistical potential, thereby increasing the probability that a person with high levels of distal risk factors will relapse. Therefore, precipitants actualize the predispositions. Aggregations of precipitating and predisposing risk factors are innumerable for any particular individual. The interaction of a number of these factors creates a complex system in which the probability of relapse may be greatly increased (Shiffman, 1989).

Factors Related to the Relapse Process

Several factors are important in considering the relapse process (Shiffman, 1989). Temptation to drink is most likely inescapable for the abstaining alcoholic. In order to remain abstinent the alcoholic typically employs coping skills, which may facilitate

resistance-promoting factors and hinder temptation-promoting ones. Shiffman (1989) proposed that a person who experienced few temptations would require fewer coping mechanisms, but as temptation increased more effective coping would be necessary. Empirical evidence has shown that an alcoholic's use of effective coping skills may be the key element to remaining abstinent (Brownell, et al., 1986; Shiffman, 1989; Greenfield, et al., 2000). Wills and Shiffman (1985) divided coping behaviors into four styles: stress, temptation, behavioral, and cognitive coping. Stress coping is used to reduce the impact of a stressor, and often drinking may act as a form of stress coping (Shiffman, 1989). Temptation coping involves strategies used to reduce temptation, such as eating or sleeping. Exercising is an example of behavioral coping; the person is actively doing something that will relieve temptation. Cognitive coping employs mental strategies for reducing temptations, such as concentrating on the ill effects of drinking on the liver.

Coping strategies may be more or less effective depending on the situation, the needs of the person, and on the temporal relationship to the precipitant (Wills & Shiffman, 1985). Strategic coping styles are used to minimize the temptation to drink (e.g., a chronic alcoholic avoids all liquor stores). Responsive coping mechanisms may be employed when a stressor becomes a direct challenge to abstinence. Responsive coping methods are often temporary reactions to stressors (e.g., leaving a party where alcohol is present). Restorative coping focuses on recovering from the lapse and preventing a relapse. Cognitive strategies are often employed as restorative coping mechanisms. A recovering alcoholic may utilize abstinence schemas in approaching

situations that are highly stressful (e.g., thinking about times of successfully remaining abstinent).

Self-efficacy is the extent that an individual feels capable of performing a certain behavior (Bandura, 1977). An individual's appraisal of his or her ability to stay abstinent may have a profound impact on that person's actual ability to resist drinking (Rychtarik, et al., 1992). Higher levels of self-efficacy are predictive of improved alcoholism treatment outcomes (Annis, & Davis, 1988; Burling, Reilly, Moltzen, & Ziff, 1989; Connors, et al., 1996; Greenfield, et al., 2000; Project MATCH Research Group, 1997; Rychtarik, Prue, Rapp, & King, 1992; Solomon, & Annis, 1990).

Connors, Maisto, and Zywiak (1996) studied self-efficacy and treatment outcomes one year following inpatient or outpatient treatment. The authors found that self-efficacy was positively related to the percentage of days abstinent (PDA), and negatively related to the number of drinks per drinking day. Greenfield and colleagues (2000) considered the relationship between self-efficacy and relapse survival in a group of male and female patients receiving inpatient treatment. The results from this prospective study supported the finding that self-efficacy was predictive of survival functions of abstinence. This finding suggests that a person's self-efficacy score was predictive of both the amount of time-to-first drink and time-to-relapse within the first twelve months following treatment. Self-efficacy, as measured by the Alcohol Abstinence Self-Efficacy Scale (AASE; DiClemente, Carbonari, Montgomery, & Hughes, 1994), was also shown to predict three-year treatment outcomes (Project MATCH Research Group, 1998). The authors concluded that self-efficacy and motivation for change were the strongest predictors of abstinence.

Coping and self-efficacy are independently important mechanisms, and both are crucial to the person's motivation for change. Prochaska and DiClemente (1983, 1984) have suggested that motivation for change can best be conceptualized as an intermittent stage model, called the transtheoretical model (TTM), where a person may cycle back and forth through the various stages of the model before obtaining the desired behavior change (Prochaska, DiClemente, & Norcross, 1992). The person may oscillate between the following stages: precontemplation, when the person has no interest in changing within the next six months; contemplation, when the person plans on attempting to change within the next six months; preparation, when the person plans on taking action during the next 30 days and has begun to make some behavioral changes; action, the person has made some behavioral changes for less than six months; and maintenance, the person implements changes for over six months. The TTM provides a perspective on behavioral change that encompasses both temporal and integrative components of the relapse process, and has been successfully applied to understanding the motivation of patients receiving treatment for substance use disorders (Joseph, Breslin, & Skinner, 1999). While it provides a good model for understanding the scope and nature of appropriate treatments, it may be inadequate for capturing the continuous and multidimensional nature of the relapse process (Joseph, et al., 1999).

A Cusp Catastrophe Model of Relapse

The five qualities of a cusp catastrophe can be examined in terms of the alcohol relapse process, and several addictive behaviors researchers have referred to these elements of relapse with anecdotal evidence. The apparent bimodality of the relapse process is often observed in the behavior of problem drinkers immediately post-treatment

(Humphrey, Moos, & Cohen, 1997). Patients tend to either remain abstinent or they return to heavy drinking. Likewise, inaccessibility extends the idea of bimodality to incorporate the notion that returning to social drinking is very unlikely immediately after treatment, given the configuration of relevant risk factors (Brownell, et al., 1986). The risk factors also play a role in divergence within the system. As Brownell, et al. (1986) described: "A person is always on the brink of relapse, ready to fall at any disturbance" (p. 766).

Those people who are trying to abstain from substances may experience an abrupt change, or sudden transition, to heavy drinking (Besancon, 1993; Edwards & Gross, 1976, Miller, 1996). Edwards and Gross (1976) have stated: "A syndrome which had taken many years to develop is fully reinstated within perhaps 72 hours of drinking, and this is one of the most puzzling features of the condition" (p. 1060). In support of this claim, Hore (1971) observed that in a sample of 22 alcoholics relapse occurred rapidly and without warning. In addition, common sense and clinical experience strongly suggest that the intensity of risk factors that facilitate the departure from abstinence to dependence after receiving treatment is much different from the level of risk that will produce a path from dependence back to abstinence (Shiffman, 1989), demonstrating the concept of hysteresis.

Description of the Cusp Model Applied to Relapse

As described above, the normal and splitting parameters define the surface of a cusp catastrophe model. In terms of relapse, Shiffman (1989) provides an excellent framework for these control parameters in his conceptualization of distal and proximal risk factors. Distal risk factors are proposed as those factors that create an increased

statistical risk for relapse, and proximal risk factors actualize the statistical risk.

Therefore distal risk is comprised of those characteristics that determine who is most

likely to relapse, and proximal risk incorporates variables that indicate the timing of

relapse. The distal risks make up the grenade, and the proximal risks can be interpreted

as the pin being pulled.

Shiffman (1989) considered any variable that may be a predisposition for relapse

as a distal risk factor. Factors may include: family history of alcoholism, the nature and

severity of the alcoholism, comorbid psychiatric and substance abuse diagnoses, impaired

cognitive capabilities, or a tendency to be reactive towards alcohol-related cues

(Donovan, 1996). Within a cusp catastrophe model the distal risk may be interpreted as

the splitting parameter.

The normal parameter is characterized as a person's level of proximal risk.

According to Donovan (1996): "relapse is relatively precipitous and potentially

unpredictable" (p. 35). Proximal factors may include: situational threats to self-efficacy,

craving, social cue reactivity, affective states, stressful life events, the rapid deterioration

of social support (e.g. loss of a friend), or acute psychological distress (Donovan, 1996).

A depiction of a cusp catastrophe model applied to relapse is shown in Figure 4.
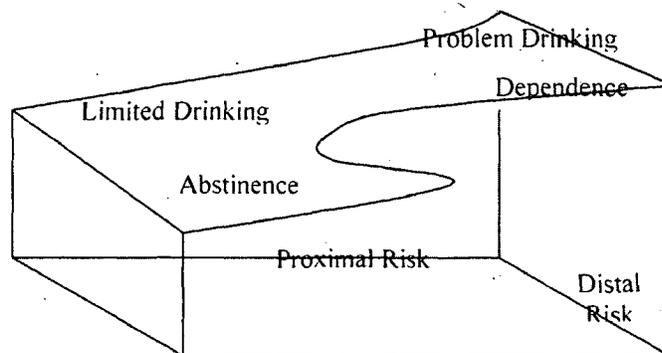
Figure 3. Cusp Catastrophe Model Applied to Relapse Process.

The increasing level of distal risk will create a bifurcation, whereby the potential for relapse is greatly increased if the level of proximal risk is also high. Consider a person who has been drinking heavily for several years. This person has a strong family history of alcoholism, comorbid major depression, and all of this person's hobbies are related to drinking. The combination of these factors would constitute high distal risk. Now imagine that this person went to an outpatient treatment facility for several months and is attempting to stay abstinent. During the months following treatment this person's spouse files for divorce and all of this person's drinking friends continually harass him or her for not taking a drink. This person feels less and less capable of abstaining and begins to experience strong cravings for alcohol. The combination of these factors (e.g., increased stress and support for drinking, and decreased self-efficacy) could be considered as increasing this person's level of proximal risk.

Looking back at Figure 3, this person is situated somewhere in the foreground on the top sheet (as indicated by the high level of distal risk). Based on the hypothesized model the increasing level of proximal risk will then actualize the potential for relapse pushing this person over the cusp to heavy drinking behavior. If this person had a high level of distal risk but was not experiencing an increase in proximal risk, then he or she would have most likely remained abstinent. If the person had a low level of distal risk, then the increase in proximal risk may have caused an increase in problematic drinking behavior (e.g., lapses), but not a relapse. If the person had low levels of both proximal and distal risk, then he or she may have been able to return to social drinking.

It is hypothesized that the use of the polynomial regression equation to measure the fit of a catastrophe model, in combination with previous research on coping

mechanisms, maintaining abstinence, and proximal and distal risk factors (Brownell, et al., 1986; Marlatt, 1996; Shiffman, 1989) may provide much needed insight into the process of relapse. Therefore a test of the cusp catastrophe model in predicting relapse in patients with alcohol dependent symptoms was conducted as part of a two-study pilot investigation.

Pilot Studies

Two pilot studies were conducted to determine how a cusp catastrophe model of relapse would compare to traditional linear models in predicting post-treatment drinking outcomes. Drinking outcome was conceptualized as a change in drinking quantity between intake to treatment and six months post-treatment. The predictor variables were based on a composite of several variables that were empirically reduced to represent distal and proximal risk components.

The normal parameter was conceptualized as proximal risk factors, and the splitting parameter was conceptualized as distal risk factors. The proximal risk variables were conceptualized as family conflicts (McKay, Longabaugh, Beattie, Maisto, & Noel, 1993), depression (McLellan, Luborsky, Woody, O'Brien, & Druley, 1983), psychological distress (McLellan, et al., 1983), and alcohol self-efficacy expectancies (Donovan, 1996; Greenfield, et al., 2000). The following variables were hypothesized to constitute distal risks: severity of alcohol dependence (Marlatt, & Gordon, 1985) and family history of alcoholism (Craig, Krishna, & Poniarski, 1997).

Data were collected at intake to treatment and at a 6-month follow-up among inpatient ($n = 40$) and outpatient ($n = 42$) participants with alcohol use disorders. The cusp catastrophe model was compared to traditional linear models to determine which

model explained the most variance in the relapse process. It was hypothesized that a cusp catastrophe model would better account for substance abuse treatment outcomes than a traditional linear regression model.

Method

Participants

Participants for these studies were obtained from a larger sample (n = 364) of adult inpatients that volunteered for treatment at an inpatient substance abuse treatment unit and a sample (n= 193) of adult outpatients receiving substance abuse treatment in an outpatient community center. Participants in the inpatient sample were Caucasian (83%) and Native American (17%) with a mean age of 39.2 (SD = 13.4). Participants in the outpatient sample were Caucasian (94%), Native American (4%), and African American (2%) with a mean age of 33.8 (SD = 9.49). Patients in both settings were interviewed, using several standardized measures described below, shortly following their admission to treatment (M = 7 days). All participants provided informed consent for the intake assessment and the follow-up interviews. The inpatient sample was contacted by telephone at 30-days, 6-months, and 12-months following discharge from the program. The outpatient sample consented to return to the community treatment center for follow-up interviews at 6-months and 1-year. Patients in the outpatient study were provided with reimbursement of $10 for each follow-up interview they attended.

Most of the inpatient (N = 275) and outpatient (N = 133) participants in the total sample did not attend follow-up interviews and were not included in this investigation. Independent samples t-tests were conducted to examine whether differences existed between those participants who were included versus those who were excluded on age,

gender, ethnicity, and all of the measures described below. No significant differences (α = .05) were found between the two groups (excluded participants versus included participants) on any of these variables.

Procedures

Those participants who completed both the intake and 6-month follow-up interviews were included in the two studies reported here. Any participant with missing data was excluded from the analyses. The final sample consisted of 40 (17 female) inpatient alcoholics and 42 (10 female) outpatient alcoholics.

Participants in both samples were administered demographic questionnaires that included questions on previous treatments, family history of alcoholism, and current employment. At the intake interview all participants received the Structured Clinical Interview for DSM-IV Disorders-I (SCID-I; First, Spitzer, Gibbon, & Williams, 1997); the Addiction Severity Index (ASI; McLellan, et al., 1992); the Timeline Follow-Back (TLFB; Sobell & Sobell, 1992); the Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996); and the Situational Confidence Questionnaire (SCQ; Annis & Graham, 1988). The measures used for the pilot studies are provided in Appendix A. The 6-month follow-up interviews provided information from the TLFB and questions regarding current employment status and self-help group attendance during the 6-months post-discharge.

Statistical Analyses

For both studies, variables that have been identified by the research literature as possible proximal and distal risk factors for alcohol relapse, as described above, were entered into separate Principal Component Analyses (PCA), one for proximal risk and

one for distal risk. The number of extracted components was set at one. This procedure allowed PCA to operate as an exploratory analysis technique that created component variables that accounted for as much of the total variance of the variables entered into the analysis. This step was required because the tested models necessitated single variables as predictors. These analyses were conducted in such a way that only the variables that meaningfully contributed to the linear composite were included. All of the variables selected for inclusion into the PCA for both studies, and the breakdown of the proximal and distal risk composites are provided in Table 1.

Table 1. <u>Proximal and Distal Risk Composites for Pilot Studies</u>

Sample	Distal Risk	Loadings	Proximal Risk	Loadings
Inpatient	Family history of alcoholism	.82	Family conflict	.71
	Severity of alcohol dependence	.82	Depression	.87
			Psychological distress	.81
			Situational confidence	-.44
Outpatient	Family history of alcoholism	.79	Family conflict	.74
	Severity of alcohol dependence	.71	Depression	.79
	Comorbid substance abuse	.72	Situational confidence	-.81

For both studies, the component scores derived from PCA were entered into six different regression equations as the variables X_1 and X_2, proximal and distal risk components, respectively. Using the TLFB methodology, the quantity of drinks consumed in the thirty days prior to the interviews was entered as the criterion variables. The quantity of drinks prior to the follow-up interview was entered as Y_2, and the amount of drinks consumed in the 30 days prior to intake was entered as Y_1. The Y values were

reduced by their lower limit and subsequently divided by their standard deviations. This allowed for the transformation of these variables by location and scale, as described by Guastello (1995).

Three linear models: the linear difference, pre-post, and linear-interaction, have typically been used as a comparison to the cusp catastrophe model (Clair, 1995; Guastello, 1992). The studies presented in this paper incorporate the three linear models and the cusp catastrophe model. The first linear model, called the *linear difference model*,

$$Y_2 - Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2, \tag{1}$$

attempts to predict the amount of change in the criterion variable, drinking from intake to follow-up, based on the two predictor variables, proximal and distal risk factors:

The second linear model, the *pre-post model*,

$$Y_2 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 Y_1 \tag{2}$$

measures drinking at follow-up as the criterion variable by adding drinking at intake to both sides of the *linear difference* equation, creating drinking at intake as an additional coefficient. The third linear model, called the *linear-interaction model*,

$$Y_2 - Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2, \tag{3}$$

adds the interaction between the predictor variables to the *linear difference model*. The *cusp catastrophe model* is analyzed using the following polynomial regression equation:

$$Y_2 - Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 Y_1 + \beta_3 Y_1^2 + \beta_4 Y_1^3; \tag{4}$$

the cusp model is considered superior if it accounts for a statistically significant higher proportion of variance in the criterion variable (Clair, 1995; Guastello, 1992).

<u>Results</u>

For the inpatient data set, the component score of the three distal risk variables explained 67% of the variance in the distal risk component. The component score of the three proximal risk variables explained 53% of the variance in the proximal risk component. The difference between the two sets of risk variables in terms of the percentage of variance they explain is due to the higher correlations between the distal risk variables. For the outpatient data set, the linear combination of the four distal risk variables explained 46% of the variance in the distal risk component, while the seven proximal risk variables explained 65% of the variance in the proximal risk component.

The results from the inpatient sample showed that the linear models did not explain a significant amount of variance in the criterion variable (*linear difference*: R^2 = .17, F (2, 38) = 3.82, p = .03; *linear pre-post*: R^2 = .16, F (2, 38) = 2.33, p = .09; *linear interaction*: R^2 = .20, F (3, 37) = 3.16, p = .04). The *cusp model*, equation (4), explained a significant proportion of the variance in the change in drinking from intake to follow-up (cusp: R^2 = .59, F (4, 36) = 12.82, p < .0005).

Using the outpatient data, the *linear difference model* accounted for 16% of the variance in the criterion variable (F (2, 40) = 3.70, p = .033). The *linear pre-post model* explained an insignificant amount of variance in the prediction of the change in drinking (R^2 = .09, F (3, 39) = 1.20, p = .32). The *linear interaction model* also explained a small amount of variance in the criterion variable (R^2 = .16, F (3, 39) = 2.54, p = .07). The *cusp model* explained a significant proportion of variance in predicting the change in drinking from time 1 to time 2 (R^2 = .88, F (4, 38) = 70.12, p = .0005).

Discussion

The two studies presented here provide preliminary support for the cusp catastrophe model in predicting substance abuse treatment outcomes. In both the inpatient and the outpatient samples the cusp catastrophe analyses accounted for a greater amount of variance than the linear models in the prediction of change in drinking. The heterogeneity of the two samples suggests that the cusp catastrophe model may be more flexible in predicting relapse in a variety of different subsets of an alcoholic population. Furthermore, the incorporation of both proximal and distal risk factors in the cusp model may provide the quantitative mechanism for predicting the complexity of the relapse process, which has been hypothesized, but not empirically tested, by addictive behaviors researchers (Brownell, et al., 1986; Hore, 1971; Litman, 1986; Shiffman, 1989).

The encouraging results from these studies should be considered in light of the many limitations of both studies. Having small sample sizes can be detrimental when testing a variety of statistical models (Cohen, 1988). Polynomial regression is a less robust test than linear regression and often requires larger samples sizes (Guastello, 1995). In addition, the polynomial regression model for testing a cusp catastrophe has received some criticism (Alexander, et al., 1992). According to Alexander and colleagues (1992), the reverse hierarchical entry of regression coefficients (first entering the cubic term, then the quadratic term, then the interaction term and finally the X_1 term) may lead to inaccurate results. Guastello (1992) answers this criticism by claiming that variable entry in the order of descending polynomials is theory driven, and that this is acceptable based on qualitative analysis of functions.

The polynomial regression model has also been questioned because of the redundancy between the criterion and the polynomial predictor variables used in the equation (Alexander, et al., 1992; Hufford, Witkiewitz, Shields, Kodya, & Caruso, under review). Guastello (1992) provides a rebuttal to this criticism suggesting that as the correlation between the two scores that create the difference score increases the catastrophic differences must disappear.

S. J. Guastello (personal communication, April, 2000) has justified his methods by suggesting that if the cusp model explains more variance than the next best linear comparison, than it is the better model. Upon inspecting the cusp model (see equation 4) it becomes clear that the polynomial regression equation, as proposed by Guastello (1982, 1995), may be a test of the linear relationship between Y_1 and the difference score rather than a test of a true cusp catastrophe model[1]. Furthermore, the linear comparison models proposed by Guastello (1995; equations 1 and 2) and Clair (1995; see equation 3) do not share in the cusp model's advantage of including the relationship between the predictor variables and the criterion variable. Despite the criticisms of the polynomial regression in testing a cusp catastrophe model, the results from the pilot studies suggest further investigation of the relapse process using catastrophe theory and nonlinear applications.

Current Study

The questions raised in the pilot studies are restated and extended in the current study. This study was designed to provide a more statistically powerful investigation of the cusp catastrophe model of the relapse process. The current study uses the data from Project MATCH, a large alcohol treatment outcomes database (N = 1,726), obtained from the NIAAA. The goals of the current study are to replicate the findings from the pilot

studies and to compare the three different methods (polynomial regression, generalized multivariate, and method of maximum likelihood) for analyzing a cusp catastrophe model. These methods are compared based on goodness of fit to the actual data, ease of use, and interpretability.

<center>Project MATCH</center>

Project MATCH is the largest and arguably most well conducted psychotherapy trial ever conducted (Project MATCH, 1997). It was designed to test the hypothesis that certain client variables would predict differential response to three types of therapy. Project MATCH used three types of psychotherapy to treat both inpatient (n = 774) and outpatient alcoholics (n = 952): cognitive-behavioral therapy (CBT), motivational enhancement therapy (MET), and 12-step facilitation therapy (TSF). Participants were matched on ten primary variables (gender, alcohol use, psychiatric severity, cognitive abilities, conceptual abilities, meaning seeking, motivation for change, social support, and risk severity) and eleven secondary matching variables (Alcoholics Anonymous participation, alcohol dependence score, anger, antisocial personality disorder, interpersonal dependence, psychopathology, religiosity, confidence and temptation self-efficacy, social functioning, and readiness for change). Follow-up assessments were conducted at 3, 6, 9, 12, and 15 months after the initial therapy session.

The Project MATCH Research Group (1997) found no significant differences in treatment outcomes based on the three different treatment types. However, the relapse rates in the Project MATCH sample are noteworthy. Only 35% of the participants reported continuous abstinence over the 15-month period, and 40% of the total inpatient sample reported more than three consecutive heavy-drinking days. The outpatient group

was less successful at abstaining, with 81% lapsing (single episode of heavy drinking) at some point during the 15 months, and 46% reporting at least three consecutive heavy drinking days.

The Project MATCH database was obtained from the NIAAA specifically for this project, and it is available for qualified investigators who contact the NIAAA.

Method

Participants

Participants in Project MATCH were recruited from nine research units, including five outpatient treatment facilities (Albuquerque, NM, Buffalo, NY, Farmington, CT, Milwaukee, WI, and West Haven, CT) and five inpatient-aftercare treatment centers (Charleston, SC, Houston, TX, Milwaukee, WI, Providence, RI, and Seattle, WA). Out of 4,481 potential participants screened for inclusion in Project MATCH, 4,022 participants agreed to take part in the investigation. The sample was then reduced based on a variety of ineligibility and exclusionary criteria, including noncompliance with protocol, legal or residential problems that prohibited travel to the treatment centers, comorbid psychopathology that would interfere with treatment, and failure to meet DSM-III-R criteria for alcohol abuse or dependence. The final sample included 1,726 participants.

Procedures

Participants provided informed consent and completed three intake assessments, which included personal videotaped interviews, computerized assessment techniques, self-report questionnaires, and blood and urine screening. Detoxification, under medical supervision, was provided for those participants who tested positive for alcohol use at the

time of the intake assessment. Upon completion of all intake assessments all participants

were randomly assigned to three different treatment modalities: Twelve Step Facilitation

Therapy (TSF), Motivation Enhancement Therapy (MET), or Cognitive-Behavioral

Treatment (CBT). Therapy sessions were videotaped to assure consistent treatment

delivery, and all participants received treatment for 12 weeks. Follow-up assessments

were conducted in three-month intervals for the first 15-months following treatment.

Further information on the MATCH trial protocol and treatment procedures have been

described by the Project MATCH Research Group (1997).

Intake Assessment

Participants who met the inclusion criteria were provided with a diagnostic

interview and screening, which included demographic history questioning, interview

assessments, and self-report questionnaires (photocopies of the measures used in Project

MATCH, with the exception of the Computerized Diagnostic Interview Schedule, are

provided in Appendix B).

Addiction Severity Index. The Addiction Severity Index (ASI; McLellan, et al.,

1992) consists of 57 items assessing seven categories of problems, related to addiction

severity, that an individual may have experienced in the past 30 days. For this

investigation only the family and psychiatric sections of the ASI were utilized. McLellan

and colleagues (1992) reported that the family and psychiatric indices of the ASI had

satisfactory validity based on normative samples of opioid, alcohol, and cocaine abusers,

drug abusing inmates, pregnant women, homeless men, and inpatient psychiatric

substance abusers. Internal consistency and test-retest reliability estimates for scores on

the ASI were estimated in a sample of treatment seeking substance abusers (Alterman,

Brown, Zaballero, & McKay, 1994). The internal consistency values ranged from .68 to .87, and test retest estimates ranged from .88 to .99.

Alcohol Abstinence Self-Efficacy Scale. The AASE (DiClemente, Carbonari, Montgomery, & Hughes, 1994) is a 20-item Likert-type scale used to measure self-reported expectations of ability to abstain from alcohol in a variety of situations. Given twenty high-risk situations subjects respond to their level of confidence in abstaining from alcohol. The authors assessed the reliability and validity of the scores on the AASE in a sample of individuals attending an outpatient alcohol treatment center. Factor analysis of the scores in that sample resulted in a four-factor solution. Cronbach's alpha for scores on the total scale in the sample was .92. To investigate the validity of the AASE the authors examined the relationship of AASE subscale scores with several demographic and alcohol use variables. These analyses suggested that the AASE has adequate convergent and discriminant validity (see DiClemente et al., 1994).

Beck Depression Inventory (BDI). The BDI (Beck, 1978) consists of 21 items assessing depressive symptoms. The BDI has been widely used to assess depressive symptomatology in alcohol abusing samples (Connors, et al., 1996; Hyer, Carson, Nixon, Tamkin, & Saucer, 1987; Miller, Westerberg, Harris, & Tonigan, 1996). Yin and Fan (2000) conducted a reliability generalization of the BDI employed in 90 different studies, including five studies that used the BDI in assessing depression in a substance abusing population. The average reliability of the scores on the BDI in substance abusing populations was .77 (SD = .008). The authors of this meta-analysis on the reliability of BDI scores concluded that the reliability estimates in the five studies that included

substance abusers were consistently lower than those from studies that used the BDI in non-substance abusing samples.

Computerized Diagnostic Interview Schedule (C-DIS). The C-DIS was developed to serve as a fully computerized, self-administered method of obtaining information needed to determine DSM-III diagnoses. Levitan, Blouin, Navarro, and Hill (1991) demonstrated that diagnoses from the C-DIS are in concordance with the original DIS and a semi-structured interview using a symptom checklist. The test-retest reliability of scores on the C-DIS was calculated in a psychiatric inpatient sample and the mean Cohen's kappa value was .57 (Blouin, Perez, & Blouin, 1988). The internal consistency of alcohol and substance use diagnoses on the C-DIS and the Structural Clinical Interview for DSM-IIIR ranged from .71 to 81 (Ross, Swinson, Larkin, & Doumani, 1994).

Form-90. Form-90 (Miller and Del Boca, 1994) is a structured clinical interview that was designed specifically for standardizing across all sites in Project MATCH. The primary goal of the Form-90 interview is to gather accurate information regarding a person's drinking behavior over a 90-day period prior to the interview. Form-90 incorporates both the time-line follow-back procedure (Sobell & Sobell, 1992) and drinking pattern estimations from the Comprehensive Drinker Profile (Miller & Marlatt, 1984). Percentage of days abstinent (PDA) is one post-treatment alcohol consumption estimates that can be derived from Form-90. PDA provides an estimate of the number of days without any drinking, and therefore has been considered a measure of drinking frequency (Potgieter, Deckers, & Geerlings, 1999). The reliability of the information gathered from Form-90 was assessed in two test-retest studies. Both studies were cross-

site reliability studies with different interviewers interviewing inpatient and outpatient substance abusers, and college drinkers. The mean intraclass correlation coefficient for PDA in the substance-abusing samples was .85.

Important People and Activities (IPA). The IPA (Clifford & Longabaugh, 1991) is a measure of a person's interaction with individuals who are identified as important in that person's social environment. Specifically, the IPA assesses the drinking behavior of the identified important people, the frequency of contact between the important person and the participant, and the reactions of the important people to the participant when the participant is, and is not, drinking. There is no published information about the reliability of scores on the IPA, and no validation studies have been published.

Shipley Institute of Living Scale (SILS). The SILS (Shipley, 1940) is a paper-and-pencil test, which assesses vocabulary and abstraction abilities. The test-retest reliability of scores on the SILS was calculated in a group of 181 psychiatric inpatients, and the results demonstrated that scores on the SILS are not stable over repeated administrations (Stone, 1965).

Stages of Change Readiness and Treatment Eagerness Scale, Short Form (SOCRATES). The short form of the SOCRATES (Miller & Tonigan, 1996) is a 19-item Likert-type scale assessing the motivation to change drinking behavior in individuals with drinking problems. When the 19 items are subjected to factor analysis, the SOCRATES produces three stable factors, Taking Steps, Recognition, and Ambivalence. These three factors explained 45% of the variance in item responses for the Project MATCH data set. The internal consistency of each scale in the MATCH data set was calculated using Cronbach's alpha. Alphas were .83 for Taking Steps, .85 for

Recognition, and .60 for Ambivalence. Miller and Tonigan (1996) also assessed the test-retest reliability of the SOCRATES in a non-randomly selected group of MATCH participants ($\underline{N}$ = 82). In the smaller group of patients alphas ranged from .87 to .96 for the three scales. Several studies have demonstrated the predictive and construct validity of the SOCRATES (see Miller & Tonigan, 1996).

Structured Clinical Interview for DSM-III-R Disorders (SCID). The SCID (Spitzer & Williams, 1985) is a semi-structured clinical interview that allows for assessment of DSM-III-R Axis I clinical disorders. Adequate concurrent, discriminant, and predictive validity for the SCID was demonstrated in a substance abuse population (Kranzler, Kadden, Babor, & Tennen, 1996). The interrater reliability of substance abuse diagnoses generated from the SCID in this sample of adults was found to range from .85 for substance abuse or dependence to .96 for alcohol abuse or dependence.

Follow-up assessments

Five follow-up assessments were conducted by either an in-person interview or a telephone interview with each participant. The Form-90, the BDI, and the ASI were all used to assess drinking behavior and psychosocial functioning at 3-, 9-, and 15-months post-treatment. Retrospective reports of the percentage of days abstinent (PDA) between 3-, 6-, 9-, 12-, and 15-months post-treatment were gathered using the Form-90.

Statistical Analyses

Data Reduction

Criterion variable formation. The criterion variables used in this investigation were based on the PDA outcome variable. In order to capture the dynamic change between a baseline assessment and a follow-up assessment, the polynomial regression

technique requires the criterion variable to be a change score (Guastello, 1982). For the purposes of this investigation the PDA at baseline was subtracted from the PDA at the 12-month follow-up assessment. This change score was then utilized as the criterion variable in the linear difference and linear interaction models. The linear pre-post model uses 12-month PDA as the criterion variable.

For the cusp catastrophe model Guastello (1982, 1992, 1995) recommends transforming all variables by location and scale. Guastello (1995) described several methods for these transformations, and recommends using a z-transformation (subtracting the mean and dividing by the standard deviation) when the change score is highly correlated with the baseline assessment. In this study, the PDA at baseline and 12-months were each transformed in this manner, and the dynamic difference equation used as the criterion variable is the standardized baseline PDA subtracted from the standardized 12-month PDA.

Predictor variable formation. Several predictor variables were identified based on the theoretical conceptualizations of relapse precipitants proposed by previous researchers. These include: number of alcohol dependence symptoms (Marlatt & Gordon, 1985); comorbid psychopathology (McLellan, Luborsky, Woody, O'Brien, & Druley 1983); alcohol self-efficacy expectancies (Donovan, 1996, Greenfield et al., 2000); psychological distress (McLellan, et al., 1983); risk typology (Zweben & Cisler, 1995); motivation for change (Project MATCH Research Group, 1998; Miller & Tonigan, 1996); and social functioning (Donovan, 1996; Shiffman, 1989). These constructs were operationally defined as each participant's score on various instruments in the Project MATCH data set and are summarized in Table 2.

Table 2. Proximal and Distal Risk Composites for Current Study

	Construct	Measure	M	SD
Distal Risk	Severity of alcoholism	SCID-III-R (Spitzer & Williams, 1985)	6.23	1.97
	Comorbid psychopathology	C-DIS (Robins, et al., 1989)	.38	.49
	Cognitive impairment	Shipley Institute of Living Scale (Shipley, 1940)	-.01	2.39
	Risk typology: Composite		Low Risk: n = 1191 (70%)	
	-family history of alcoholism	ASI (McLellan, et al., 1992)	High Risk: n = 520 (30%)	
	-Drinking behavior	MMPI MacAndrew scale (MacAndrew, 1965)		
	-Antisocial personality	C-DIS (Robins, et al., 1989)		
	-Alcohol dependency	SCID-III-R (Spitzer & Williams, 1985)		
Proximal Risk	Self-efficacy	AASE (DiClemente, et al., 1994)	-.15	1.53
	Affective state	BDI (Beck, 1967)	10.17	8.24
	Psychiatric distress	ASI (McLellan, et al., 1992)	.21	.20
	Social support for drinking	IPA (Longabaugh, Wirtz, & Clifford, 1991)	-.0002	.49
	Motivation for change	SOCRATES (Miller & Tonigan, 1996)	11.90	4.10

In order to construct the normal and splitting parameters for testing the cusp model, these scores were entered into a Principal Component Analysis (PCA) with the number of factors set at two. Varimax rotation was used to enhance the interpretability of the resulting components. The sums of squared loadings for the first rotated component was 1.81 (20.1% of the variance) and for the second, 1.25 (13.9% of the variance). The

rotated component loadings (correlations between each variable and each component) for

each variable are shown in Table 3. The weighted component scores were then used as

the predictor variables in the linear comparison models. For the cusp catastrophe model

the two component scores were transformed by location (subtracting the mean) and scale

(dividing by the standard deviation).

Table 3. <u>Rotated Component Loadings for Proximal and Distal Risk Components.</u>

Variable	Proximal	Distal
Severity of alcoholism	.46	**.49**
Comorbid psychopathology	.17	**.22**
Risk typology	.39	**.47**
Psychiatric distress	**.76**	-.11
Affective state	**.78**	-.07
Self-efficacy	**.44**	.10
Cognitive impairment	-.15	**.47**
Social support for drinking	.13	**-.54**
Motivation for change	.11	**.46**

<u>Note.</u> Component loadings in bold type have the highest loadings on that component.

<u>Model Fit</u>

The regression analyses used in the pilot study (see equations 1 through 4) were

replicated for this investigation. In addition the study variables were analyzed using the

generalized multivariate method (Oliva, et al., 1987) and the maximum likelihood

method (Cobb, 1981).

<u>Generalized multivariate method.</u> The generalized multivariate method was used

to estimate the cusp catastrophe model empirically. Oliva, et al., (1987) proposed a

General Multivariate methodology for estimating catastrophe models (GEMCAT) that

uses a latent variable approach in testing catastrophe models. Lange (2000) developed a 32-bit windows based computer program, GEMCAT II, which allows the normal and splitting parameters, and the criterion variable to be represented by three latent variables consisting of linear combinations of observed variables.

GEMCAT II allows the researcher to either estimate or fix the weights for each variable, and at least one of the weights must be fixed. For estimating the variable weights the program uses two algorithms, the Downhill Simplex method and Powell's Conjugate Gradient approach, which minimize the squared residuals between all observations. For more information about these algorithms see the GEMCAT II manual (Lange, 2000).

For this study, two catastrophe models were estimated using GEMCAT II. Because of the exploratory nature of this project the weights of the criterion variable were fixed at .30, .50, and 1.00 for both models. These weights were chosen to assess the difference in model fit for small, medium, and large contributions of the criterion variable. For the first model the proximal and distal risk components were entered as the normal and splitting parameters, respectively, and their weights were estimated by the GEMCAT II program. The second model included each of the nine variables used in the PCA, described above, entered into GEMCAT II as observed variables. The nine variables were classified as the normal and splitting latent parameters based on the PCA component loadings, seen in Table 3. For both models, all of the variables were standardized, and the initial estimation was replicated 200 times using the bootstrap method.

Maximum likelihood. Cobb (1978, 1981) developed a method that relies on

maximum likelihood estimation of the normal and splitting parameters. Cobb (1998) has

developed a computer program for estimating the parameters of a data set titled the "Cusp

Surface Analysis Program" (CUSP). CUSP begins by analyzing the estimated

coefficients of the linear regression model given by the observed data. These estimations

are then iterated, using the Newton-Raphson method, to provide the best possible fit to a

cusp catastrophe model. Cobb (1998) recommends testing the model in three ways: 1)

using a chi-square test to compare the fit of the cusp and linear models, 2) inspecting that

the coefficients of the cubic term and one of the control parameters are statistically

significant, and 3) determining that at least 10% of the data points are in the bimodal

portion of the cusp model.

Results

Table 4 provides the means and standard deviations of the criterion and predictor

variables (before standardization) used in the linear regression models. For the

polynomial regression, GEMCAT, and CUSP models all of the study variables were

standardized and therefore have a mean of zero and a standard deviation of one.

Table 4. Descriptive Statistics for Predictor and Criterion Variables.

Variable	M	SD	Range
PDA baseline	.32	.30	.00 - .99
PDA 12-months	.78	.33	.00 - 1.00
Proximal risk component	-.012	1.00	-2.18 – 3.63
Distal risk component	-.005	1.01	-3.29 – 3.55

Polynomial Regression and Linear Comparsion Models

The linear difference model (equation 1) predicted 4.8% of the variance in the

PDA change score (F (2, 1241) = 31.62, p < .0005). In this model the distal risk

component was significant (β = -.21, t = -7.74, p < .0005) in predicting the criterion

variables, and the proximal risk component was not significant (β = .05, t = 1.89, p =

.06).

The linear pre-post model (equation 2) predicted a statistically significant amount

of variance in the criterion variable (R^2 = .097, F (3, 1240) = 44.21, p < .0005). All of the

predictors in this model were statistically significant (Proximal risk: β = -.11, t = -4.02, p

< .0005; Distal risk: β = .14, t = 5.07, p < .0005; PDA-baseline: β = .27, t = 9.74, p <

.0005).

The linear interaction model (equation 3) accounted for 4.9% of the variance in

the PDA change score (F (3, 1240) = 21.22, p < .0005). Both the distal and proximal risk

components were significant in this model (Proximal risk: β = .06, t = 1.97, p = .05;

Distal risk: β = -.21, t = -7.71, p < .0005) and the interaction term was not significant (β =

.02, t = .65, p = .52).

The cusp catastrophe model (equation 4) explained 32.1% of the variance in the

transformed PDA change score (F (4, 1239) = 146.22, p < .0005). All of the predictors in

the cusp model were statistically significant ($Z_{Proximal\ Risk}$: β = -.08, t = -3.35, p = .001; Z

$_{(Distal\ Risk\ *PDA\ at\ baseline)}$: β = -.07, t = -2.81, p = .005; $Z_{PDA\ at\ baseline}^2$: β = .27, t = 5.98, p <

.0005; $Z_{PDA\ at\ baseline}^3$: β = -.78, t = -17.58, p < .0005).

Generalized Multivariate Method for Estimating Cusp Models

Two catastrophe models were estimated using GEMCAT II (Lange, 2000).

The first model replicated the predictor and criterion variables that were used in the

polynomial regression equation. The weight of the criterion variable was fixed at .30.

The Pseudo-R^2 index was .93 (Pseudo-F (1, 1242) = 17,513.16), and the estimated

weights of the predictor variables were .007 for the proximal risk component, and .0009

for the distal risk component.

The second model included the nine observed variables that were used to create

the proximal and distal risk components. The weight of the criterion variable was also

fixed at .30. The Pseudo-R^2 index for this model was .96 (Pseudo-F (8, 1413) =

3,920.76). The estimate weights for the nine predictor variables are listed in Table 5.

Table 5. Indicator Weights Estimated by GEMCAT II.

Latent Variable	Observed Variable	Weight
Proximal risk	Psychiatric distress	.006
	Affective state	.002
	Self-efficacy	-.005
Distal risk	Severity of alcoholism	.012
	Comorbid psychopathology	-.008
	Cognitive impairment	-.02
	Risk typology	-.002
	Motivation for change	-.001
	Social support for drinking	.02

Each of these models was then tested with the criterion variable fixed at .5. For

both models the Pseudo-R^2 was reduced to .49 (first model) and .66 (second model).

Each model was further tested with the criterion variable fixed at 1.0. GEMCAT would

not run with the weight set at 1.0; and with the weight of the criterion variable set at

.9999 GEMCAT II returned a negative Pseudo-R^2 value for both models. The Pseudo-

R^2 value is computed by subtracting the residual sums of squares divided by the total

sums of squares for the dependent variable by one. A negative Pseudo-R^2 value

indicates that the ratio of the residuals sums of squares to the total sums of squares is

greater than one.

Cusp Surface Analysis Program

The proximal risk, distal risk, and 12-month PDA were entered into the CUSP

program. The total data file was too large for the CUSP program to analyze. To correct

for this problem, 20% of the participants in the total data file were randomly sampled

three times, creating three samples of 263 participants. In all three samples the iterations

were halted with an error message stating that the "cubic coefficient is vanishing." Cobb

(1998) indicates that this message will occur when the Newton-Raphson iteration yields a

negative coefficient for the cubic term. He interprets this condition as indicating that the

cusp model does not fit the data better than a linear model.

Discussion

The purpose of this study was to investigate the process of relapse using

catastrophe theory. Specifically, this study was designed to address two objectives. The

primary goal was to replicate and extend the preliminary findings from two pilot studies

(Hufford, et al., under review), which provided evidence for the superiority of a cusp

catastrophe model, over traditional linear models, in predicting substance abuse treatment

outcomes. The secondary goal was to compare three different methods for analyzing

cusp catastrophe models: polynomial regression (Guastello, 1992, 1995), generalized

multivariate (Oliva, et al., 1987), and maximum likelihood parameter estimation (Cobb,

1978, 1981).

Replication and Extension of the Pilot Studies

The results from this study support the preliminary evidence for the applicability of cusp catastrophe models to the phenomenon of relapse. Using the polynomial regression method, the cusp catastrophe model explained 22.4% more variance in the criterion variable than the most efficacious linear comparison model. This finding is consistent with the results from the two pilot studies. The present study provides additional support for the unique contributions of the nonlinear terms in the polynomial regression model. All of the predictors in the model were significant and the cubic term accounted for the largest proportion of unique variance.

The present study extended the pilot studies by using a more empirical approach in forming the predictor variables. In the pilot studies and the current investigation Principal Component Analysis (PCA) was used to create linear composites of the variables that were consistent with Shiffman's (1989) conceptualization of distal and proximal risk. For each of the pilot studies the measured variables were entered into two PCAs with the number of components set equal to one. Therefore, one PCA created a distal risk component and the other created a proximal risk component. In the current study, all of the measured variables were entered into a single PCA with the number of extracted components set equal to two. This allowed for the linear composites to be created by accounting for each variable's loading on both the distal risk and the proximal risk component. The two orthogonal component scores were used as the normal and splitting parameters in the cusp catastrophe model. The breakdown of proximal and distal risk components is consistent with Shiffman's (1989) conceptualization of the variables that may constitute distal and proximal risk.

Comparison of Cusp Catastrophe Methods

The polynomial regression technique is the most widely used method for analyzing the fit of cusp catastrophe models to empirical data (Guastello, 1995). The generalized multivariate method (GEMCAT) is generally the easiest method to employ, with the researcher only required to entire data into a windows-based software program and then select the latent variables to be represented by the observed data. The Cusp Surface Analysis Program (CUSP) is also a user-friendly method for computing the fit of data to a cusp catastrophe model. It is designed to only analyze a cusp catastrophe (for example, it will not analyze a fold or butterfly catastrophe model) and the program will only run with a limited number of subjects (in the current study 250 was the maximum number of cases that the program would run). Each of these techniques has received criticism (see Alexander, et al., 1992; Guastello, 1995), and no other study has attempted to compare these three methods using the same data.

Polynomial regression. As described above, the results from the polynomial regression technique suggest that the data fit a catastrophe model better than any linear comparison model. One criticism of polynomial regression is the inherent relationship between the predictor and criterion variables (Alexander, et al., 1992; Hufford, et al., under review). Both the dynamic difference equation (the criterion variable) and three out of four predictor variables (the cubic, quadratic, and splitting parameter terms) use transformations of the same baseline measure (PDA at baseline in this study). If the criterion variable and predictor variables are highly correlated, as they often will be under these circumstances, then the polynomial regression equation may simply reflect a measure of this redundancy.

For this reason, interpretations based on the findings from a polynomial regression model need to be interpreted with caution. If a researcher has highly intercorrelated variables then the polynomial regression method will identify the linear relationships between these variables. One way of reducing the intercorrelation between variables is using the transformation by location and scale proposed by Guastello (1995). In the pilot studies all of the variables were transformed by subtracting the lower limit (location) and then dividing by the standard deviation (scale). After transformation in the pilot studies the greatest correlation between the predictors and the criterion variable was .91 (outpatient sample) and .66 (outpatient sample). Guastello (1995) recommends that when variables are intercorrelated it may be advantageous to use the mean value as location, therefore subtracting the mean of the values. This method of transformation was employed in the current study, and it reduced the intercorrelations between the predictor and criterion variables ($r = .54$). There are several methods for transforming by location and scale (see Guastello, 1995) and although one should always use a transformation that most accurately represents the data, it may be useful to consider a method that minimizes the relationships between the predictor and criterion variables.

Generalized multivariate method. The two GEMCAT II models were tested and compared based on Pseudo- R^2 and Pseudo-F values. The first model used the same variables that were used in calculating the polynomial regression equation. The results from this model suggest a highly significant fit between the cusp catastrophe model and the empirical data. The second model used the variables that had been entered into the PCA as observed variables representing two latent variables, which were defined based on the loadings found in the PCA. This model also suggested a highly significant fit.

However, when the initial weight of the dynamic difference equation was increased from .3 to .5, the model did not fit the data as well. When the initial weight was increased to .9999 the program returned a meaningless result. The author of the GEMCAT program was contacted and his response to these results was:

> The program is not like, say, factor analysis in that it will behave regardless of what one throws at it. The best way to look at it is as a hypothesis testing device, which presumes that you know at least some weights. In other words, the results will vary with the extent to which you pick the right weight to constrain. Things go smoothest if you already have some notion of what the weights should be (R. Lange, personal communcation, October, 2000).

Based on this statement, it appears that GEMCAT may be most appropriate as a confirmatory technique, rather than an exploratory one. In the present study, the weights were not known a priori, and therefore the results from the GEMCAT analysis are difficult to interpret.

Method of maximum likelihood. In the current study the method of maximum likelihood estimation, tested using the CUSP program (Cobb, 1998), indicated that the data did not fit a catastrophe model. The CUSP program stopped iterating upon one of the parameters being estimated at a negative value. This result indicates that, based on the estimations used in CUSP, the data does not fit a cusp surface. Given that the other methods for analyzing cusp catastrophe models suggested that the data fit a cusp model much better than a linear model, it is interesting that the CUSP program estimations did not converge on this finding.

One possible explanation is that the predictors are entered into the CUSP program in a randomized order, with only the criterion variable being specified. The theory behind catastrophe modeling is that each control parameter serves a very specific purpose in the model. But the CUSP program does not allow for the a priori arrangement of the normal and splitting parameters. Alexander and colleagues (1992) and Guastello (1995) have suggested that one drawback of the method of maximum likelihood estimation is that it requires a multitude of estimations and may therefore capitalize on chance. Based on the current study and these previous criticisms, the CUSP program may be summarized as an exploratory technique for analyzing a cusp catastrophe model.

Three methods for analyzing cusp catastrophe models were applied to the prediction of post-treatment drinking outcomes in a large group of people who had received 12-weeks of treatment for alcohol use problems. There was disagreement between these methods as to whether a cusp catastrophe model better fit the data than a linear model. The method of maximum likelihood (Cobb, 1981) appears to be too exploratory, in that the CUSP program did not allow for the parameters to be identified a priori. The generalized multivariate method (Oliva, et al., 1987) is too confirmatory, in that GEMCAT requires at least one of the parameters to have a fixed weight, which should be determined based on previous research. The polynomial regression technique (Guastello, 1995) provided the most interpretable result. It allowed for the control parameters to be specified a priori, and it estimated all of the parameter weights.

Limitations of the Current Study

The current study had several limitations. In regards to the predictor variable formation, several of the measures used in Project MATCH and the current study may

produce scores with low reliabilities. The data that was used in this study came from the NIAAA in the form of summary scores, and no item-level information was provided. When available, the reliabilities of scores from the MATCH data set were described in the Methods section of this paper, but for several of the measures (e.g., ASI, AASE, BDI, Form-90, SCID, SIL) the reliabilities of the scores from MATCH were unknown.

In addition to the psychometric limitations of the predictor variables, the current study was also limited to the information obtained from the Project MATCH data. Although many of the hypothesized determinants of relapse were incorporated into this investigation there are several key variables that were not included. In particular, information on coping skills and temptations were not provided by any of the measures in Project MATCH. Litman's (1986) model is based largely on a person's coping strategies. Shiffman (1989) also places a strong emphasis on the lack of appropriate coping mechanisms as a distal risk factor. Temptations and physiological withdrawal from alcohol are two mechanisms that may exert a powerful influence on the recovering alcoholic. The limbic system may also play a very important role in the relapse process (Adinoff, O'Neill, & Ballenger, 1995). However, none of these risk factors were assessed.

The criterion variable formation may also be problematic. The creation of this variable was based on the assumption that a nonlinear dynamical change occurred between the baseline PDA and the PDA at the 12-month follow-up. Twelve months may not be a long enough measurement interval, or the baseline measure may not be a good starting point for assessing change. Furthermore, the difference between these two intervals may not provide an adequate time span for the cusp to emerge. If relapse is

truly a catastrophe, then it seems more probable that the response surface would be better estimated from several measurements of drinking behavior for many years following treatment.

The measurement of drinking behavior is another limitation of this study. Form-90 uses retrospective, self-reported information for estimating the PDA of each participant. An individual's retrospective reconstruction of behavior and events is often shown to have biases (Bradburn, Rips, Shevell, 1987). Recounts of relapse, in particular, may be highly influenced by a person's schemas about addictive behavior (Shiffman, et al., 1997). For those who did not have a single drink following treatment it may not be difficult to recount the number of days they were abstinent (100%), but those who drank occasionally may have a much higher incidence of biased reporting.

The methods used to analyze a cusp catastrophe have several limitations, many of which are described above. The polynomial regression technique may produce spurious results if the variables are highly intercorrelated. The GEMCAT II program relies heavily on existing knowledge of the importance of each variable in the model and also tends to overestimate the goodness of fit of a model. The CUSP program does not allow for a priori designation of the normal and splitting parameters and may be susceptible to statistical errors due to multiple estimations of the parameters

Summary and Conclusions

Despite the various limitations of the current study the results from the polynomial regression method suggest that a cusp catastrophe model provides a better fit to the data than the traditional linear models tested in this study. This finding provides additional empirical support for the conceptualization of relapse as a dynamic

phenomenon. Future research should continue to explicate the nonlinear relationships between risk factors and post-treatment drinking outcomes found in the current study. The dynamical nature of relapse may be further studied by a time-series design, which would capture information about the movement of a person through the recovery process.

Future studies could also incorporate other methods for estimating post-treatment drinking behavior (e.g., Ecological Momentary Assessment, see Stone & Shiffman, 1994) and different conceptualizations of proximal and distal risk factors (see Donovan, 1996). Other catastrophe models, such as the butterfly or swallowtail, may also provide meaningful representations of the relationship between these risk factors and post-treatment drinking outcomes. The ultimate goal is to provide a better understanding of relapse so that individual's who are struggling to remain abstinent may be provided with the necessary tools for overcoming obstacles in their recovery. Or, in the vernacular of the catastrophe literature these models may help individuals remove themselves from a hysteresis cycle and remain on the abstinence sheet of the cusp.

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Footnote

1.   The pilot studies presented incorporate the three linear models that have been

supported by the literature. An additional model, which seemed to provide a more

rigorous test of the cusp model, was tested as part of the data analysis for these studies.

An adaptation of the pre-post linear model, called the pre-change model,

$$\hat{Y}_2 - \hat{Y}_1 = b_0 + b_1 X_1 + b_2 X_2 + b_3 Y_1 \tag{5}$$

incorporates drinking at Time 1 as a predictor variable, as in the pre-post model; but,

unlike the pre-post model, it uses change in drinking from Time 1 to Time 2 as the

criterion measure.

The pre-change model shares the cusp model's advantage of having a predictor

(Y_1) that is inherently correlated with the criterion measure $(Y_2 - Y_1)$. This model was

evaluated using the data from both studies, and in each case the pre-change model

accounted for as much, or more, variance in the criterion as the cusp model. It appeared

that the polynomial regression technique was ignoring a fruitful "linear" model. S. J.

Guastello (personal communication, July 2000) responded that when you mathematically

integrate the pre-change model it results in the function:

$$f(Y) = (X_1 + X_2) Y + Y^2, \tag{6}$$

which contains a quadratic term. Therefore, the pre-change model is not a linear

comparison, but rather a nonlinear comparison model. Future studies should investigate

the merit of the pre-change model as a nonlinear comparison for a cusp catastrophe

model.

I D No [ ]   Date [ ]   Month No [ ]

THE ADDICTION SEVERITY INDEX

APPENDIX A

INSTRUCTIONS:
Leave no blanks - where appropriate code items
X = question not answered
N = question not applicable

PATIENT'S RATING SCALE:
0 = Not at all
1 = Slightly
2 = Moderately
3 = Considerably
4 = Extremely

Office use only
ID. ____

MEDICAL STATUS

1. How many days have you experienced medical problems in the past 30 days? [ ]

FOR QUESTIONS 2 AND 3, PLEASE ASK PATIENT TO USE THE
PATIENT'S RATING SCALE.

2. How troubled or bothered have you been by these medical problems in the past 30 days? [ ]

3. How important to you now is treatment for these medical problems? [ ]

COMMENTS:
_____
_____
_____

EMPLOYMENT/SUPPORT STATUS

4. Do you have a valid driver's license?   0 - No   1 - Yes [ ]

5. Do you have an automobile available for your use?   0 - No   1 - Yes [ ]
   (Answer "No" if no valid driver's license)

6. How many days were you paid for working in the past 30 days? [ ]
   (Include "under the table" work)

7. How much money did you receive from employment in the past 30 days? [ ]
   (net income)

ALCOHOL USE
Office Use only

8. Alcohol - any use at all in the past 30 days? (# of days) [ ]

9. Alcohol - to intoxication in the past 30 days? (# of days) [ ]

10. How much money would you say you spent during the past 30 days on alcohol? [ ]

11. How many days in the past 30 have you experienced alcohol problems? [ ]

FOR QUESTIONS 12 AND 13, PLEASE ASK PATIENT TO USE THE
PATIENT'S RATING SCALE.

12. How troubled or bothered have you been in the past 30 days by alcohol problems? [ ]

13. How important to you now is treatment for alcohol problems? [ ]

COMMENTS:
_____
_____

DRUG USE

14. Heroin - any use at all in the past 30 days? (# of days) [ ]

15. Methadone - any use at all in the past 30 days? (# of days) [ ]

16. Other opiates/analgesics - any use at all in the past 30 days? (# of days) [ ]

17. Barbiturates - any use at all in the past 30 days? (# of days) [ ]

18. Other sed/hyp/tranq - any use at all in the past 30 days? (# of days) [ ]

19. Cocaine - any use at all in the past 30 days? (# of days) [ ]

20. Amphetamines - any use at all in the past 30 days? (# of days) [ ]

21. Cannabis - any use at all in the past 30 days? (# of days) [ ]

22. Hallucinogens - any use at all in the past 30 days? (# of days) [ ]

23. How many days in the past 30 have you experienced drug problems? [ ]

24. How troubled or bothered have you been in the past 30 days by drug problems? [ ]

25. How important to you now is treatment for drug problem [ ]

COMMENTS
_____
_____

FAMILY/SOCIAL RELATIONSHIPS

A. What is your current marital status?   CHECK ONE.
___ (1) Married
___ (2) Remarried
___ (3) Widowed
___ (4) Separated
___ (5) Divorced
___ (6) Never married
[ ]

31. Are you satisfied with this marital situation?   0 - No   1 - Indifferent   2 - Yes [ ]

FAMILY/SOCIAL RELATIONSHIPS (CONT.)
Office Use only

32. How many days in the past 30 have you had serious conflicts with your family? [ ]

In the past 30 days have you had significant periods in which you have experienced
serious problems with:
                                    0-no   1-yes

33. Mother _____ [ ]

34. Father _____ [ ]

35. Brothers/Sisters _____ [ ]

36. Sexual partner/spouse _____ [ ]

37. Children _____ [ ]

38. Other significant family _____ [ ]   nly

39. Close friends _____ [ ]   —

40. Neighbors _____ [ ]

41. Co-workers _____ [ ]

FOR QUESTIONS 42 AND 43, PLEASE ASK PATIENT TO USE THE
PATIENT'S RATING SCALE.

42. How troubled have you been in the past 30 days by family problems? [ ]

43. How important to you now is treatment or counseling for family problems? [ ]

COMMENTS

PSYCHIATRIC STATUS

In the past 30 days have you had a significant period, (that was not a direct result of drug/
alcohol use), in which you have.   0 - no   1 - yes

44. Experienced serious depression? _____ [ ]

45. Experienced serious anxiety or tension? _____ [ ]

46. Experienced hallucinations? _____ [ ]

47. Experience trouble understanding, concentrating, or remembering? ___ [ ]

48. Experienced trouble controlling violent behavior? ____ [ ]

49. Experienced serious thoughts of suicide? _____ [ ]

50. Attempted suicide? _____ [ ]

51. Have you taken prescribed medication for any psychological/emotional problems? ___ [ ]

52. How many days in the past 30 have you experienced these psychological or
emotional problems? _____ [ ]

FOR QUESTIONS 53 AND 54, PLEASE ASK PATIENT TO USE
THE PATIENT'S RATING SCALE.

53. How much have you been troubled or bothered by these psychological or emotional
problems in the past 30 days? [ ]

54. How important to you now is treatment for these psychological problems? [ ]

COMMENTS
_____

What are your current Medications?
Name .... Dose........... mg. #days taken this month [ ]
Name .... Dose........... mg. #days taken this month [ ]
Name .... Dose........... mg. #days taken this month [ ]
Name .... Dose........... mg. #days taken this month [ ]

55. Are you taking Naltrexone? [ ]

56. What dose? [mg]

57. How many days have you taken Naltrexone in the past 30 days? [ ]

Beck Depression Inventory – Second Edition

Date

Name: _____ Marital Status: _____ Age: _____ Sex: _____

Occupation _____ Education: _____

Instructions: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the one statement in each group that best describes the way you have been feeling during the past two weeks, including today. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

1. Sadness
0 I do not feel sad.
1 I feel sad much of the time.
2 I am sad all the time.
3 I am so sad or unhappy that I can't stand it.

2. Pessimism
0 I am not discouraged about my future.
1 I feel more discouraged about my future than I used to be.
2 I do not expect things to work out for me.
3 I feel my future is hopeless and will only get worse.

3. Past Failure
0 I do not feel like a failure.
1 I have failed more than I should have.
2 As I look back, I see a lot of failures.
3 I feel I am a total failure as a person.

4. Loss of Pleasure
0 I get as much pleasure as I ever did from the things I enjoy.
1 I don't enjoy things as much as I used to.
2 I get very little pleasure from the things I used to enjoy.
3 I can't get any pleasure from the things I used to enjoy.

5. Guilty Feelings
0 I don't feel particularly guilty.
1 I feel guilty over many things I have done or should have done.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.

6. Punishment Feelings
0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

7. Self-Dislike
0 I feel the same about myself as ever.
1 I have lost confidence in myself.
2 I am disappointed in myself.
3 I dislike myself.

8. Self-Criticalness
0 I don't criticize or blame myself more than usual.
1 I am more critical of myself than I used to be.
2 I criticize myself for all of my faults.
3 I blame myself for everything bad that happens.

9. Suicidal Thoughts or Wishes
0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10. Crying
0 I don't cry anymore than I used to.
1 I cry more than I used to.
2 I cry over every little thing.
3 I feel like crying, but I can't.

11. Agitation
0 I am no more restless or wound up than usual.
1 I feel more restless or wound up than usual.
2 I am so restless or agitated that it's hard to stay still.
3 I am so restless or agitated that I have to keep moving or doing something

12. Loss of Interest
0 I have not lost interest in other people or activities.
1 I am less interested in other people or things than before.
2 I have lost most of my interest in other people or things.
3 It's hard to get interested in anything.

13. Indecisiveness
0 I make decisions about as well as ever.
1 I find it more difficult to make decisions than usual.
2 I have much greater difficulty in making decisions than I used to.
3 I have trouble making any decisions.

14. Worthlessness
0 I do not feel I am worthless.
1 I don't consider myself as worthwhile and useful as I used to.
2 I feel more worthless as compared to other people.
3 I feel utterly worthless.

15. Loss of Energy
0 I have as much energy as ever.
1 I have less energy than I used to have.
2 I don't have enough energy to do very much.
3 I don't have enough energy to do anything.

16. Changes in Sleeping Pattern
0 I have not experienced any change in my sleeping pattern.
1a I sleep somewhat more than usual.
1b I sleep somewhat less than usual.
2a I sleep a lot more than usual.
2b I sleep a lot less than usual.
3a I sleep most of the day.
3b I wake up 1-2 hours early and can't get back to sleep.

17. Irritability
0 I am no more irritable than usual.
1 I am more irritable than usual.
2 I am much more irritable than usual.
3 I am irritable all the time.

18. Changes in Appetite
0 I have not experienced any change in my appetite.
1a My appetite is somewhat less than usual.
1b My appetite is somewhat greater than usual.
2a My appetite is much less than before.
2b My appetite is much greater than usual.
3a I have no appetite at all.
3b I crave food all the time.

19. Concentration Difficulty
0 I can concentrate as well as ever.
1 I can't concentrate as well as usual.
2 It's hard to keep my mind on anything for very long.
3 I find I can't concentrate on anything.

20. Tiredness or Fatigue
0 I am no more tired or fatigued than usual.
1 I get more tired or fatigued more easily than usual.
2 I am too tired or fatigued to do a lot of the things I used to do.
3 I am too tired or fatigued to do most of the things I used to do.

21. Loss of Interest in Sex
0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I am much less interested in sex now.
3 I have lost interest in sex completely.

_____ Subtotal Page 1

Continued on Back

NOTICE

_____ Subtotal Page 2
_____ Subtotal Page 1

Situational Confidence Questionnaire

...ted below are a number of situations ... ... people experience a drinking problem.

Imagine yourself as you are right now in each of these situations. Indicate on the scale provided how confident you are that you would be able to resist the urge to drink heavily in that situation.

Circle 100 if you are 100% confident right now that you could resist the urge to drink heavily; 80 if you are 80% confident; 60 if you are 60% confident. If you are more unconfident than confident, circle 40 to indicate that you are only 40% confident that you could resist the urge to drink heavily; 20 for 20% confident; 0 if you have no confidence at all about that situation.

I would be able to resist the urge to drink heavily

	not at all confident				very confident	
1. If I felt that I had let myself down	0	20	40	60	80	100
2. If there were fights at home	0	20	40	60	80	100
3. If I had trouble sleeping	0	20	40	60	80	100
4. If I had an argument with a friend	0	20	40	60	80	100
5. If other people didn't seem to like me	0	20	40	60	80	100
6. If I felt confident and relaxed	0	20	40	60	80	100
7. If I were out with friends and they stopped by a bar for a drink	0	20	40	60	80	100
8. If I were enjoying myself at a party and wanted to feel even better	0	20	40	60	80	100
9. If I remembered how good it tasted	0	20	40	60	80	100
10. If I convinced myself that I was a new person and could take a few drinks	0	20	40	60	80	100

I would be able to resist the urge to drink heavily

	not at all confident				very confident	
21. If I were angry at the way things had turned out	0	20	40	60	80	100
22. If other people treated me unfairly	0	20	40	60	80	100
23. If I felt nauseous	0	20	40	60	80	100
24. If pressure built up at work because of the demands of my supervisor	0	20	40	60	80	100 N/A
25. If someone criticized me	0	20	40	60	80	100
26. If I felt satisfied with something I had done	0	20	40	60	80	100
27. If I were relaxed with a good friend and wanted to have a good time	0	20	40	60	80	100
28. If I were in a restaurant and the people with me ordered drinks	0	20	40	60	80	100
29. If I unexpectedly found a bottle of my favorite booze	0	20	40	60	80	100
30. If I started to think that just one drink could cause no harm	0	20	40	60	80	100

I would be able to resist the urge to drink heavily

	not at all confident				very confident	
11. If I were afraid that things weren't going to work out	0	20	40	60	80	100
12. If other people interfered with my plans	0	20	40	60	80	100
13. If I felt drowsy and wanted to stay alert	0	20	40	60	80	100
14. If there were problems with people at work	0	20	40	60	80	100 N/A
15. If I felt uneasy in the presence of someone	0	20	40	60	80	100
16. If everything were going well	0	20	40	60	80	100
17. If I were at a party and other people were drinking	0	20	40	60	80	100
18. If I wanted to celebrate with a friend	0	20	40	60	80	100
19. If I passed by a liquor store	0	20	40	60	80	100
20. If I wondered about my self-control over alcohol and felt like having a drink to try it out	0	20	40	60	80	100

I would be able to resist the urge to drink heavily

	not at all confident				very confident	
31. If I felt confused about what I should do	0	20	40	60	80	100
32. If I felt under a lot of pressure from family members at home	0	20	40	60	80	100
33. If my stomach felt like it was tied in knots	0	20	40	60	80	100
34. If I were not getting along well with others at work	0	20	40	60	80	100 N/A
35. If other people around me made me tense	0	20	40	60	80	100
36. If I were out with friends "on the town" and wanted to increase my enjoyment	0	20	40	60	80	100
37. If I met a friend and he/she suggested that we have a drink together	0	20	40	60	80	100
38. If I suddenly had an urge to drink	0	20	40	60	80	100
39. If I wanted to prove to myself that I could take a few drinks without becoming drunk	0	20	40	60	80	100

Structured Clinical Interview for the DSM-IV

E. ALCOHOL AND OTHER SUBSTANCE USE DISORDERS

E7 p. 41

		?	—	+	
E1	Had a period of excessive drinking OR had evidence of alcohol-related problems		E17 p. 43		E1

ALCOHOL ABUSE CRITERIA

A. A maladaptive pattern of alcohol use leading to clinically significant impairment or distress, as manifested by one (or more) of the following occurring within a 12-month period:

		?	—	+	
E2	(1) failure to fulfill major role obligations at work, school, or home Notes:	?	—	+	E2
E3	(2) use in situations in which it is physically hazardous Notes:	?	—	+	E3
E4	(3) recurrent alcohol-related legal problems Notes:	?	—	+	E4
E5	(4) continued alcohol use despite having problems caused or exacerbated by the effects of alcohol Notes:	?	—	+	E5
E6	AT LEAST ONE ABUSE ITEM IS "+"	?	— E17 p. 43	+	E6

ALCOHOL DEPENDENCE CRITERIA

A maladaptive pattern of alcohol use, leading to clinically significant impairment or distress, as manifested by three (or more) of the following occurring at any time in the same 12-month period:

		?	—	+	
E7	(3) often taken in larger amounts OR over a longer period than was intended Notes:	?	—	+	E7
E8	(4) there is a persistent desire OR unsuccessful effort to cut down or control alcohol use Notes:	?	—	+	E8
E9	(5) a great deal of time is spent in activities necessary to obtain alcohol, use alcohol, or recover from its effects Notes:	?	—	+	E9
E10	(6) important social, occupational, or recreational activities are given up or reduced because of use Notes:	?	—	+	E10
E11	(7) continued use despite knowledge of having a persistent or recurrent physical or psychological problem Notes:	?	—	+	E11
E12	(1) tolerance Notes:	?	—	+	E12

Ratings: ? = Inadequate information; — = Absent (or subthreshold; + = Present

---

E. ALCOHOL/OTHER SUBSTANCES

SCID-CV Scoresheet

		?	—	+	
E13	(2) withdrawal Notes:	?	—	+	E13
E14	AT LEAST THREE DEPENDENCE ITEMS ARE "+" AND OCCURRED WITHIN THE SAME 12-MONTH PERIOD	?	— E2, p. 40 E16, below	+	E14
E15	303.90 Alcohol Dependence Check here ___ if criteria have been met in the past month.			+	E15

Alcohol Dependence

E17 p. 43

				+	
E16	305.00 Alcohol Abuse Check here ___ if criteria have been met in the past month.			+	E16

Alcohol Abuse

E17 p. 43

Ratings: ? = Inadequate information; — = Absent (or subthreshold); + = Present

Time Line Follow Back

TIME LINE FOLLOW BACK (X PAST 30 DAYS)

ID #:_____

DATE:___/___/___

EVALUATOR:_____

MEDS? Y N
Rx Date:_____
MNC= Non-compliant

DRUGS:

H= Heroin
M= Methadone
O= Opiates
BA= Barbituates
S= Sed, hyp; tranq

Amp= Amphet
MJ= Marijuana
Hal= Hallucinogens
I= Inhalents

SUBSTANCE USE CODES:

A= Abstinant
B= Beer
L= Liquor (vodka, whiskey, rum)
G= Glass
W= Wine (natural)

WF= Wine (fortified)
LI= Liquer
BO= Bottle
MD= Mixed Drink

TO _____

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
MNC	MNC	MNC	MNC	MNC	MNC	MNC
MNC	MNC	MNC	MNC	MNC	MNC	MNC
MNC	MNC	MNC	MNC	MNC	MNC	MNC
MNC	MNC	MNC	MNC	MNC	MNC	MNC
MNC	MNC	MNC	MNC	MNC	MNC	MNC
MNC	MNC	MNC	MNC	MNC	MNC	MNC

I D No		Date		Month No	

THE ADDICTION SEVERITY INDEX

APPENDIX B

INSTRUCTIONS:
Leave no blanks - where appropriate code items
    X = question not answered
    N = question not applicable

PATIENT'S RATING SCALE:
  0 = Not at all
  1 = Slightly
  2 = Moderately
  3 = Considerably
  4 = Extremely

Office use only
ID. ____

MEDICAL STATUS

1. How many days have you experienced medical problems in the past 30 days?

FOR QUESTIONS 2 AND 3. PLEASE ASK PATIENT TO USE THE **PATIENT'S RATING SCALE.**

2. How troubled or bothered have you been by these medical problems in the past 30 days?

3. How important to you now is treatment for these medical problems?

COMMENTS:

_____

EMPLOYMENT/SUPPORT STATUS

4. Do you have a valid driver's license?   0 - No   1 - Yes

5. Do you have an automobile available for your use?   0 - No   1 - Yes
  (Answer "No" if no valid driver's license)

6. How many days were you paid for working in the past 30 days?
  (include "under the table" work)

7. How much money did you receive from employment in the past 30 days?
  (net income)

ALCOHOL USE
Office Use only

8. Alcohol - any use at all in the past 30 days? (# of days)

9. Alcohol - to intoxication in the past 30 days? (# of days)

10. How much money would you say you spent during the past 30 days on alcohol?

11. How many days in the past 30 have you experienced alcohol problems?

FOR QUESTIONS 12 AND 13. PLEASE ASK PATIENT TO USE THE **PATIENT'S RATING SCALE.**

12. How troubled or bothered have you been in the past 30 days by alcohol problems?

13. How important to you now is treatment for alcohol problems?

COMMENTS:

_____

DRUG USE

14. Heroin - any use at all in the past 30 days? (# of days)

15. Methadone - any use at all in the past 30 days? (# of days)

16. Other opiates/analgesics - any use at all in the past 30 days? (# of days)

17. Barbiturates - any use at all in the past 30 days? (# of days)

18. Other sed/hyp/tranq - any use at all in the past 30 days? (# of days)

19. Cocaine - any use at all in the past 30 days? (# of days)

20. Amphetamines - any use at all in the past 30 days? (# of days)

21. Cannabis - any use at all in the past 30 days? (# of days)

22. Hallucinogens - any use at all in the past 30 days? (# of days)

23. How many days in the past 30 have you experienced drug problems?

24. How troubled or bothered have you been in the past 30 days by drug problems?

25. How important to you now is treatment for drug problem

COMMENTS

_____

FAMILY/SOCIAL RELATIONSHIPS

A. What is your current marital status?   CHECK ONE.
  (1) Married
  (2) Remarried
  (3) Widowed
  (4) Separated
  (5) Divorced
  (6) Never married

31. Are you satisfied with this marital situation?   0 - No   1 - Indifferent   2 - Yes

FAMILY/SOCIAL RELATIONSHIPS (CONT.)
Office Use only

32. How many days in the past 30 have you had serious conflicts with your family?

In the past 30 days, have you had significant periods in which you have experienced serious problems with:
  0-no   1-yes

33. Mother

34. Father

35. Brothers/Sisters

36. Sexual partner/spouse

37. Children

38. Other significant family

39. Close friends

40. Neighbors

41. Co-workers

FOR QUESTIONS 42 AND 43. PLEASE ASK PATIENT TO USE THE **PATIENT'S RATING SCALE.**

42. How troubled have you been in the past 30 days by family problems?

43. How important to you now is treatment or counseling for family problems?

COMMENTS

PSYCHIATRIC STATUS

In the past 30 days, have you had a significant period. (that was not a direct result of drug/alcohol use) in which you have.   0 - no   1 - yes

44. Experienced serious depression?

45. Experienced serious anxiety or tension?

46. Experienced hallucinations?

47. Experience trouble understanding, concentrating, or remembering?

48. Experienced trouble controlling violent behavior?

49. Experienced serious thoughts of suicide?

50. Attempted suicide?

51. Have you taken prescribed medication for any psychological/emotional problems?

52. How many days in the past 30 have you experienced these psychological or emotional problems?

FOR QUESTIONS 53 AND 54. PLEASE ASK PATIENT TO USE **THE PATIENT'S RATING SCALE.**

53. How much have you been troubled or bothered by these psychological or emotional problems in the past 30 days?

54. How important to you now is treatment for these psychological problems?

COMMENTS

_____

What are your current Medications?.
Name .... Dose .... mg. #days taken this month
Name .... Dose .... mg. #days taken this month
Name .... Dose .... mg. #days taken this month
Name .... Dose .... mg. #days taken this month

55. Are you taking Naltrexone?

56. What dose?   mg

57. How many days have you taken Naltrexone in the past 30 days?

Alcohol Abstinence Self-Efficacy Scale

Intsructions: Please respond as to how tempted you would be to drink in each situation on a 5-point scale (1 = not at all tempted to 5 = extremely tempted). Then rate how confident you are that you will not drink in that situation on the same 5-point scale (1 = not at all confidence to 5 = extremely confident).

1. When I am feeling angry inside. _____ _____
2. When I sense everything is going wrong with me. _____ _____
3. When I am feeling depressed. _____ _____
4. When I feel like blowing up because of frustration. _____ _____
5. When I am very worried. _____ _____
6. When I see other drinking at a bar or a party. _____ _____
7. When I am excited or celebrating with others. _____ _____
8. When I am on vacation and want to relax. _____ _____
9. When people I used to drink with encourage me to drink. _____ _____
10. When I am being offered a drink in a social situation. _____ _____
11. When I have a headache. _____ _____
12. When I am physically tired. _____ _____
13. When I am concerned about someone. _____ _____
14. When I am experiencing some physical pain. _____ _____
15. When I dream about taking a drink. _____ _____
16. When I am in agony because of stopping or _____ _____
    withdrawing from alcohol use.
17. When I have the urge to try just one drink to _____ _____
    see what happens.
18. When I am feeling a physical need or craving _____ _____
    for alcohol.
19. When I want to test my willpower over drinking. _____ _____
20. When I experience an urge or impulses to _____ _____
    take a drink that catches me unprepared.

Beck Depression Inventory

BDI

Date: _____

Name: _____ Marital Status: _____ Age: _____ Sex: _____

Occupation: _____ Education: _____

This questionnaire consists of 21 groups of statements. After reading each group of statements carefully circle the number (0. 1. 2 or 3) next to the one statement in each group which best describes the way you have been feeling the past week, including today. If several statements within a group seem to apply equally well, circle each one. Be sure to read all the statements in each group before making your choice.

1
0 I do not feel sad.
1 I feel sad.
2 I am sad all the time and I can't snap out of it.
3 I am so sad or unhappy that I can't stand it.

2
0 I am not particularly discouraged about the future.
1 I feel discouraged about the future.
2 I feel I have nothing to look forward to.
3 I feel that the future is hopeless and that things cannot improve.

3
0 I do not feel like a failure.
1 I feel I have failed more than the average person.
2 As I look back on my life, all I can see is a lot of failures.
3 I feel I am a complete failure as a person.

4
0 I get as much satisfaction out of things as I used to.
1 I don't enjoy things the way I used to.
2 I don't get real satisfaction out of anything anymore.
3 I am dissatisfied or bored with everything.

5
0 I don't feel particularly guilty.
1 I feel guilty a good part of the time.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.

6
0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

7
0 I don't feel disappointed in myself.
1 I am disappointed in myself.
2 I am disgusted with myself.
3 I hate myself.

8
0 I don't feel I am any worse than anybody else.
1 I am critical of myself for my weaknesses or mistakes.
2 I blame myself all the time for my faults.
3 I blame myself for everything bad that happens.

9
0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10
0 I don't cry any more than usual.
1 I cry more now than I used to.
2 I cry all the time now.
3 I used to be able to cry, but now I can't cry even though I want to.

11
0 I am no more irritated now than I ever am.
1 I get annoyed or irritated more easily than I used to.
2 I feel irritated all the time now.
3 I don't get irritated at all by the things that used to irritate me.

12
0 I have not lost interest in other people.
1 I am less interested in other people than I used to be.
2 I have lost most of my interest in other people.
3 I have lost all of my interest in other people.

13
0 I make decisions about as well as I ever could.
1 I put off making decisions more than I used to.
2 I have greater difficulty in making decisions than before.
3 I can't make decisions at all anymore.

Subtotal Page 1

CONTINUED ON BACK

14
0 I don't feel I look any worse than I used to.
1 I am worried that I am looking old or unattractive.
2 I feel that there are permanent changes in my appearance that make me look unattractive.
3 I believe that I look ugly.

15
0 I can work about as well as before.
1 It takes an extra effort to get started at doing something.
2 I have to push myself very hard to do anything.
3 I can't do any work at all.

16
0 I can sleep as well as usual.
1 I don't sleep as well as I used to.
2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
3 I wake up several hours earlier than I used to and cannot get back to sleep.

17
0 I don't get more tired than usual.
1 I get tired more easily than I used to.
2 I get tired from doing almost anything.
3 I am too tired to do anything.

18
0 My appetite is no worse than usual.
1 My appetite is not as good as it used to be.
2 My appetite is much worse now.
3 I have no appetite at all anymore.

19
0 I haven't lost much weight. if any, lately.
1 I have lost more than 5 pounds.
2 I have lost more than 10 pounds.
3 I have lost more than 15 pounds.

I am purposely trying to lose weight by eating less. Yes _____ No _____

20
0 I am no more worried about my health than usual.
1 I am worried about physical problems such as aches and pains; or upset stomach; or constipation.
2 I am very worried about physical problems and it's hard to think of much else.
3 I am so worried about my physical problems that I cannot think about anything else.

21
0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I am much less interested in sex now.
3 I have lost interest in sex completely.

_____ Subtotal Page 2

_____ Subtotal Page 1

_____ Total Score

TPC 0828 001   17 18 19 20   B C D E

Form 00-A1

Drinking Assessment Interview—Intake

Form-90

[form text largely illegible]

1. For period from
   ___/___/___
   through
   ___/___/___

2. Number of days in this assessment period:
   _____

3. This is
   (0) Intake

4. ___(1) Female
   ___(2) Male

5. Current body weight in pounds
   _____

6. Weight was obtained by:
   ___(1) weighing
   ___(2) self-report

7. This interview was conducted:
   ___(1) on site
   ___(2) by telephone
   ___(3) home visit
   ___(4) other locations

Medications

During this period, on how many days did you take any medications prescribed by a physician?

[Do not enter medication days on the calendar unless they appear to be of memory value.]

To treat a medical problem   30. _____
Specify medication _____

To prevent you from drinking (antidipsotropic only) 31. _____

To help you detoxify/come off alcohol or another drug 32. _____
Specify medication _____

To help you stabilize or change your use of drugs other than alcohol
   Maintaining/stabilizing drugs (e.g., methadone)   33. _____
   Specify medication _____

   Drug antagonists/blockers   34. _____
   Specify medication _____

For psychological or emotional problems   35. _____
Specify medication _____

Periods of Abstinence

[text largely illegible]

[Mark all abstinent days as "A" on calendar.]

Date of first drink during period   36. ___/___/___
Date of last drink during period   37. ___/___/___

[drinking pattern instructions, largely illegible]

Form 90-AF

Followup Interview Assessment of Drinking and Related Behaviors

[form text largely illegible]

1. For period from
   ___/___/___
   through
   ___/___/___

2. Number of days in this assessment period:
   _____

3. This is ___ month followup

4. ___(1) Female
   ___(2) Male

5. Current body weight in pounds

6. Weight was obtained by:
   ___(1) weighing
   ___(2) self-report

7. This interview was conducted:
   ___(1) on site
   ___(2) by telephone
   ___(3) home visit
   ___(4) other locations

Important People and Activities

Shipley Institute of Living Scale

Vocabulary Test and Abstraction Test

NAME ....

In the test below, the first word in each line is printed in capital letters. Opposite it are four other words. *Draw a line* under the *one word* which means the *same thing*, or most nearly the same thing, as the first word. A sample has been worked out for you. If you don't know, guess. Be sure to underline the *one word* in each line that means the same thing as the first word.

sample

LARGE	red	big	silent	wet

begin here

(1) TALK	draw	eat	speak	sleep
(2) PERMIT	allow	sew	cut	drive
(3) PARDON	forgive	pound	divide	tell
(4) COUCH	pin	eraser	sofa	glass
(5) REMEMBER	swim	recall	number	defy
(6) TUMBLE	drink	dress	fall	think
(7) HIDEOUS	silvery	tilted	young	dreadful
(8) CORDIAL	swift	muddy	leafy	hearty
(9) EVIDENT	green	obvious	sceptical	afraid
(10) IMPOSTOR	conductor	officer	book	pretender
(11) MERIT	deserve	distrust	fight	separate
(12) FASCINATE	welcome	fix	stir	enchant
(13) INDICATE	defy	excite	signify	bicker
(14) IGNORANT	red	sharp	uninformed	precise
(15) FORTIFY	submerge	strengthen	vent	deaden
(16) RENOWN	length	head	fame	loyalty
(17) NARRATE	yield	buy	associate	tell
(18) MASSIVE	bright	large	speedy	low
(19) HILARITY	laughter	speed	grace	malice
(20) SMIRCHED	stolen	pointed	remade	soiled
(21) SQUANDER	tease	belittle	cut	waste
(22) CAPTION	drum	ballast	heading	ape
(23) FACILITATE	help	turn	strip	bewilder
(24) JOCOSE	humorous	paltry	fervid	plain
(25) APPRISE	reduce	strew	inform	delight
(26) RUE	eat	lament	dominate	cure
(27) DENIZEN	senator	inhabitant	fish	atom
(28) DIVEST	dispossess	intrude	rally	pledge
(29) AMULET	charm	orphan	dingo	pond
(30) INEXORABLE	untidy	inviolate	rigid	sparse
(31) SERRATED	dried	notched	armed	blunt
(32) LISSOM	moldy	loose	supple	convex
(33) MOLLIFY	mitigate	direct	pertain	abuse
(34) PLAGIARIZE	appropriate	intend	revoke	maintain
(35) ORIFICE	brush	hole	building	lute
(36) QUERULOUS	maniacal	curious	devout	complaining
(37) PARIAH	outcast	priest	lentil	locker
(38) ABET	waken	ensue	incite	placate
(39) TEMERITY	rashness	timidity	desire	kindness
(40) PRISTINE	vain	sound	first	level

Complete the following. Each dash (__) calls for either a number or a letter to be filled in. Every line is a separate item. Take the items in order, but don't spend too much time on any one.

start here

(1) 1 2 3 4 5 __

(2) white black short long down __ __

(3) AB BC CD D __

(4) Z Y X W V U __

(5) 12321 23432 34543 456 __ __

(6) NE/SW SE/NW E/W N/__

(7) escape scape cape __ __ __

(8) oh ho rat tar mood __ __ __ __

(9) A Z B Y C X D __

(10) tot tot bard drab 537 __ __ __

(11) mist is wasp as pint in tone __ __

(12) 57326 73265 32657 26573 __ __ __ __ __

(13) knit in spod up both to stay __ __

(14) Scotland landscape scapegoat __ __ __ __ee

(15) surgeon 1234567 more 17635 rogue __ __ __ __ __

(16) tam tan rib rid rat raw hip __ __ __

(17) tar pitch throw saloon bar rod fee tip end plank __ __ __ __ __ meals

(18) 3124 82 73 154 46 13 —

(19) lag leg pen pin big bog rob __ __ __

(20) two w four r one o three __

Stages of Change Readiness and Treatment Eagerness Scale

Instructions: Please describe how much the following statements are true for you on a 5-point scale (5 = strongly agree to 1 = strong disagree).

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
1. I really want to make changes in my drinking.	1	2	3	4	5
2. Sometimes I wonder if I am an alcholic.	1	2	3	4	5
3. If I don't change my drinking soon, my problems are going to get worse.	1	2	3	4	5
4. I have already started making some changes in my drinking.	1	2	3	4	5
5. I was drinking too much at one time, but I've managed to change my drinking.	1	2	3	4	5
6. I have made some changes in my drinking, and I want some help to kep from going back to the way I used to drink.	1	2	3	4	5
7. Sometimes I wonder if my drinking is hurting other people.	1	2	3	4	5
8. I am a problem drinker.	1	2	3	4	5
9. I'm not just thinking about changing my drinking, I'm already doing something about it.	1	2	3	4	5
10. I have already changed my drinking and I am looking for new ways to keep from slipping back into my old pattern.	1	2	3	4	5
11. I have serious problems with drinking.	1	2	3	4	5
12. Sometimes I wonder if I am in control of my drinking.	1	2	3	4	5
13. My drinking is causing a lot of harm.	1	2	3	4	5
14. I am actively doing things now to cut down or stop drinking.	1	2	3	4	5
15. I want help to keep from going back to the drinking problems that I had before.	1	2	3	4	5
16. I know that I have a drinking problem.	1	2	3	4	5
17. There are times when I wonder if I drink too much.	1	2	3	4	5
18. I am an alcoholic.	1	2	3	4	5
19. I am working hard to change my drinking.	1	2	3	4	5

Structured Clinical Interview for the DSM-III-R

SCID-P SUMMARY SCORE SHEET

SCID-P (Version 1.0)   Summary Score Sheet I

Duration of interview (minutes) ____ ____

DIAGNOSIS	LIFETIME PREVALENCE				MEETS SYMPTOMATIC DIAGNOSTIC CRITERIA PAST MONTH	
	INADEQUATE INFO	ABSENT	SUB-THRESHOLD	THRESHOLD	ABSENT	PRESENT

MOOD DISORDERS

01 Bipolar Disorder (D.1)   ?   1   2   [3] ——— 1   3

1	manic
2	depressed
3	mixed

1	mild
2	moderate
3	severe, without psychotic features
4	with mood-congruent psychotic features
5	with mood-incongruent psychotic features

02 Other Bipolar Disorder (D.1)   ?   1   2   [3] ——— 1   3

03 Major Depression (D.2)   ?   1   2   [3] ——— 1   3

1	mild
2	moderate
3	severe, without psychotic features
4	with mood-congruent psychotic features
5	with mood-incongruent psychotic features

SCID-P (Version 1.0)   Summary Score Sheet II

DIAGNOSIS	LIFETIME PREVALENCE				MEETS SYMPTOMATIC DIAGNOSTIC CRITERIA PAST MONTH	
	INADEQUATE INFO	ABSENT	SUB-THRESHOLD	THRESHOLD	ABSENT	PRESENT

MOOD DISORDERS (continued)

04 Dysthymia (current only) (A.16)   ?   1   2   3

| 1 | primary |
| 2 | secondary |

05 Depressive Syndrome Superimposed on Chronic Psychotic Disorder (D.2)   ?   [3] ——— 1   3

PSYCHOTIC DISORDERS

06 Schizophrenia (C.5)   ?   1   2   [3] ——— 1   3

07 Schizophreniform Disorder (C.8)   ?   1   2   [3] ——— 1   3

| 1 | with good prognostic features |
| 2 | without good prognostic features |

08 Schizoaffective Disorder (C.9)   ?   1   2   [3] ——— 1   3

| 1 | bipolar type |
| 2 | depressed type |

09 Delusional Disorder (C.11)   ?   1   2   [3] ——— 1   3

10 Brief Reactive Psychosis (C.2)   ?   1   2   [3] ——— 1   3

11 Psychotic Disorder NOS (C.12)   2   [3] ——— 1   3

SCID-P (Version 1.0)   Summary Score Sheet III

DIAGNOSIS	LIFETIME PREVALENCE				MEETS SYMPTOMATIC DIAGNOSTIC CRITERIA PAST MONTH	
	INADEQUATE INFO	ABSENT	ABUSE	DEPENDENCE	ABSENT	PRESENT

PSYCHOACTIVE SUBSTANCE USE DISORDERS

12 Alcohol (E.4)   ?   1   2   3 ——— 3

13 Sedative Hypnotic Anxiolytic (E.13)   ?   1   2   3 ——— 1   3

14 Cannabis (E.15)   ?   2   3 ——— 3

15 Stimulant (E.13)   ?   1   2   3 ——— 1   3

16 Opioid (E.13)   ?   1   2   3 ——— 1   3

17 Cocaine (E.13)   ?   1   2   3 ——— 3

18 Hall PCP (E.13)   ?   1   2   3 ——— 3

19 Poly Drug (E.13)   ?   1   [3] ——— 1   3

20 Other (E.13)   2   3 ——— 3

SCID-P (Version 1.0)   Summary Score Sheet IV

DIAGNOSIS	LIFETIME PREVALENCE				MEETS SYMPTOMATIC DIAGNOSTIC CRITERIA PAST MONTH	
	INADEQUATE INFO	ABSENT	SUB-THRESHOLD	THRESHOLD	ABSENT	PRESENT

ANXIETY DISORDERS

21 Panic Disorder (F.2)   ?   1   2   [3] ——— 1   3

| 1 | without Agoraphobia |
| 2 | with Agoraphobia |

22 Agoraphobia without History of Panic Disorder (AWOPD) (F.6)   ?   2   [3] ——— 1   3

23 Social Phobia (F.9)   ?   2   [3] ——— 1   3

24 Simple Phobia (F.11)   ?   2   [3] ——— 1   3

25 Obsessive Compulsive Disorder (F.13)   ?   2   [3] ——— 1   3

26 Generalized Anxiety Disorder (current only) (F.17)   ?   2   3