THE ROLE OF HOPE IN

DELAY DISCOUNTING

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Bachelor of Arts in Psychology

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Lawrence, Kansas

2006

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
MASTER OF SCIENCE
December, 2007

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DELAY DISCOUNTING

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CHAPTER I

INTRODUCTION

Delay discounting is a construct originally developed in the behavioral economic literature. It is commonly seen as a behavioral measure of impulsivity, wherein a participant is offered a choice between a smaller immediate outcome and a larger delayed outcome (Ainslie, Haslam, Loewenstein, & Elster, 1992). Research has shown that substance using individuals tend to discount the value of a delayed reward at faster rates than non-substance-using controls (e. g. Heil, Johnson, Higgins, & Bickel, 2006; Kirby & Petry, 2004; Madden, Bickel, & Jacobs, 1999). Although not yet conclusive, research has pointed to several possible reasons for this difference. For instance, Ostaszewski (1996) looked at the relationships between personality factors and delay discounting and found that extraverts and highly impulsive individuals tend to have higher discounting rates than introverts and individuals who score low on impulsivity.

Although there has been a considerable amount of research looking at factors that predispose an individual to higher rates of discounting, there is a dearth of research looking at protective factors for impulsive behavior as measured by delay discounting. One possible avenue of protection can be found in Hope Theory (Snyder, Harris, Anderson, & Holleran, 1991). Hope is a positive motivational construct that has been consistently linked to better mental health outcomes and superior academic, athletic, and

work performance (see Snyder et al., 2002). Hope is posited to consist of 3 separate components which influence one another: goals, pathways (strategies to achieve goals), and agency (motivation to achieve goals) (Snyder et al., 1991). Hope relates to people perceiving probable future outcomes because they have the "will and the ways" to successfully get what they want out of life (Snyder et al., 1991). Over the course of the last sixteen years, empirical research has reliably supported the link between high levels of hope and positive outcomes in many areas such as academics, mental health, athletics, and physical health.

In the area of academics, hope has been found to correlate positively with higher scores on achievement tests among grade-school students (Snyder, Hoza, Pelham, & Rapoff, 1997) and higher cumulative grade-point average for high school students (Snyder et al., 1991) and college students (Chang, 1998; Curry, Maniar, Sondag, & Sandstedt, 1999; Curry, Snyder, Cook, Ruby & Rehm, 1997; Snyder et al., 1991). Hope even has predicted prospectively college graduation and dropout rates (Snyder et al., 2002b).

In the area of mental health, higher-hope people have been found to experience less suicidal thoughts (Range & Penton, 1994), less depression (Chang, 1998; Kwon, 2000; Snyder et al., 1997; Snyder et al., 1996), and less anxiety (Barnum, Snyder, Rapoff, Mani, & Thompson, 1998; McNeal, 1997). Since high levels of hope have been related to positive outcomes in several areas, it is possible that hope could serve as a protective factor for impulsive behavior.

In addition, higher hope provides benefit in the areas of athletics and physical health. A study by Curry et al. (1997) found that hope scores predicted athletic success

beyond what was expected of the athletes due to their talent alone. Individuals with higher hope also tend to possess more knowledge about illness and engage in more preventative behaviors than lower-hope participants (Floyd & McDermott, 1998; Harney, 1990; Irving et al. 1998).

In addition, research on delay discounting primarily focuses on the discounting of delayed outcomes received in the future. However, Yi, Gatchalian, and Bickel (2006) recently compared the discounting of outcomes received in the future to the discounting of outcomes in the past. It was found that there were no systematic differences in the discounting rates of participants indicating that individuals may view past outcomes in a similar manner as future outcomes (Yi et al., 2006).

Thus, the present study attempted to expand upon the delay discounting literature by investigating the relationship between hope and delay discounting. Furthermore, the present study attempted to replicate and expand the findings of Yi et al. (2006) by comparing the discounting rates of both future and past rewards using two different measures of delay discounting. A final purpose of the present study was to examine how individuals view both negative and positive events that have occurred in the past or that are expected to occur in the future. Specifically, we investigated if individuals' discounting rates are related to the temporal distance of past and future events that individuals list.

Delay discounting may have implications for the identification and effective treatment of individuals with substance use disorders. Since individuals who abuse substances tend to discount delayed rewards more rapidly than non-substance-abusing individuals, delay discounting could be used to identify people who are at risk to abuse

substances. In addition, it has been found that the discounting rates of individuals who are actively abusing alcohol are higher than the discounting rates of currently abstinent alcoholic individuals (Petry, 2001a). These results imply that delay discounting is related to abstinence and that it could be used to assess the efficacy of treatment. Although delay discounting is certainly an interesting area of research with important implications, more research is required to strengthen possible applications.

CHAPTER II

REVIEW OF LITERATURE

Delay discounting refers to the amount of change in the value of a reinforcer as a function of temporal change (Ainslie et al., 1992). It is measured by offering an individual a choice between receiving a relatively smaller dollar amount today and a relatively larger dollar amount in a given time frame (i.e. $10 today and $15 in one week). This choice is thought to mirror the choices that individuals make on a daily basis, such as a choice between studying for an exam or going to a party. In this instance, one might choose to attend the party because it would be more enjoyable in the short term, while at the same time knowing that they may perform worse on the examination as a consequence. Delay discounting has been frequently used to study substance use disorders and results indicate that substance users typically discount delayed rewards at a significantly more rapid rate than non-substance users (Bickel, Odum, & Madden, 1999; Heil et al., 2006; Hoffman et al., 2006; Petry, 2001a).

Delay discounting is commonly represented by a hyperbolic function first developed by Mazur et al. (1987). This function takes the following form:

$$V = A/(1 + kD) \qquad (1)$$

where V represents the value the individual assigns to the reward, A refers to the numerical amount of the reward, D refers to the temporal delay of the reward, and k indicates a participant's sensitivity to delay. Larger k-values reflect higher discounting

rates whereas smaller *k*-values represent lower discounting rates. The superiority of the hyperbolic function over an exponential function in representing delay discounting has been shown in numerous studies (e.g. Green, Myerson, & McFadden, 1997; Kirby & Marakovic, 1995; Madden et al., 1999; Mazur et al., 1987; Richards, Zhang, Mitchell, & de Wit, 1999).

The vast majority of studies of discounting rates have looked at the discounting of hypothetical rewards. It is possible that individuals might discount real rewards differently because they would actually receive the outcomes. Several studies have examined participant's discounting rates of both hypothetical and real rewards to determine if any differences exist (Johnson & Bickel, 2002; Madden, Begotka, Raiff, & Kastern, 2003; Madden et al., 2004). All three studies revealed no systematic differences in discounting rates for real and hypothetical rewards, suggesting that individuals think about hypothetical rewards in the same manner as real rewards.

As noted by Madden et al. (2003), these results should be viewed with caution for two reasons. First, even though participants did receive a real reward in the Madden et al. study, they only received 1 out of a possible 216 rewards. Thus, the majority of choices were, in fact, hypothetical choices. Second, both the Johnson and Bickel (2002) and the Madden et al. (2003) studies employed a within-subjects design which leaves open the possibility that participants recalled their responses from the first task and simply reproduced them on the second task (Madden et al., 2003). In a more recent study, Madden, et al. (2004) addressed these alternative explanations by using a within-subjects design and increasing the number of real rewards delivered. Results indicated that there were still no systematic differences in the discounting of real and hypothetical rewards

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(Madden et al., 2004) providing additional support that this construct can be successfully studied using a hypothetical design.

Although the rate of discounting can be determined several different ways, it is most often determined by modeling a procedure commonly used in psychophysical studies where participants are presented with a constant stimulus (e.g. light, sound) and an alternative stimulus which is increased or decreased until the participant deems that they are equal in intensity (Stevens, 1975). For the construct of delay discounting this estimation has been accomplished several ways. The first method was developed by Rachlin, Raineri, and Cross (1991) and involves presenting participants with two cards simultaneously. On one card the delayed reward is displayed (e.g. $1,000 in 6 months) and on the other the immediate reward is shown (e.g. $500 today). The procedure starts with a low immediate reward and this card is changed to a larger value until the participant switches from preferring the immediate reward. This procedure is called the ascending condition. Usually, participants are also presented with the same values in a descending condition. In this condition, the immediate reward is equivalent to the delayed reward and is reduced until the participant switches from preferring the immediate reward to preferring the delayed reward. In both conditions, the point at which the participant switches reward preferences is referred to as their indifference point. That is, the individual is indifferent as to which reward—the immediate or the delayed—that they prefer.

A variation on this method was developed by Mitchell (1999) where the reward choices are presented on a computer instead of on cards. Another option is to present 40 choices per page (e.g. Yi et al., 2006). In the left column, a constant amount is presented

and in the right column, increasing or decreasing alternatives to this value are presented in a given increment. This method is employed in the current study (the Delay Discounting Task). To reduce the number of questions a participant had to answer, Richards et al. (1999) created a computer program that included an adjusting amount (AA) procedure. This program adjusts which questions are asked of participants based on their previous responses, thus reducing the total number of questions asked. Another method for assessing delay discounting is the 27-item questionnaire developed by Kirby, Petry, and Bickel (1999). This questionnaire presents a series of choices between a larger delayed reward and a smaller immediate reward with three questions assessing each of the nine discounting values (k-scores) and is also used in the current study.

To determine the agreement of the computer based AA measure and the Kirby questionnaire, Epstein et al. (2003) administered both measures to 78 smokers. Results indicated that the k-scores obtained from each method correlated highly ($r = .82$) and that both measures had similar degrees of correlation with amount of cigarettes smoked daily and neither significantly correlated with body-mass index, age, nor gender (Epstein et al., 2003). However, results also indicated that the AA procedure tended to produce smaller k-scores overall than the Kirby questionnaire, a difference that was largest for small reward values. These results suggest that both measures for assessing delay discounting are very similar but not identical.

Factors That Influence Delay Discounting

The factors that influence delay discounting are generally divided into two groups, Level I Factors and Level II Factors. Level I Factors refer to differences with the

outcome itself and include the length of delay, magnitude effect, sign effect, and domain effect. Level II Factors are individual differences among participants such as, age, income, culture, substance use status, and personality. Each will be investigated below.

Level I Factors

Length of Delay

The first factor that deals with the reward itself is the length of time until the receipt of the reward. This has also been called the delay effect. The delay effect refers to the fact that if all other elements are equal, a person will prefer an immediate reward over a delayed reward. Several studies have demonstrated that longer delays tend to produce higher rates of discounting (Chapman, 1996; Green, Fristoe, & Myerson, 1994; Richards et al., 1999; Vuchinich & Simpson, 1998).

Magnitude

Another factor that relates to the reward itself is what is called the magnitude effect. The magnitude effect refers to the phenomenon that people usually discount larger monetary values less steeply than smaller monetary values. For instance, an individual might prefer to receive $5 now instead of $20 sometime in the future, but may simultaneously prefer $20,000 sometime in the future over $5,000 now even though the proportion of the two choices is equivalent. The magnitude effect has been demonstrated with both hypothetical and real monetary rewards in a considerable number of studies (Benzion, 1989; Green, Fristoe et al., 1994; Green, Fry, & Myerson, 1994; Green et al., 1997; Johnson & Bickel, 2002; Myerson & Green, 1995; Raineri & Rachlin, 1993;

Thaler, 1981). These results have been extended to health outcomes as well (Chapman,

1996).

Sign

In addition to the aforementioned effects of delay and magnitude, an effect of the

sign of the reward has been demonstrated. The sign effect refers to the difference in rates

of discounting for gains and losses, such that gains are typically discounted more steeply

than losses (Chapman, 1996). This effect has been found in studies for monetary

outcomes (Baker, Johnson, & Bickel, 2003; Benzion, 1989; Shelley, 1993; Thaler, 1981)

and health outcomes (Chapman, 1996; MacKeigan, 1993).

Domain

Finally, researchers have found that the domain or commodity type can influence

the rate of discounting (Baker et al., 2003). Specifically, people may consider monetary,

health, or vacation outcomes and the discounting rate usually varies between these

different commodities. Chapman and Johnson (1995) found that people tend to discount

health outcomes more steeply than monetary and vacation outcomes. However, monetary

and vacation outcomes were not discounted differently (Chapman & Johnson, 1995).

Level II Factors

Age

The first Level II Factor of interest for delay discounting is age. Considering that

many people view infants as individuals who want all their needs met as soon as possible,

it would make intuitive sense that young children should discount delayed rewards at a greater rate than older individuals. Indeed, research has confirmed that children have a more difficult time delaying gratification than more mature individuals do (Mischel, Shoda, & Rodriguez, 1989). In addition, Green, Fry, and Myerson (1994) reasoned that children should display higher delay discounting rates because of the difficulty delaying gratification and found that delay discounting was highest in children and lowest in older adults. Another study looked at groups that differed in age and income level (Green, Myerson, Lichtman, Rosen, & Fry, 1996). The groups consisted of a higher-income younger group, a higher-income older group, and a lower-income older group. Results indicated that adults with different ages but similar income discounted similarly, such that there were no differences in the upper-income groups. In addition, adults who had similar ages but different income discounted at different rates, such that the lower-income individuals tended to discount more steeply (Green, et al., 1996). These results may indicate that income plays a larger role in affecting delay discounting than does age.

Income

A second Level II Factor that has been related to delay discounting is the income of participants. This is an interesting question because one would expect that poorer participants would view a given monetary value differently than wealthier participants would. For example, an individual who makes $20,000 per year would tend to place more subjective importance on a $1,000 bonus than a person who earns $1,000,000 per year. Since lower-income individuals view a given monetary value as more useful they might be expected to display the magnitude effect (lower rates of discounting for higher

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monetary values) for lower values than higher-income individuals. If this were the case, one would expect to see lower discounting rates among lower-income individuals as compared to higher-income individuals. The results of one study (Green, et al. 1996) point to the opposite effect however. Specifically, lower-income participants were found to have higher discounting rates than higher-income participants (Green, et al. 1996). It has been hypothesized that this difference occurs because lower-income individuals may be more likely to need money sooner to pay bills or to meet other financial needs than higher-income individuals.

Culture

A third factor related to delay discounting is culture. Du, Green, and Myerson (2002) conducted a cross-cultural study comparing the discounting rates of American, Chinese, and Japanese individuals. Although all three cultural groups discounted in a manner best represented by a hyperbola, one cultural difference was found. Particularly, American and Chinese participants discounted delayed monetary rewards more steeply than Japanese participants (Du, Green, & Myerson, 2002)

Delay Discounting and Substance Use

Delay discounting has been frequently used in studies comparing how substance users compare with non-substance using controls in rate of discounting. The hypothesis provided by the construct of delay discounting should hold that the average substance user would discount delayed rewards at a steeper rate than the average non-substance

user. This hypothesis should hold because substance users routinely choose an immediate reward (i.e. a substance) over a delayed reward (i.e. better health outcomes).

Since tobacco is relatively widely used among the American public and its use is the largest contributor to avoidable death, it should be no surprise that smoking has been the subject of many studies involving delay discounting. Many studies have found that cigarette smokers tend to discount delayed outcomes at a greater rate than non-smokers do (e.g. Bickel et al., 1999; Field, Santarcangelo, Sumnall, Goudie, & Cole, 2006; Reynolds, 2004; Reynolds, Richards, Horn, & Karraker, 2004). One study compared current cigarette smokers to both non-smokers (individuals who have successfully quit smoking) and never smokers and found that current smokers discount delayed outcomes at a greater rate than the other two groups (Bickel et al., 1999). This finding was particularly interesting because it found that non-smokers and never smokers discount at similar rates. Two different interpretations can be inferred from these results: (1) those who successfully quit have either learned to value delayed rewards more than they used to or (2) those who successfully quit tend to have lower discounting rates than those who do not quit (Bickel et al., 1999).

Following a similar line of thinking, another study found that rate of cigarette smoking is positively correlated with rate delay discounting and delay discounting does not seem to make people vulnerable to high rates of cigarette consumption (Reynolds, 2004). This finding indicates that the use of cigarettes can change rates of delay discounting and not that smokers inherently possess more rapid delay discounting rates. In addition, a separate study found that knowing delay discounting rates allowed researches to predict the smoking status of participants (Reynolds et al., 2004).

Although most studies comparing smokers and non-smokers focus on discounting of the value of a delayed monetary reward, the pattern of more rapid discounting extends to cigarettes as well. For instance, one study found that smokers tend to discount hypothetical delayed cigarettes more steeply than hypothetical delayed money (Field et al., 2006).

Much like cigarette smokers, research has shown that people who abuse other substances tend to have higher discounting rates. This effect has been shown with individuals who abuse alcohol (Petry, 2001a; Richards et al., 1999; Vuchinich & Simpson, 1998), people who are opioid dependent (Bretteville-Jensen, 1999; Kirby & Petry, 2004; Kirby, Petry, & Bickel, 1999; Madden et al., 1999; Madden, Petry, Badger, & Bickel, 1997), cocaine dependent individuals (Coffey, Gudleski, Saladin, & Brady, 2003; Heil et al., 2006; Kirby & Petry, 2004), and methamphetamine dependent individuals (Hoffman et al., 2006). In addition, alcoholics tend to discount hypothetical alcohol rewards more steeply than hypothetical financial rewards, although this pattern was seen in both alcoholic individuals and control participants (Petry, 2001a). A similar pattern was shown among crack/cocaine dependent participants, (Coffey et al., 2003) and among opioid dependent individuals (Odum, Madden, Badger, & Bickel, 2000) such that each group tended to discount hypothetical drug rewards more rapidly than hypothetical monetary rewards.

Comparisons of currently active users to currently abstinent users have yielded mixed findings. Specifically, one study (Kirby & Petry 2004) found that individuals who were currently abstinent from heroin had lower delay discounting rates than currently active heroin users. Conversely, both currently abstinent cocaine and alcohol abusers did

not have lower discounting rates than individuals who were currently using these substances (Kirby & Petry, 2004). These findings are corroborated by another study which found that there was no difference between abstinent and active cocaine-dependent individuals but contradicted by Petry (2001a) which found that currently active alcoholics had more rapid discounting than abstinent alcoholics. More research is needed in this area to clear up the current results.

An area which is similar to substance abuse, in that it is believed to stem from a common impulse control disorder, that has been investigated with delay discounting is pathological gambling. Several studies have shown that pathological gamblers tend to discount delayed outcomes at a greater rate than controls (Petry, 2001b; Petry & Casarella, 1999). Furthermore, delay discounting rates have been predicted using gambling severity scores of pathological gamblers (Alessi & Petry, 2003). In addition, many pathological gamblers also have comorbid substance abuse disorders. Research indicates that individuals with comorbid pathological gambling and substance dependence tend to discount delayed monetary outcomes at a greater rate than non-substance-using pathological gambling individuals (Petry, 2001b; Petry & Casarella, 1999). Thus, the data reveal an additive effect in that substance dependence and pathological gambling together increase the discounting of a delayed outcome more than each factor alone.

Personality Factors

Another factor that has been linked to delay discounting is personality differences. One study (Ostaszewski, 1996) looked at the relationships between delay discounting and

several personality factors; namely, sensation seeking, introversion-extroversion, and impulsivity. Results indicated that extraverted individuals had higher rates of delay discounting than introverts, highly impulsive individuals had higher rates of delay discounting than low impulsive individuals, and sensation seeking was not related to delay discounting (Ostaszewski, 1996). Although, the correlation between impulsivity and delay discounting makes intuitive sense since delay discounting is often conceptualized as a behavioral measure of impulsivity, the relationship between extraversion and delay discounting requires more of an explanation. Ostaszewski (1996) posited two possible reasons for the difference in delay discounting rates between introverts and extraverts. Specifically, (1) extraverts have been found to view the passage of time more slowly than introverts (Claridge, 1960; Eysenck, 1959; Lynn, 1961; Wudel, 1979) and (2) the increased responsiveness to rewards typically found amongst extraverts (Eysenck, 1967; Gupta, 1978). Since extraverts view time periods as taking longer, it may be that they have a more difficult time waiting for a delayed reward and, hence, respond more impulsively on the delay discounting measure.

Although these results are intriguing, it should be noted that Ostaszewski tested individuals on delayed rewards of two different magnitudes ($100 and $1,000) and only the larger reward evidenced a significant difference in discounting rates between introverts and extraverts. Furthermore, the relationship between the larger magnitude reward and discounting rate was not especially strong (Ostaszewski, 1996).

Delay Discounting and Past Outcomes

Thus far, research has looked at delay discounting of future outcomes when presented with an immediate outcome. However, until recently, no research has investigated the possibility of discounting of past outcomes. Delay discounting theory would predict that individuals would discount past outcomes ($10,000 received 6 months ago) in a similar manner as future outcomes when given an option of receiving a more recent outcome ($7,500 received one hour ago). Recently, Yi, Gatchalian, and Bickel (2006) compared the discounting rates of individuals for future and past outcomes and found no systematic differences in discounting rates or functions. These results suggest that individuals are constantly comparing choices between past, present, and future outcomes when making choices. Interestingly, this study used the longer measure of delay discounting—the Delay Discounting Task—to evaluate discounting measures but did not evaluate if the shorter measure—the Kirby questionnaire—is a valid measure of the discounting of past outcomes. This information is important because if both measures are equally valid, researchers would most likely prefer to use the shorter version. Thus, one purpose of the current study is to determine if both measures of delay discounting obtain similar results for past rewards.

Hope Theory

Hope (Snyder et al., 1991) is a cognitive motivational construct composed of reciprocally related (a) pathways (strategies to attain goals), and (b) agency (motivation to use those pathways in the goal-pursuit process). In the vernacular, hope relates to people perceiving probable future outcomes because they have the "will and the ways" to

successfully get what they want out of life (Snyder et al., 1991). More than a decade of empirical research consistently has supported the link between high levels of hope and positive outcomes in relation to academic and athletic achievements, and better overall mental and physical health (Snyder et al., 2002a).

Athletes with higher hope scores have been found to have an advantage over their lower-hope peers. For example, Curry et al. (1997) studied seven track teams by obtaining hope scores from the athletes and rankings of the inherent athletic ability of each athlete. It was found that the higher-hope athletes had significantly better outcomes than the low-hope athletes. Curry et al. (1997) also found that the Trait Hope Scale and State Hope Scale scores of female track competitors accounted for a large proportion of variance (56%) in their outcomes. Furthermore, Brown, Curry, Hagstrom, and Sandstedt (1999) found that girls who were attending a sport-focused summer camp had fewer thoughts of quitting their sport and formulated more goals related to sports.

In the area of academics, research has consistently shown that students with higher hope scores tend to have better outcomes in academics in areas such as higher grade point averages (GPAs), lower rates of students dropping out, and higher graduation rates. For instance, hope has been found to be related to elementary age students' achievement test scores even after controlling for perceived school competency (Snyder, Hoza, et al., 1997) In addition, Snyder, Harris, et al. (1991) found higher GPAs among high school students and college students. The relationship between hope and academics has been studied most vigorously in the college-aged population. Studies indicate that hope positively predicts college grade point averages (Chang, 1998; Curry et al., 1997) even after controlling for factors such as age, sex, coping with academic stress, and self-

worth. In addition, a six-year longitudinal study (Snyder, Shorey et al. 2002) which tracked 213 undergraduate students from their entrance into college until the completion of the six-year study. Results indicated that high hope scores predicted higher cumulative GPAs, a higher chance of graduating, and a lower chance of being dismissed for poor grades (Snyder et. al, 2002).

These achievement area successes may result from high-hope students' abilities to retain their positive emotions even after experiencing setbacks. For example, Shorey (2003) found that, after a laboratory induced failure experience, positive affect mediated the relationship between hope (assessed before the failure) and effort exerted as well as related performances after the failure. Such successes also may explain why higher levels of hope have related to greater life satisfaction and higher overall positive mental health. Indeed, higher-hope people have been found to have better mental health status across a gamut of disorders. For instance, one study (Range & Penton, 1994), found that individuals with higher hope scores experienced less suicidal ideation than their lower hope counterparts. Furthermore, several studies has found a link between higher hope scores and less depression (Chang, 1998; Kwon, 2000; Snyder et al., 1997; Snyder et al., 1996), and less anxiety (Barnum et al., 1998; McNeal, 1997).

Hope Theory has not been used to look at impulsivity however. It seems likely that hope could serve as a buffering factor for substance abuse, much like it protects individuals from negative mental health outcomes. Thus, an additional purpose of the current study was to assess if hope can affect discounting rates in individuals.

Present Study

The purpose of the present study was to assess the relationships between two measures of delay discounting in the past and future, the role that hope plays as a possible protective factor for impulsivity as measured by delay discounting, and to asses the relationship between delay discounting and anticipated events. The following hypotheses were proposed in the current study in relation to the measurement of delay discounting (1) the two measures of delay discounting were predicted to produce significantly correlated k-values for rewards hypothetically delivered in the future. (2) The two measures of delay discounting were predicted to produce significantly correlated k-values for rewards hypothetically delivered in the past. (3) The Delay Discounting Task would produce significantly correlated k-scores for rewards hypothetically delivered in the past and the future. (4) The Kirby Questionnaire would produce similar k-scores for rewards hypothetically delivered in the past and the future. A previous study, Yi et al. (2006) found that there were no systematic differences in discounting rates for future or past outcomes.

Further, hope scores were used to determine if hope can serve as a potential protective factor for impulsivity as measured by delay discounting. Specifically it was predicted that, individuals with high hope scores would have significantly lower k-scores on the (5) Kirby questionnaire and the (6) Delay Discounting Task than individuals with low hope scores. Finally, the temporal distance of events listed in the Anticipated Events Task were compared to the discounting rates obtained from both measures of discounting to determine if individuals think of positive and negative events in both the past and future in a similar manner. Specifically, it was hypothesized that K-scores would be

significantly positively correlated with the temporal distance from the present of positive

events which occurred (7) in the future and (8) the past, and k-scores would be positively

correlated with negative events which occurred (9) in the future and (10) the past as

indicated on the Anticipated Events Task.

CHAPTER III

METHODOLOGY

Participants

Participants were 220 students (156 female, 64 male) currently enrolled at a large

Midwestern University whose participation partially fulfilled requirements for

psychology classes or for additional credits in said classes. The average age of

participants was 20.31 years with a range from 18-54. Participants consisted of

individuals from all classes and were fairly evenly distributed among freshman (19.2%),

sophomores (29.9%), juniors (21.0%), and seniors (13.8%). The majority of participants

self-identified as Caucasian (81.3%) followed by American Indian (7.6%), African

American/Black (3.1%), Biracial (3.1%), Hispanic American/Latino/Latina (1.3%),

Asian American (1.3%), and Other (.4%).

Additionally, there were a considerable amount of participants who signed up for

the study but never turned in the packet. For instance, during the fall 2007 semester, 202

participants signed up for the study, 135 participants completed the study, and 67 did not

complete the study. Thus, during this semester, the attrition rate for the study was

approximately 33%. Unfortunately attrition data is not available for the remaining

participants since the Experimetrix website deleted all data from previous semesters. In

addition, demographic data for the non-completing participants was not collected so it is

not possible to determine whether participants who completed the study differed on demographic variables from non-completers.

Measures

 Demographics. Demographic information was obtained from participants with regard to sex, age, ethnicity, and year in school.

 Delay Discounting. Delay discounting was assessed using two different methods. First, the 27-item questionnaire developed by Kirby, Petry and Bickel (1999) was used. The questionnaire presents a series of choices between a smaller, more immediate reward and a larger, more delayed reward and participants are instructed to indicate their preferences. Each of the nine possible discounting rates (k values) is assessed with three questions. One such item offers a choice between "$67 today" and "$75 in 119 days." The wording was changed slightly for the questionnaire assessing past discounting rates to a choice between "$67 one hour ago" and "$75 received 119 days ago." A subjective evaluation that these values are equal or an indifference point for this question indicates a k value of .0010. If an individual chose the immediate reward, their k value would be larger than .0010, whereas if they chose the delayed reward, their k would be assumed to be lower than .0010. A geometric mean was calculated for the point where an individual switches from preferring immediate rewards to preferring delayed rewards and this was treated as an individual's k-value.

 The second method for assessing delay discounting in the current study was modeled after the technique used in the Yi et al. (2006) study. The Delay Discounting Task presents individuals with 40 choices per page. In the left column, a constant amount

was presented (either $10 or $10,000) and in the right column, increasing or decreasing alternatives to this value were presented in 2.5% increments. Individuals were asked to mark the choice they prefer. In addition, several values varied including magnitude ($10 or $10,000), time to receipt of delayed reward (1 day, 1 week, 1 month, 6 months, 1 year, or 5 years), and time period (past or future). The point at which an individual switches from preferring the immediate reward to preferring the delayed reward was then identified for each reward magnitude and time to receipt of reward. The *k*-score for each participant was determined by plotting all indifference points for each magnitude and time period individually in a non-linear regression using equation 1.

Anticipated Events Task. How individuals look at future and past events was assessed using the Anticipated Events Task, which asks participants to write down 20 different events occurring at different time periods (future or past) and possessing different valence (positive or negative events). In addition, participants are instructed to indicate when this event occurred or when they think it will occur. The time period was then assessed to see how far in the future or past each individual tended to look. This task was piloted in the current study.

Revised Trait Hope Scale (HS-R2; Shorey & Snyder, 2004a): The HS-R2 is an 18-item self-report measure that uses six-items each to assess the three hope components of goals, pathways, and agency. Response options on the 8-point Likert-type scale range from 1 = *definitely false*, to 8 = *definitely true*. Half of the items are reverse scored. In assessing the validity of the revised scale, Shorey and Snyder (2004) found that each of the three hope components is positively related (correlations from .54 to .68) yet empirically distinct. As such, the subscales can be used individually or they can be

combined as a unified hope measure. Across multiple college student samples, reliabilities for the subscales ranged from .64 to .81 while overall scale reliabilities ranged from .86 to .88. The revised scale, relative to the original (Snyder et al., 1991), is a stronger predictor of various criterion variables including self-efficacy, and psychological distress and well-being. HS-R2 scores were not related to performance goals, hypercompetitive attitudes, or pessimism.

Procedure

Participants were identified through the Oklahoma State University Psychology Department subject pool. This subject pool is organized through an internet based system called Experimetrix. After they signed up, they were given a URL address (http://fp.okstate.edu/collinslab/collin/) for a PDF copy of the study. They were instructed to download this PDF and to print a copy. The instructions for downloading and printing the PDF file were provided online. Participants then completed the informed consent, read the instructions and completed all measures. Copies of the informed consent (Appendix A) and the PDF file (Appendix B) are attached. Upon completion, the participants returned the packet of measures to room 232 in North Murray and were awarded credit. American Psychological Association (APA) ethical standards (ES 6.10 - 6.19, APA, 2002) were followed strictly in relation to all participants.

CHAPTER IV

FINDINGS

Means, standard deviations, and possible ranges of all measured variables are

presented in Table 1. The means of the Kirby questionnaire are within ranges reported by

Kirby et al. (1999) and the means of the Delay Discounting Task are within the ranges

reported by Green, Myerson, and McFadden (1997). The means for the Revised Hope

Scale and the Anticipated Events Task could not be compared to those obtained in the

literature because there are currently no published studies utilizing either measure (see

Table 1). Table 2 displays how many participants had data that could be scored for each

measure. In other words, if individuals did not complete enough questions or a certain

questionnaire as a whole, scores for that measure could not be calculated. Responses to

the Kirby questionnaire require additional attention because the scoring methods do not

include participants who respond inconsistently to the questions. If it appears that an

individual is switching their preferences arbitrarily between immediate and delayed

rewards, their responses cannot be scored.

Zero-order correlations between the Kirby questionnaire and the standard money

choice task are presented in Table 3. A Bonferroni adjustment was performed ($p < .008$)

to control for possible Type I error inflation. Results indicated that all measures of delay

discounting were significantly positively related to one another consistent with

hypotheses 1-4. The smallest relationship was between the k-scores from the past

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condition on the Kirby questionnaire and the future $10 reward condition on the Delay Discounting Task ($r = .31$, $p < .01$) and the largest relationship between the k-scores from the past and future conditions of the Kirby questionnaire ($r = .79$, $p < .01$).

To test hypothesis 5, two linear regressions were conducted with hope as the independent variable and the k-scores from the Kirby questionnaire in future and past time conditions as a dependent variable. To control for Type I error inflation, a Bonferroni adjustment was conducted and results were not treated as significant unless $p < .025$. The linear regression between hope and the Kirby questionnaire in the future indicated that hope was a significant predictor of delay discounting [$B = -.001$, $t(171) = -2.849$, p(2-tailed) $= .005$] with hope accounting for 4.5% of the variance in k-scores. Further, using hope scores as a predictor for the k-score obtained from the past Kirby questionnaire found marginally significant results [$B = -.001$, $t(141) = -2.157$, p(2-tailed) $= .033$] with hope accounting for 3.2% of the variance in k-scores. Therefore, hypothesis 5 was partially supported.

To test hypothesis 6, hope was assessed as a predictor of the k-scores obtained from the Delay Discounting Task using four linear regressions. Again, a Bonferroni adjustment was conducted such that results were not accepted as significant unless $p < .0125$. Results indicated that hope did not predict the k-scores of the past $10,000 condition of the Delay Discounting Task [$B = -.00004$, $t(216) = -2.286$, p(2-tailed) $= .023$] the past $10 condition [$B = .000$, $t(215) = -1.938$, p(2-tailed) $= .054$], the future $10 condition [$B = .000$, $t(215) = -1.478$, p(2-tailed) $= .141$], or the future $10,000 condition[$B = .000$, $t(215) = -1.476$, p(2-tailed) $= .141$]. Therefore, hypothesis 6 was not supported.

To test hypotheses 7-10, bivariate Pearson's correlations were conducted between the temporal distance of events in the Anticipated Events Task and all the *k*-scores obtained from both methods of assessing delay discounting. After adjusting for Type I error rate inflation ($p < .005$) results indicated that none of the *k*-scores were significantly correlated with the temporal distance of events in the Anticipated Events Task (see Tables 4 and 5). Thus, hypotheses 7-10 were not supported.

CHAPTER V

CONCLUSION

The present study had several aims. First, to evaluate the similarity of the results obtained from two different measures of delay discounting in both past and future time periods. Secondly, this study aimed to determine if hope significantly predicts discounting scores and, lastly, to determine if delay discounting scores were significantly correlated with the temporal distance of events listed on the Anticipated Events Task.

Results indicated that discounting scores in the future time condition obtained from both methods of assessing delay discounting were highly correlated. Additionally, results indicated that discounting scores in the past were also highly correlated regardless of the assessment method used (the Delay Discounting Task or the Kirby questionnaire). Further, individuals tended to discount rewards similarly regardless of the time period of their hypothetical delivery (future or past). These results may indicate that individuals think about the past and future in similar ways such that, if they are likely to discount the value of a delayed reward in the future, they are also likely to discount the value of a delayed reward in the past. Since all measures of delay discounting were highly correlated—r's ranging from .32 to .79—these results also indicate that both methods are assessing the construct of delay discounting.

The results of hypotheses 1-4 replicate and extend the results of the Yi et al. (2006) study such that both measures of delay discounting (the Delay Discounting Task

and the Kirby questionnaire) produce similar k-scores in both past in future time conditions. There is also further indication that individuals tend to think about rewards in the past and present time domains similarly. This excessive focus on the present with little weight given to events in either the past or the future could serve as one possible explanation why individuals with substance use problems tend to engage in behavior despite possible negative outcomes in the future (i.e. missing work) and negative outcomes that have occurred in the past (i.e. drug related arrests). In addition, these individuals may not process relevant positive outcomes that could occur if the individual did not engage in substance use in the past and the future. For example, an individual who abuses alcohol may not account for the fact that when they did not use in the past positive things occurred (such as staying out of legal trouble) and positive things could possibly occur in the future (such as no hangover the next day).

The second purpose of the current study (hypotheses 5 and 6) was to assess if hope could predict delay discounting scores. These hypotheses were partially supported such that the k-scores derived from the questionnaire method in both time periods (past and future) were significantly predicted by hope scores, although the past k-scores were marginally significant after adjusting for Type I error inflation. However, the k-scores from the Delay Discounting Task were not significantly predicted by hope scores. Since the Delay Discounting Task was significantly more involved and consisted of dozens of pages to obtain k-scores, it is possible that these k-scores were not as reliable as those obtained from the Kirby questionnaire. Indeed, it was evident that a significant proportion of individuals were responding inconsistently or improperly to the task indicating possible boredom or frustration with the task (see Table 6). It should be noted that

although a relatively high proportion of individuals responded inconsistently to some items on the Delay Discounting Task, overall k-scores for each time condition and reward value could still be estimated for the majority of the participants by not including inconsistent responses.

Despite this, results from the Kirby questionnaire indicated that individuals with high hope scores tended to have lower discounting scores indicating slower rates of discounting. Since delay discounting is commonly conceptualized as a behavioral measure of impulsivity, these results seem to indicate that hope may play a protective role in the development of disorders related to impulsivity such as Alcohol/Drug Abuse and Dependence and Pathological Gambling. Although Hope Theory has commonly been studied in relation to mental health (See Snyder, 2002), no previous study has looked at hope in relation to impulsivity. Thus, these results may have implication for the assessment and treatment of individuals with impulsivity related disorders such as substance use and pathological gambling problems, since individuals with high hope tend to focus on many attainable, yet challenging goals, have more effective strategies and more motivation to attain these goals (Snyder et al. 1991). Specifically, it is likely that individuals in treatment who have higher hope scores would be more likely to successfully complete treatment and stay clean or sober than their lower-hope counterparts due to their better coping strategies. Further, individuals in treatment with low hope scores may benefit from interventions created to increase hope (Snyder, 1994).

Finally, hypotheses 7-10 predicted that k-scores would be significantly related to the temporal distance of events listed in the Anticipated Events Task. Since individuals who discount more steeply seem to place greater emphasis on the present time relative to

both the past and future, it seemed probable that they would view significant life events in the future and past differently than low discounters. Specifically, hypotheses 7-10 predicted that individuals with higher discounting scores would list events that were temporally closer to the present than individuals with lower discounting scores. However, results indicated that k-scores were not significantly related to the temporal distances of positive and negative events in both the past and future. It is possible that the predicted relationship did not occur because the instructions of the measure were too general. For instance, some participants responded with specific dates (i.e. "September 2010") while others used a more general metric (i.e. "next summer") and still others did not put a quantifiable date (i.e. "sometime in my life"). In addition, there was considerable variability in the number of events that individuals listed for each of the questions (0-5 events). In future studies, it would be advisable to change the directions (i.e. ask for specific dates the events occurred or are expected to occur) of this task to obtain more reliable results.

The present study was not without limitations. Specifically, the participants of the current study consisted of undergraduate students enrolled in psychology classes. Thus, this sample is not representative of the population in general. It may be possible that individuals in the general population think about outcomes in the past and future differently than individuals in this college sample. However, many studies looking at delay discounting include samples of drug abusing individuals such as heroin users, (Kirby & Petry, 2004; Kirby et al., 1999; Madden et al., 1999; Madden et al., 1997; Odum et al., 2000) cocaine users, (Coffey et al., 2003; Heil et al., 2006; Kirby & Petry, 2004) and individuals who abuse other drugs such as methamphetamines (Hoffman et al.,

2006). Results from these studies indicate that substance abusing individuals tend to have higher discounting rates than non-substance abusing control participants. Thus, it is likely that college participants have lower discounting rates and the effects found in the current study may underestimate the effect in the general population.

The second limitation was that all the measures of delay discounting were assessing for only positive outcomes (gains) and not negative outcomes (losses). It is possible that individuals think about gains differently than losses in past and future time periods. As mentioned earlier, research tends to support the sign effect such that individuals usually discount gains more rapidly than losses (Baker et al., 2003; Benzion, 1989; Chapman, 1996; MacKeigan, 1993; Shelley, 1993; Thaler, 1981). Thus, future research should look at the discounting of gains and losses in past and future time domains.

Future research should focus on several areas. First, although these results may suggest that hope could serve as a protective factor for impulsivity and, thus, substance use disorders, substance use was not assessed in the current study. It is necessary to replicate the predictive role of hope in delay discounting and extend these findings by testing for relationships between substance use and hope. Further, it is possible that hope scores could serve as a mediator or a moderator of the relationship between delay discounting and substance use. Additionally, further research should attempt to reassess a possible predictive role of hope on delay discounting scores obtained from the Delay Discounting Task. As mentioned earlier, many participants responded inconsistently or incorrectly to several pages of the Delay Discounting Task which is a possible reason that hope did not significantly predict the discounting scores from this task. To test this

possibility, future studies should administer the task in person to ensure that the

participants are responding correctly.

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APPENDIX

Table 1: Means, Standard Deviations, and Possible Ranges

	Mean	Standard Deviation	Possible Range
Kirby questionnaire future	.0325	.0394	.1600
Kirby questionnaire past	.0366	.0425	.1600
DD task future $10	.0154	.0212	.0609
DD task future $10,000	.0023	.0039	.0152
DD task past $10	.0186	.0227	.0632
DD task past $10,000	.0021	.0037	.0155
Hope	113.68*	13.96	69.00
Goals	37.66*	5.44	34.00
Pathways	36.43*	5.50	28.00
Agency	39.56*	5.85	26.00
AET future positive	2130.40*	1824.34	17140.20
AET future negative	4921.90*	5087.51	21900.00
AET past positive	1605.99*	1531.94	14570.00
AET past negative	1718.93*	1408.08	12161.00

*Observed means could not be compared to means reported in the literature because this information is not currently available in the literature

Table 2: Number of participants with data that could be scored per measure

KQF	KQP	DDT	Hope	Goals	Pathways	Agency	Future Pos	Future Neg	Past Pos	Past Neg
175	144	219	217	218	217	218	213	200	206	207

KQF = Kirby questionnaire Future Rewards, KQP = Kirby questionnaire Past Rewards, DDT = All Delay Discounting Task *k*-scores, Future Pos = AET future positive events, Future Neg = AET future negative events, Past Pos = AET past positive events, Past Neg = AET past negative events

Table 3: Zero-order correlations between the Kirby questionnaire and the Delay Discounting Task

	KQF	KQP	DDTF 10	DDTP 10	DDTF 10,000	DDTP 10,000
KQF	1					
KQP	.79**	1				
DDTF 10	.33**	.31**	1			
DDTP 10	.34**	.35**	.62**	1		
DDTF 10,000	.36**	.39**	.54**	.41**	1	
DDTP 10,000	.52**	.48**	.44**	.52**	.75**	1

$* = p < .05$; $** = p < .01$; KQF = Kirby questionnaire Future Rewards, KQP = Kirby questionnaire Past Rewards, DDTF 10 = Delay Discounting Task Future $10 Rewards, DDTP 10 = Delay Discounting Task Past $10 Rewards, DDTF 10,000 = Delay Discounting Task Future $10,000 Rewards, DDTP 10,000 = Delay Discounting Task Past $10,000 Rewards

Table 4: Zero-order correlations between the Kirby questionnaire and the Anticipated Events Task (AET)

	KQF	KQP	Future Pos	Future Neg	Past Pos	Past Neg
KQF	1					
KQP	.79**	1				
Future Pos	-.08	-.05	1			
Future Neg	-.16*	-.12	.49**	1		
Past Pos	-.07	-.10	.14*	.07	1	
Past Neg	.03	.08	.03	.01	.20**	1

$* = p < .05$; $** = p < .01$; KQF = Kirby questionnaire Future Rewards, KQP = Kirby questionnaire Past Rewards, Future Pos = AET future positive events, Future Neg = AET future negative events, Past Pos = AET past positive events, Past Neg = AET past negative events

Table 5: Zero-order correlations between the Delay Discounting Task and the Anticipated Events Task (AET)

	DDTF 10	DDTP 10	DDTF 10,000	DDTP 10,000	Future Pos	Future Neg	Past Pos	Past Neg
DDTF 10	1							
DDTP 10	.62**	1						
DDTF 10,000	.54**	.41**	1					
DDTP 10,000	.44**	.52**	.75**	1				
Future Pos	.08	.07	-.14*	.01	1			
Future Neg	.08	.05	.02	-.02	.49**	1		
Past Pos	-.08	.02	.08	-.06	.14*	.07	1	
Past Neg	-.01	.02	-.02	.04	.03	.01	.20**	1

$* = p < .05$; $** = p < .01$; DDTF 10 = Delay Discounting Task Future $10 Rewards, DDTP 10 = Delay Discounting Task Past $10 Rewards, DDTF 10,000 = Delay Discounting Task Future $10,000 Rewards, DDTP 10,000 = Delay Discounting Task Past $10,000 Rewards, Future Pos = AET future positive events, Future Neg = AET future negative events, Past Pos = AET past positive events, Past Neg = AET past negative events

Table 6: Consistency of responding on the Delay Discounting Task

	DDTF 10	DDTP 10	DDTF 10,000	DDTP 10,000
Consistent	109	78	167	133
Inconsistent	111	142	53	87

DDTF 10 = Delay Discounting Task Future $10 Rewards, DDTP 10 = Delay Discounting Task Past $10 Rewards, DDTF 10,000 = Delay Discounting Task Future $10,000 Rewards, DDTP 10,000 = Delay Discounting Task Past $10,000 Rewards

Oklahoma State University Institutional Review Board

Date: Friday, March 09, 2007

IRB Application No   AS0712

Proposal Title: Evaluation of Different Methods for Measuring Choice

Reviewed and   Expedited
Processed as:

Status Recommended by Reviewer(s): Approved   Protocol Expires: 3/8/2008

Principal
Investigator(s

Frank L Collins   Collin L. Davidson
215 N Murray   1501 W. 3rd Ave. #22
Stillwater, OK 74078   Stillwater, OK 74074

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☑ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North (phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,

Sue C. Jacobs

Sue C. Jacobs, Chair
Institutional Review Board

VITA

Collin Levi Davidson

Candidate for the Degree of

Master of Science

Thesis: THE ROLE OF HOPE IN DELAY DISCOUNTING

Major Field: Psychology

Biographical:

> Personal Data: Born in Winona, Minnesota, on July 31, 1983, the son of Craig and Janet Davidson

> Education: Graduated from Benilde-St. Margaret's High School, St. Louis Park, Minnesota in June 2002; received Bachelor of Arts degree in Psychology with Honors from the University of Kansas, Lawrence, Kansas in May 2006. Completed the requirements for the Master of Science degree in your Psychology at Oklahoma State University, Stillwater, Oklahoma in December, 2007.

> Experience: Worked as a research assistant as an undergraduate in several Psychology laboratories; volunteered for Headquarters Counseling Center in Lawrence, Kansas; Employed by Oklahoma State University, Department of Psychology as a teaching assistant 2006 to present.

> Professional Memberships: American Psychological Association, Association for Behavioral and Cognitive Therapies, Oklahoma Psychological Association.

Name: Collin Levi Davidson   Date of Degree: December, 2007

Institution: Oklahoma State University   Location: Stillwater, Oklahoma

Title of Study: THE ROLE OF HOPE IN DELAY DISCOUNTING

Pages in Study: 48   Candidate for the Degree of Master of Science

Major Field: Psychology

Scope and Method of Study: To evaluate different methods of measuring delay
    discounting and study the role that hope theory plays in delay discounting.
    Participants were recruited from the Psychology department subject pool in
    exchange for partial fulfillment of requirements of Psychology classes. After they
    signed up, they were given a URL address (http://fp.okstate.edu/collinslab/collin/)
    for a PDF copy of the study. They were instructed to download this PDF and to
    print a copy. Participants then completed the informed consent, read the
    instructions, completed all measures, and returned the document to room 232 in
    North Murray.

Findings and Conclusions: Results indicated that all the discounting scores obtained from
    both methods of delay discounting were significantly related. Further, results
    suggested that hope scores significantly predicted delay discounting scores on the
    Delay Discounting Questionnaire but did not predict scores on the Delay
    Discounting Task. Possible implications include using hope scores to identify
    individuals in treatment for substance use disorders who are most likely to
    successfully complete treatment and to use interventions to raise the hope of those
    unlikely to complete treatment. Additionally, it appears that individuals tend to
    view past and future rewards similarly and both measures of delay discounting
    appear to be assessing the same construct.

ADVISER'S APPROVAL: Frank L. Collins