Empirical Modeling Of A Marijuana Expectancy Memory Network In Children As A Function Of Age And Marijuana Use

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EMPIRICAL MODELING OF A MARIJUANA EXPECTANCY MEMORY NETWORK IN CHILDREN AS A FUNCTION OF AGE AND MARIJUANA USE

by

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ABSTRACT

The present investigation modeled the expectancy memory organization and likely memory activation patterns of marijuana expectancies of children across age and marijuana use. The first phase of the study surveyed 142 children to obtain their first associate to marijuana use. From their responses, the Marijuana Expectancy Inventory for Children and Adolescents (MEICA) was developed. The second phase of the study administered the MEICA to a second sample of 392 children to model marijuana expectancy organization and probable memory activation paths of marijuana users versus never-users. Results indicated that irrespective of age, adolescents who have used marijuana tend to emphasize positive-negative effects, whereas adolescents who have never used marijuana tend to emphasize psychological-physiological effects. Memory activation patterns also differed by marijuana use history such that users are more likely to begin their paths with short-term positive effects of marijuana, versus non-users who access long-term cognitive and physiological effects with more likelihood. This study is the first to examine specific marijuana outcome expectancies of children and adolescents as they relate to marijuana-using behavior. Implications for marijuana prevention and intervention programs, future research, and limitations of the current investigation are discussed.

This work is dedicated to my grandparents, Rosa and Telesforo Molina (Mima and Pipo). Their courage, hard work, and determination to provide a life of freedom for their family and generations to come have made it possible for me to live out my dreams. For that, I will forever thank them. This is just a small token of my appreciation for their unconditional love.

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INTRODUCTION

Research conducted in order to elucidate the negative effects of smoking marijuana have found that the lung damage associated with smoking one marijuana cigarette is ten-fold that of smoking one tobacco cigarette, and that this damage could also lead to lung cancer (Sussman, Stacy, Dent, & Simon, 1996). Although those who smoke marijuana are faced with the possibility of developing lung cancer, 17% of young adults (aged 18-25 years) report using marijuana within the last 30 days (Substance Abuse and Mental Health Services Administration [SAMHSA], 2003). The Center for Disease Control (CDC; 2004) reports that 22% of adolescents in high school admit to having used marijuana within the past month, placing this population at an even higher rate of use when compared to adults. When examining the incidence rate of marijuana users, there were an estimated 2.6 million in 2002, yielding an average of 7,000 Americans per day trying marijuana for the first time (SAMHSA, 2003). Of those new users, nearly two-thirds were under 18 years-of-age, with 10% of children reporting having tried marijuana before the age of 13 (CDC, 2004; SAMHSA, 2003).

Despite the universal implementation of drug use prevention programs in schools and small fluctuations in marijuana use, overall use of marijuana among children and young adults has not consistently decreased. In fact, reviews of the literature on the effectiveness of common prevention programs have all concluded that they do not significantly decrease drug use, and are as likely to increase use as to cause a decline (e.g., Dunn, Cruz, Bowers, Ingram & Besaw, 1998). The fundamental problem with popular prevention programs like DARE (Drug Abuse Resistance Education) may be that they have been developed intuitively rather than being based on a firm foundation of empirically-supported theories of the development of drug use in children. One approach to understanding the etiology of drug and alcohol use that may inform

effective prevention approaches focuses on outcome expectancies as a possible causal variable and a mediator of the influence of other antecedent variables.

Tolman (1932) proposed the notion that past experiences are stored as mental representations in memory. These mental representations, or "expectancies," are essentially learned relations between behaviors and their consequences that are continuously being shaped through experience with similar stimuli. It has been shown that alcohol expectancies exist before substantial experience with alcohol (Dunn & Goldman, 1996; Miller, Smith, & Goldman, 1990), covary with alcohol use levels of children and adults (Dunn & Goldman 1998, 2000; Brown, Goldman, Inn, & Anderson, 1980), predict future alcohol use (Christiansen, Goldman, & Brown, 1985; Christiansen, Smith, Roehling, & Goldman, 1989), and mediate the influence of other antecedent variables on alcohol use (Sher, Walitzer, Wood, & Brent, 1991; Stacy, Newcomb, & Bentler, 1991). Expectancies have also been found to be changeable in children (Cruz & Dunn, 2001; Dunn & Yniguez, 1999) and adults, and expectancy changes have been found to predict subsequent changes in drinking behavior (Darkes & Goldman, 1993, 1998; Dunn, Lau, & Cruz, 2000). Therefore, substantial support exists for the hypothesis that expectancies are a causal variable in drinking behavior. Given the notion that expectancies influence behavior, attention has focused on the processes or mechanisms by which expectancies exert control. Modeling memory processes has been used to understand expectancy operation and has found that activation patterns correspond to use of alcohol in children and adults (Dunn & Earleywine, 2001; Dunn & Goldman, 1998, 2000; Rather & Goldman, 1994; Rather, Goldman, Roehrich, & Brannick, 1992; Stacy, Leigh, & Weingardt, 1994), as well as marijuana use (Linkovich-Kyle & Dunn, 2001; Stacy, 1997), cocaine use (Stacy, Newcomb, & Bentler, 1995), and smokeless tobacco use (Stacy, Dent, Sussman, & Raynor, 1990).

A study conducted by Linkovich-Kyle and Dunn (2001) of marijuana expectancy processes in adults modeled the activation of marijuana expectancies in relation to marijuana use with a sample of college students. The study was conducted in two phases. Participants in Phase I were asked to respond to the prompt "Marijuana makes one…" in order to generate free responses that were used to create a memory model-based marijuana expectancy measure. During Phase II, the Memory Model-Based Marijuana Expectancy Questionnaire (MMBMEQ), created from the free responses generated by Phase I participants, was administered to a second group of participants along with a measure of marijuana use. Groups were then divided based on marijuana consumption into four categories: never consumers, experimenters, light consumers, and heavy consumers. Individual Differences Scaling (INDSCAL; Carroll & Chang, 1970) was used to model group differences in the organization of information related to marijuana by comparing group weights. Results indicated that heavy consumers emphasized the relaxed-agitated dimension, with Preference Mapping (PREFMAP; Carroll, 1972) indicating that heavy consumers begin their paths at the relaxed pole. Groups decreasing in consumption levels emphasized the detached-aware dimension, with paths likely to begin at the detached pole. These results indicate that patterns of organization and activation of marijuana expectancies covary with marijuana use patterns in young adults.

The findings of Linkovich-Kyle and Dunn (2001) and others provide a fertile conceptual framework for the development of expectancy-based secondary prevention strategies targeted at young adults and people who are nearing the end of high school. These conclusions are particularly exciting when the similarity of expectancy effects between marijuana and alcohol are considered in the context of a growing body of literature that supports the effectiveness of "expectancy challenge" strategies in reducing alcohol use. The stage has been set for the development of effective expectancy-based interventions to target marijuana use in young adults

in the same manner that this type of research facilitated successful expectancy-based alcohol use interventions for young adults (see Dunn et al., 2000). Furthermore, there is a great potential for success in reducing marijuana use through expectancy-based strategies if the example set by those who developed the most successful expectancy-based strategy for reducing alcohol use is followed. That example can be described simply as using a step-by-step approach that begins with foundational theory development, exploration of the expectancy domain for a particular substance, and empirical modeling of expectancy processes in relation to substance use. These steps are largely complete in relation to the marijuana expectancies of young adults, supporting the statement above regarding the well-developed conceptual framework that is ready to support the development of secondary prevention strategies for marijuana. Unfortunately, expectancy-based primary prevention interventions for marijuana use do not enjoy such a strong foundation of theory-driven background research. In fact, very little marijuana expectancy research has focused on children, and there are no reports of mechanistic or process-oriented studies that would have the potential to begin to inform the development of strategies to influence children's marijuana expectancies in ways that would reduce marijuana use. The present study was conceived for the purpose of filling part of this void in the literature pertaining to children's marijuana expectancies. The primary goal was to complete as much of the necessary foundational work as possible to facilitate subsequent development of expectancy-based strategies to influence marijuana expectancies and reduce marijuana use in children.

To fill a specific gap in our understanding of children's marijuana expectancies, this project was designed to follow carefully the approach that ultimately was successful in elucidating aspects of children's alcohol expectancies that would subsequently form the framework for a successful primary prevention intervention focused on children's alcohol use (see Cruz & Dunn, 2003). First, a marijuana expectancy measure suitable for children and

amenable to the types of analyses employed to model memory processes was developed. This process included tapping the entire domain of children's marijuana expectancies and creating a new expectancy scale based on the material provided by children themselves. The new marijuana expectancy measure for children and a measure of actual marijuana use were administered to a new sample of children across a range of grades. A series of analyses were conducted to gain insight into the process or mechanism by which marijuana expectancies might influence actual marijuana use. Analyses included the use of INDSCAL to empirically derive a hypothetical expectancy network as it might represent the organization of marijuana expectancies stored in memory, an examination of the stimulus configuration and subject weights to identify likely organizational meaning of configuration dimensions, and computation of likely activation paths of marijuana expectancies in relation to relevant characteristics such as age and marijuana use habits. These findings provide a theory-based, empirically derived blueprint or set of instructions that can be used to create expectancy-based primary prevention and intervention strategies focused on reducing marijuana use among children, and subsequently reduce marijuana use among adults.

Hypotheses

1) INDSCAL dimension weights will differ between groups based on age and marijuana use, and these differences will provide information about how children organize information about marijuana in memory and how they understand the effects of marijuana in relation to several overarching dimensions.
2) The PREFMAP regression of expected effects for marijuana use in each group will produce vectors that discriminate between groups based on their age and marijuana use.
3) PREFMAP vectors will indicate that participants in the lower age groups are likely to begin path activation along a more negative dimension, as well as emphasize more negative expectancies as related to marijuana use. As age increases, path activation will begin along a more positive dimension, and older children will emphasize more positive marijuana expectancies.

METHOD

Phase I—Item Generation

Participants

A cross-sectional stratified sampling approach was used to recruit 142 children from a public school district located in the southeastern United States. Fifty-three percent of the participants were male (n = 75) and ranged in age from 11-18 years, with a mean age of 14.06 (SD = 2.26). The sample included 86% African Americans, 7% Hispanic Americans, 3% Caucasian Americans, 1% Asian Americans, and 3% classified themselves as "Other" (see Table 1).

Measures

Demographics Questionnaire

Participants were asked to provide information regarding their age, sex, school grade level, and ethnicity. A sample of this questionnaire is provided in Appendix C.

First Associates Expectancy Questionnaire

Participants were asked to generate words in response to the phrase "Marijuana makes people…" in order to assess expectancies first activated when the concept of marijuana is accessed in memory. Memory researchers have recommended first associates as a technique for obtaining uncontaminated memory information (Nelson, Bennett, Gee, Schreiber, & McKinney,

1993). The first word given by participants to the prompt "Marijuana makes people…" was retained for analysis and the development of the Marijuana Expectancy Inventory for Children and Adolescents (MEICA). A sample of this questionnaire is provided in Appendix A.

Marijuana Use Survey

An anonymous self-report survey was administered to participants in order to determine marijuana consumption history. Participants were asked to select their respective marijuana use frequency from a set of ten responses ranging from "I've never used marijuana" to "everyday" use. Marijuana consumption quantity was assessed using a set of six responses ranging from "I've never used marijuana" to consumption of "more than two marijuana cigarettes" during their most recent use of marijuana. A sample of this survey is provided in Appendix B.

Procedure

Participants were recruited using a passive consent procedure whereby parents/guardians were notified in writing via a detailed parent/guardian consent form of the investigation being conducted two weeks prior to the administration of surveys. Parents/guardians were informed that their child's participation was completely voluntary, that there were no foreseeable risks involved with participation, and that both they and their child maintained the right to withdraw from the study at any time without penalty. All participants were tested in classroom settings, were informed that their responses would remain anonymous, and had their assent (or consent) forms collected prior to survey administration to ensure anonymity. Participants were given the demographics questionnaire, first associates expectancy questionnaire, and marijuana use survey by trained graduate students in psychology. Measures were administered in this same order throughout the study so as to prevent contamination of expectancy responses following the self-

report of marijuana use. After survey completion, participants were debriefed as to the nature of the study, and were provided with a debriefing form to give to their parents/guardians.

Phase II—Configuration of a Hypothetical Marijuana Expectancy Network for Children

Participants

A cross-sectional stratified sampling approach was used to recruit 392 children (219 males) from various locations in the Central Florida area. Participants' age ranged from 11-19 years, with a mean age of 13.39 (*SD* = 2.36). The sample included 41% Caucasian Americans, 33% African Americans, 18% Hispanic Americans, 2% Asian Americans, and 7% classified themselves as "Other" (see Table 2).

Measures

Demographics Questionnaire

The demographics questionnaire detailed previously during Phase I of the study was administered to a different sample of participants during Phase II.

Marijuana Expectancy Inventory for Children and Adolescents (MEICA)

Items generated and retained during Phase I of the study were compiled to develop the Marijuana Expectancy Inventory for Children and Adolescents (MEICA). The MEICA is a 27-item measure that asks respondents to rate the likelihood of experiencing each stimulus (word) when using marijuana by providing a four-point Likert scale format ranging from "Never" to "Always." A sample of this inventory is provided in Appendix D.

Marijuana Use Survey

The anonymous self-report survey of marijuana consumption history detailed previously during Phase I of the study was administered to a different sample of participants during Phase II.

Procedure

Passive consent was utilized to obtain participants for Phase II of the investigation. Parents/guardians were notified in writing two weeks prior to survey administration via a detailed parent/guardian consent form of the study being conducted. Students from the Central Florida public and private school sectors were tested in classroom settings as detailed in Phase I. Participants recruited from the Central Florida community-at-large were obtained through an extracurricular basketball program held once per week during the evening at local gymnasiums. Those in the community sample were administered the surveys in enclosed, designated areas adjacent to the gymnasium by trained graduate and senior undergraduate psychology students. All of the participants received the demographics questionnaire, MEICA, and marijuana use survey, in that order, during every administration to avoid priming respondents to the MEICA, should marijuana use be reported first. Upon the completion of surveys, participants were debriefed and provided with a debriefing form to give to their parents/guardians.

RESULTS

Phase I

Participants were stratified into thirds based on age in order to assess possible changes at varying stages of development. Children aged 11 through 13 were grouped as "pre-adolescents," those aged 14 through 16 were identified as "mid-adolescents," and those aged 17 through 19 were classified as "older adolescents." Analyses to assess participants' first associates to marijuana use consisted of tabulating frequencies for each reported effect and dividing by the total number of responses produced by each group classified on the basis of age and marijuana consumption. Long phrases and items that did not complete the prompt grammatically were eliminated, and items synonymous with effects recorded more frequently were grouped together. Expectancies with proportions greater than 0.020 were retained, resulting in the inclusion of 27 stimuli on the Marijuana Expectancy Inventory for Children and Adolescents (MEICA; Appendix D) administered during Phase II of the study.

Phase II

INDSCAL has been used by expectancy researchers to investigate structural differences between groups of varying alcohol (Dunn & Earleywine, 2001; Dunn & Goldman, 1998; Rather et al., 1992; Rather & Goldman, 1994) and marijuana consumption (Linkovich-Kyle & Dunn, 2001). INDSCAL uses an algorithm to produce a distance matrix, which is similar to a correlation matrix, except the halves are separated by zeros on the diagonal to indicate no difference between items that are identical to themselves. The algorithm performs computations based on dissimilarities between items in order to locate each item on the stimulus configuration.

Group weights on each dimension are tabulated, all of which range from zero to one. Higher weights indicate greater distances between stimuli on that particular dimension, and point to greater emphasis placed on that particular dimension. Squared group weights represent the proportion of variance in the group's data accounted for by the particular dimension (Wish & Carroll, 1974). INDSCAL solutions provide stimulus configurations that can be conceptualized as mental maps in which the probability for activation of an expectancy node depends upon the proximity to other expectancy nodes that have a high probability of activation (Rather et al., 1992).

In the present study, INDSCAL was used to map marijuana expectancies and explore distinctions between dimensions for participants divided into groups based on age and marijuana use. Proximity matrices generated from responses to the MEICA were analyzed using INDSCAL to produce a stimulus configuration reflective of both marijuana consumers and non-consumers across age groups.

As described in Linkovich-Kyle & Dunn (2001), INDSCAL proximity matrices are considered stable when based on a minimum of 25 participants. Thus prior to conducting INDSCAL analyses with groups stratified by age and marijuana use, each was inspected to assure that all matrices would be comprised of at least 25 participants. Upon inspection of the groups, pre-adolescents were found to contain only eight participants who met criteria to be included in the marijuana use category due to the low base rate of marijuana consumption in this age range. In light of this finding, pre-adolescents were not included in subsequent analyses.

Due to the fact that INDSCAL does not specify where activation begins within a stimulus configuration or how it might spread, PREFMAP was used to estimate the likely path of activation of marijuana expectancies in children based on age and marijuana use. A multiple regression technique that has been used by alcohol expectancy researchers, PREFMAP estimates

a line of best fit for each group based on their alcohol use. Such vectors illustrate probable paths of activation through an expectancy network for each group of participants. PREFMAP has been utilized to model the likely path of alcohol and marijuana expectancy activation in adults (Dunn & Earleywine, 2001; Dunn et al., 2000; Linkovich-Kyle & Dunn, 2001; Rather & Goldman, 1994; Rather et al., 1992), and alcohol expectancy activation in children (Cruz & Dunn, 2003; Dunn & Goldman, 1996, 1998).

Individual-Differences Scaling (INDSCAL)

For all analyses performed, a two-dimensional solution was retained due to its ease of comprehension, and because the addition of a third dimension did not contribute information above and beyond that provided by two dimensions to merit decreased interpretability. An R^2 of .70 or greater and stress of .25 or less are considered to be a reasonable fit of the solution to the data (Linkovich-Kyle & Dunn, 2001). Davison (1983) cautions that stress is artificially inflated when using INDSCAL, and as a result, recommends using R^2 as the more appropriate fit index.

An initial INDSCAL analysis was performed using a total of four groups: mid- and older adolescents grouped by marijuana use or non-use. The analysis was conducted in this way to examine potential differences based on both development and use, which yielded a solution with less than optimal fit indices (R^2 = .67, stress = .26).

When comparing the groups on dimensional emphasis, subject weights indicated that non-users placed a greater emphasis on the psychological-physiological dimension (mid-adolescents = .60, n = 30; older adolescents = .70, n = 32) than did users (mid-adolescents = .28, n = 35; older adolescents = .26, n = 25). A similar trend was observed across age with marijuana consumers who tended to emphasize the positive-negative dimension in the mid- (.81) and older (.86) adolescent groupings, in contrast to their non-using counterparts (mid-adolescents = .38;

older adolescents = .40) who did not place as much of an emphasis on this particular dimension (see Figure 1 for a pictorial depiction). Given the resulting INDSCAL fit indices, as well as the greater similarity of subject weights across marijuana consumption history alone, adolescents were collapsed on age and a separate INDSCAL analysis was performed.

Results of the secondary INDSCAL analysis, which grouped participants based solely on marijuana use, yielded a solution with an R^2 of .81 and stress of .20, suggesting a good fit of the data and an improvement of .14 over the initial results. Consistent with the previous analysis, marijuana non-consumers placed a greater emphasis on the psychological-physiological dimension (.76, $n = 62$), while users emphasized the positive-negative dimension (.91, $n = 60$; see Figure 2).

Investigation of stimuli means as depicted in Table 4 revealed a differential emphasis on the possible effects of marijuana as a function of both age and use. Pre-adolescents who have never used marijuana, for example, endorsed "unhealthy," "addicted," and "high" in descending order as occurring with more frequency than did their marijuana-using cohorts who rated "high," "hungry," and "funny" as more readily possible. Differences also were observed among mid-adolescents with non-users having ranked "addicted," "high," and "slow" with more probability than marijuana consumers who listed "hungry," "relaxed," and "high" as their most probable effects. The oldest non-using participants endorsed "high," "hungry," and "sleepy" in descending order, whereas older users rated stimuli in the same order as mid-adolescent users ("hungry," "relaxed," and "high"). Overall, a trend was observed where non-consumers, regardless of age, tended to endorse negative physiological expectancies as being more likely to occur. The reverse is suggested by the endorsements of marijuana consumers, who rated themselves as more likely to experience positive outcomes rather than negative ones.

Preference Mapping (PREFMAP)

A final INDSCAL solution comprised of adolescents aged 14 to 19 was used to plot two vectors: one for marijuana users and one for non-users. Activation was modeled by moving a perpendicular line down each vector starting at the arrowhead. Examination of the vectors in Figure 3 revealed that the effects of marijuana most likely to activate for non-users are "high," "hungry," "unhealthy," and "slow," whereas "hungry," "high," "relaxed," and "funny" are activated more readily by their marijuana-using counterparts (non-users = 70°, users = 17° counterclockwise from the horizontal axis; see Figure 3). Non-users are least likely to access "cool," "good," and "sad," while users place "sad," "angry," and "bad" last in their chain of activation. Note that "sad" is located at the end of both memory activation paths for each of the groups regardless of marijuana use history, indicating a low probability that sadness would be activated at all for adolescents in relation to marijuana use.

DISCUSSION

The present study offers new information regarding the way that children organize and activate marijuana outcome expectancies as a function of development and marijuana use. Our first hypothesis that INDSCAL dimension weights would vary based on both age and marijuana consumption was supported partially. Specifically, analyses revealed that there was a greater emphasis placed on the psychological-physiological dimension by non-using adolescents, regardless of age grouping (see Figure 1). The reverse was observed with marijuana-using adolescents who emphasized the positive-negative dimension of possible marijuana effects. No differences were found based on age as mid- and older adolescents had similar INDSCAL group weights when compared across marijuana use. These findings suggest that adolescents who conceptualize marijuana as affecting them in a globally positive manner, such as making them feel relaxed, happy, and funny, are more likely to have used marijuana, whereas never-consumers tend to endorse negative physiological effects such as feeling addicted, unhealthy, and slow. It is plausible that those who use marijuana tend to focus on the positive reinforcement they will derive from the drug, and place less emphasis on more long-term negative effects. In addition, never-consumers may hold expectancies that are more consistent with traditional drug prevention education programs that tend to emphasize negative outcomes such as those associated with amotivational syndrome (e.g., lazy, slow) and cognitive deficits (e.g., forgetful, stupid) as a result of their inexperience with the drug. Although differences on dimensional emphasis as a function of age were not observed, it is possible that the inclusion of pre-adolescents may alter these findings.

Our second hypothesis that PREFMAP vectors would discriminate between groups based on age and marijuana use was supported partially. The high degree of subject weight similarity based solely on marijuana consumption history (such that users and non-users tended to

emphasize, and therefore cluster along the same dimension) suggested a lack of differences in expectancy outcome beliefs as a function of age. Given this finding, PREFMAP regressions based on both age and marijuana use were not performed. Instead, PREFMAP was used to produce vectors according to the more appropriate grouping variable of marijuana use history (use versus non-use; see Figure 3). As hypothesized, there were considerable differences observed in the memory activation of non-users when compared to users. Specifically, the vectors of non-consumers were found to lie closer to the psychological-physiological axis, whereas consumer vectors were located near the positive-negative axis. Apparent discrepancies between the marijuana outcome effects of non-consumers versus consumers point to considerable differences in the way each type of adolescent conceptualizes marijuana's effects. These findings corroborate our INDSCAL analyses and suggest that users focus mainly on whether or not using marijuana will be enjoyable, whereas physical and cognitive harms are much more salient for non-users.

Our final hypothesis that the PREFMAP vectors of adolescents would shift from memory activation along a more negative dimension to a more positive dimension, and that the emphasis placed on marijuana outcome expectancies also would shift from more negative to more positive expectancies as a function of an increase in age was not modeled. As noted above, similarities in INDSCAL results among mid- and older adolescents across age when grouped by marijuana use history precluded performing subsequent PREFMAP analyses based on age.

In accordance with the biopsychosocial model, there are several overarching variables that may influence outcome expectancy formation, as well as potentially explain some of the differences observed in adolescent marijuana expectancies. A narrow focus on immediate gains, as well as the inability to account for long-term consequences may be critical factors influencing the decision to use marijuana in adolescents. Studies focused on understanding the underlying

brain mechanisms involved in adolescent reward systems and decision-making abilities have linked immaturity in specific regions (e.g., prefrontal cortex) of the brain to impulsive and risk-taking behavior (Overman et al., 2004; Spear, 2002; Tarter, 2002). Given this information, adolescents undergoing neurodevelopmental changes may not possess the skills necessary to utilize appropriate impulse-control and decision-making strategies that prevent the use of drugs such as marijuana. These deficiencies also could explain the emphasis by marijuana users of outcome effects that provide immediate reinforcement (e.g., good, relaxed), as well as the overall lack of importance placed on more long-term negative consequences (e.g., addicted, unhealthy).

Actual experience with marijuana itself serves to shape the expectancies of marijuana users as well, which can understandably widen the gap between their beliefs and those of non-users. Given that non-users lack personal experience with marijuana, their outcome expectancies could reflect negative information obtained through traditional drug education programs, as well as other social channels (e.g., parents, public service announcements, and other non drug-using peers). Another possible explanation is that the environments of non-users are not conducive to the social learning that occurs when individuals observe others under the influence of a substance such as marijuana. Adolescents who are not exposed to drug-using behavior, whether personally or vicariously, potentially only have at their disposal the overall negative information provided to them both directly and indirectly by our society who classifies marijuana as an illicit drug in the Schedule I category.

Although this study is the first to examine the specific marijuana outcome expectancies of children and adolescents as they relate to marijuana-using behavior, there are several limitations to the current research. First, the low base rate of marijuana use among younger children limits the age spectrum from which we can examine differences along a developmental continuum. The inclusion of younger marijuana users could shed light on what differences exist,

if any, for children who begin to use marijuana at such an early age. Examination of an influential variable such as outcome expectancies can inform primary drug prevention approaches and lead to an increase in their effectiveness by targeting the specific factors involved in early onset marijuana-using behavior. Despite the information that the current study provides, we know from alcohol expectancy research with children that expectancies become increasingly positive over time, and that the majority of the shift occurs within the third and fifth grades (Dunn & Goldman, 1996, 1998, 2000). Though alcohol and marijuana are substances with different psychoactive properties, it is possible that a critical period exists in the expectancy formation of children before entering adolescence that may not be tapped by the present study's participants.

In addition, due to the aforementioned obstacles obtaining participants, there were a limited number of adolescents to include in each grouping variable (age by use). It is possible that a larger number of participants would have illustrated differences in outcome expectancies based on age alone. Additional information regarding potential differences in adolescents of varying ages could be utilized in designing effective intervention programs aimed at targeting outcome expectancies associated with drug-using behavior.

The ability to specify fundamental differences among adolescents on a tangible variable such as marijuana use history may prove to be an invaluable prevention and intervention tool. Awareness of sub-population specific expectancies can lead to the development and implementation of successful drug prevention and intervention programs tailored to particular groups of adolescents. Using identified outcome expectancies associated with marijuana use, empirically supported expectancy challenge approaches can be designed to reduce, and potentially even prevent marijuana use in children and adolescents. Early implementation of

such approaches eventually can reduce the number of adults who use marijuana as well, and result in an overall decrease of negative consequences associated with marijuana use.

Future research would benefit from concerted efforts to obtain larger numbers of both marijuana-using and non-using children and adolescents to examine how outcome expectancies relate to marijuana use more closely, and assess whether the findings from this study can be replicated. Conducting a longitudinal study (versus the current cross-sectional design) with a broad age range, such as following young children into adulthood, could be employed to track children's expectancies over time and assess what variables may influence potential changes in those beliefs. Lastly, designing expectancy challenge prevention and intervention programs using the information obtained during this exploratory study could serve as a springboard for the translation of empirically supported expectancy approaches to be used with a substance other than alcohol. Examining whether an expectancy challenge would be as effective with a substance such as marijuana would provide useful information that potentially could be used with other substances as well.

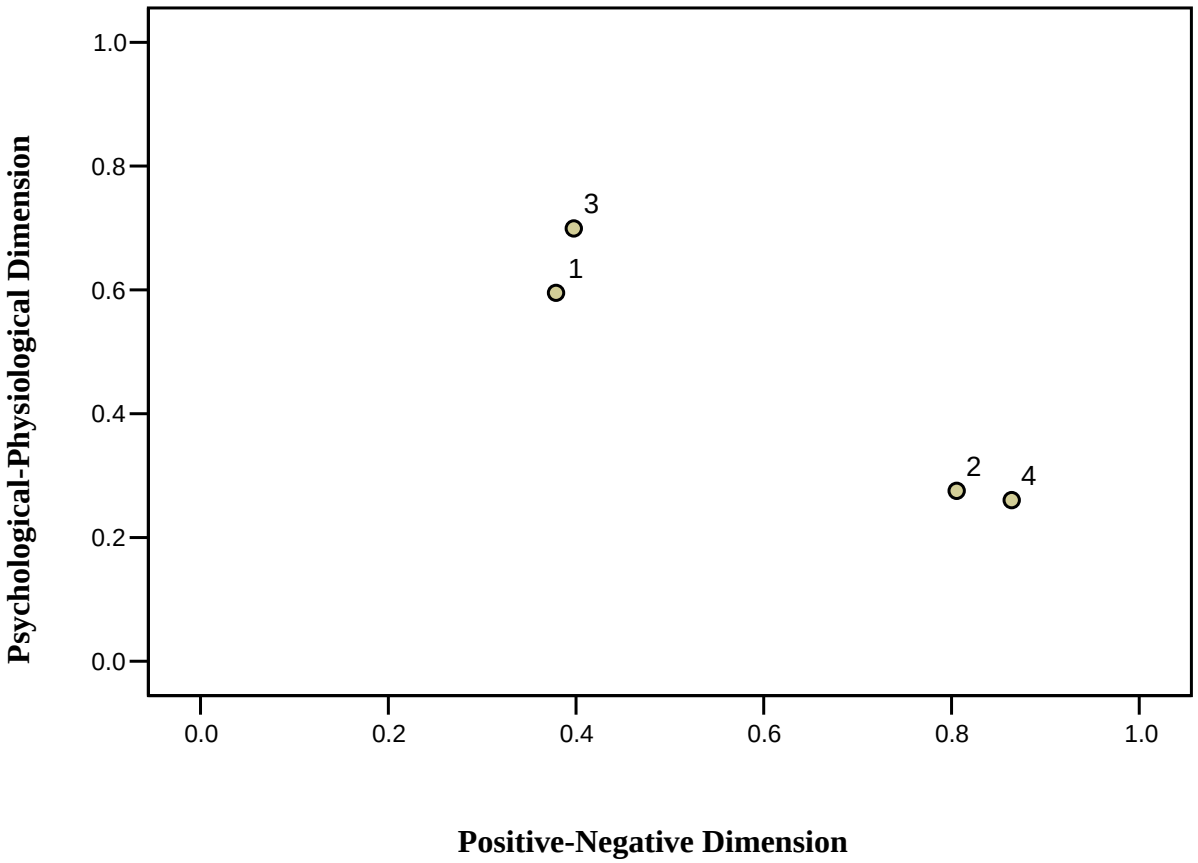

Figure 1. Individual-Differences Scaling participant weights

On the positive-negative and the psychological-physiological dimension for mid-adolescent non-users (1) and users (2), and older adolescent non-users (3) and users (4).

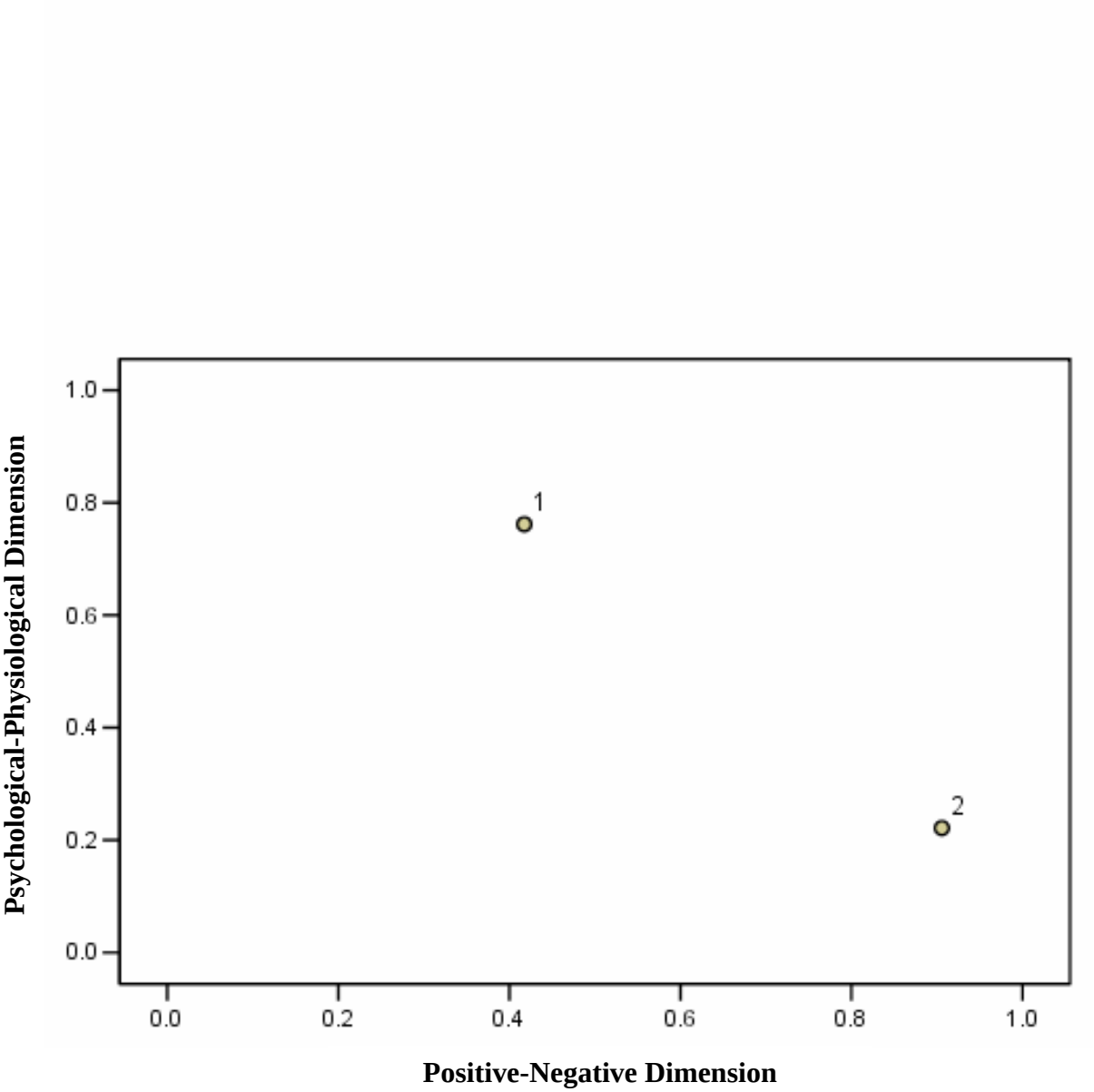

Figure 2. Individual-Differences Scaling participant weights

On the positive-negative and the psychological-physiological dimension for adolescent non-users (1) and users (2).

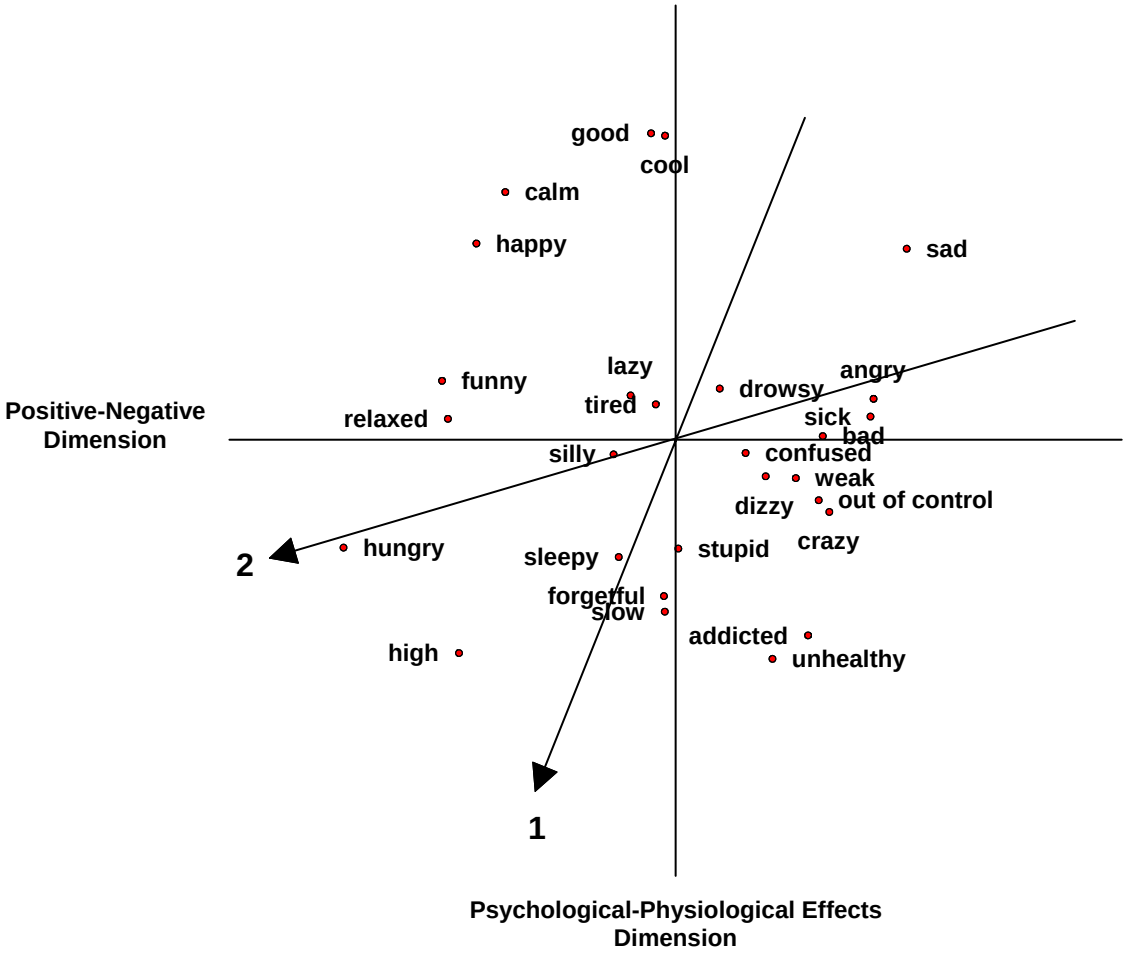

Figure 3. Individual-Differences Scaling stimulus configuration

For marijuana expectancy words representing nodes of meaning within a hypothetical expectancy memory network with preference mapping vectors for non-users (1) and users (2).

Table 1. Phase I: Participant demographics.

	Pre-Adolescents (11-13)		Mid-Adolescents (14-16)		Older Adolescents (17-19)	
	%	*n*	%	*n*	%	*n*
Variable						
Sex						
Male	48.5	32	52.1	25	58.6	17
Female	51.5	34	45.8	22	37.9	11
Unreported	0	0	2.1	1	3.4	1
Mean Age (years)	11.82		15.29		17.10	
Ethnicity						
Caucasian	0	0	2.1	1	10.3	3
African-American	81.8	54	85.4	41	82.8	24
Hispanic-American	13.6	9	2.1	1	0	0
Asian-American	0	0	4.2	2	0	0
Other	3.1	2	2.1	1	3.4	1
Unreported	1.5	1	4.2	2	3.4	1

Table 2. Phase II: Participant demographics.

	Pre-Adolescents (11-13)		Mid-Adolescents (14-16)		Older Adolescents (17-19)	
	%	*n*	%	*n*	%	*n*
Variable						
Sex						
Male	44.2	110	77.6	66	72.9	43
Female	55.8	139	21.2	18	27.1	16
Unreported	0	0	1.2	1	0	0
Mean Age (years)	11.79		15.07		17.73	
Ethnicity						
Caucasian	51.4	128	23.5	20	18.6	11
African-American	17.7	44	57.6	49	57.6	34
Hispanic-American	18.5	46	16.5	14	20.3	12
Asian-American	2.8	7	0	0	0	0
Other	9.2	23	2.4	2	3.4	2
Unreported	0.4	1	0	0	0	0

Table 3. History of marijuana use by phase and age group.

	Pre-Adolescents (11-13)		Mid-Adolescents (14-16)		Older Adolescents (17-19)	
	%	*n*	%	*n*	%	*n*
Phase						
I						
Non-Users	84.8	56	56.3	27	37.9	11
Users	13.6	9	41.6	20	55.2	16
Unreported	1.5	1	2.1	1	6.9	2
II						
Non-Users	96.4	240	51.8	44	55.9	33
Users	3.6	9	48.2	41	44.1	26
Unreported	0	0	0	0	0	0

Table 4. Individual-Differences Scaling means of stimuli.

Pre-Adolescents				Mid-Adolescents				Older Adolescents			
	Non-Users		Users		Non-Users		Users		Non-Users		Users
Stimulus	Means	Stimulus	Means	Stimulus	Means	Stimulus	Means	Stimulus	Means	Stimulus	Means
Unhealthy	2.6067	High	2.6667	Addicted	1.9333	Hungry	2.2308	High	2.2812	Hungry	2.6400
Addicted	2.3766	Hungry	2.4444	High	1.8710	Relaxed	2.0256	Hungry	2.2500	Relaxed	2.3077
High	2.2333	Funny	2.2222	Slow	1.7419	High	1.9744	Sleepy	2.1250	High	2.2692
Out of Control	2.1172	Silly	2.2222	Hungry	1.7419	Funny	1.8718	Forgetful	2.0625	Funny	2.1538
Forgetful	2.1000	Unhealthy	2.1111	Unhealthy	1.6774	Happy	1.8611	Slow	2.0000	Happy	1.9231
Confused	2.0917	Out of Control	2.1111	Stupid	1.5806	Silly	1.7692	Unhealthy	1.9687	Lazy	1.8077
Weak	2.0833	Stupid	2.1111	Sleepy	1.5806	Lazy	1.5641	Stupid	1.9063	Slow	1.7308
Sick	2.0708	Relaxed	2.0000	Forgetful	1.5484	Calm	1.5385	Addicted	1.8125	Calm	1.7308
Stupid	2.0583	Drowsy	1.8889	Confused	1.4839	Tired	1.5128	Silly	1.7500	Forgetful	1.6154
Slow	2.0083	Slow	1.8889	Relaxed	1.4839	Forgetful	1.5128	Relaxed	1.7188	Stupid	1.5385
Bad	1.9542	Lazy	1.8889	Dizzy	1.4839	Sleepy	1.4359	Dizzy	1.6875	Silly	1.5385
Drowsy	1.9160	Dizzy	1.8889	Out of Control	1.4516	Stupid	1.4103	Funny	1.6563	Unhealthy	1.4615
Lazy	1.8996	Addicted	1.7778	Tired	1.4194	Drowsy	1.3590	Confused	1.5625	Tired	1.3077
Dizzy	1.8417	Confused	1.6667	Lazy	1.4194	Slow	1.3077	Lazy	1.5625	Sleepy	1.2308
Crazy	1.7625	Happy	1.6667	Weak	1.4194	Unhealthy	1.3077	Crazy	1.5625	Cool	1.1538
Sleepy	1.6639	Crazy	1.6667	Crazy	1.3871	Confused	1.2564	Tired	1.5313	Good	1.1538
Tired	1.6583	Forgetful	1.6250	Bad	1.3871	Dizzy	1.2051	Sick	1.5313	Drowsy	1.0769
Angry	1.6167	Calm	1.5556	Silly	1.3548	Weak	1.1538	Drowsy	1.4688	Weak	1.0385
Silly	1.5708	Sleepy	1.5556	Sick	1.3226	Good	1.1538	Calm	1.4063	Dizzy	1.0000
Sad	1.2292	Bad	1.3333	Funny	1.2581	Bad	1.1389	Weak	1.3750	Confused	.9231
Hungry	1.1292	Weak	1.2222	Drowsy	1.2258	Addicted	1.1026	Out of Control	1.3750	Addicted	.8846
Relaxed	.8745	Tired	1.2222	Angry	1.1935	Cool	1.0513	Happy	1.3438	Crazy	.8077
Funny	.8577	Sick	1.1111	Happy	1.0323	Out of Control	1.0000	Bad	1.3438	Bad	.6923
Happy	.7917	Good	1.0000	Calm	1.0000	Crazy	.8974	Angry	1.2500	Sick	.6538
Calm	.5708	Angry	.7778	Good	.8387	Angry	.6410	Good	1.0938	Out of Control	.6154
Cool	.5167	Cool	.6667	Sad	.7097	Sick	.6053	Cool	.8125	Sad	.4231
Good	.4958	Sad	.4444	Cool	.7097	Sad	.4737	Sad	.5938	Angry	.3462

Note: In descending order of emphasis by age group and marijuana use.

APPENDIX A: FIRST ASSOCIATES EXPECTANCY QUESTIONNAIRE

Carefully read these directions before turning the page.

On the next page, you will be asked to answer a question. As quickly as possible, write down as many single words or short phrases as you can think of. Do not be concerned about giving a correct answer. Just write whatever comes to your mind first.

For example, if the question was, "Name types of birds," you might write:

Robin
Bluebird
Seagull
Heron
Crow
Eagle
Hawk
Vulture
Stork

Now turn the page, read the question, and quickly write down as many responses as you can think of.

Marijuana makes one:

APPENDIX B: MARIJUANA USE SURVEY

These questions are about marijuana. Marijuana is also called pot, weed, or grass. Marijuana is usually smoked, either in cigarettes, called joints, or in a pipe. It is very important that you answer these questions **honestly** because your answers are completely **anonymous** and no one will ever know it was you who answered these questions. Thank you.

How often do you use marijuana?

a) I've never used marijuana
b) Less than 4 times in my life
c) 1-2 times a year
d) 3-8 times a year
e) 1-2 times a month
f) Once a week
g) Twice a week
h) 3 times a week
i) 4 times a week
j) Every day

How much marijuana did you smoke the last few times you used marijuana?

a) I've never used marijuana
b) 1-2 puffs
c) 3-4 puffs
d) one marijuana joint
e) two marijuana joints
f) more than two marijuana joints

APPENDIX C: DEMOGRAPHICS QUESTIONNAIRE

How old are you? _____ years-old

(Circle only one answer for each question below)

I am a:

a) Boy/Male

b) Girl/Female

What grade are you in right now, OR what is the highest grade you completed?

a) Third (3^{rd})
b) Fourth (4^{th})
c) Fifth (5^{th})
d) Sixth (6^{th})
a) Seventh (7^{th})
b) Eighth (8^{th})
c) Ninth (9^{th})
d) Tenth (10^{th})
e) Eleventh (11^{th})
f) Twelfth (12^{th})
g) High School Graduate (Diploma or GED)
h) In College

Which answer best describes your ethnicity?

a) Caucasian/White

b) African-American/Black

c) Hispanic

d) Asian-American

e) Other

APPENDIX D: MARIJUANA EXPECTANCY INVENTORY FOR CHILDREN AND ADOLESCENTS

The following pages contain words describing possible effects of marijuana. For each word, imagine it completing the sentence: "MARIJUANA MAKES ME _____." Then, for each word circle the word that indicates how often you think that this effect happens or could happen to you after using marijuana. **If you have never used marijuana, answer according to how you *think* it would affect you if did use it.** There are no right or wrong answers. Answer each item quickly according to your first impression and according to your own personal beliefs about the effects of using marijuana. Circle **ONE** answer for each question.

"MARIJUANA MAKES ME _____."

1.	High	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
2.	Dizzy	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
3.	Crazy	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
4.	Sick	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
5.	Sad	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
6.	Bad	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
7.	Happy	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
8.	Hungry	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
9.	Sleepy	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
10.	Good	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
11.	Stupid	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**

"MARIJUANA MAKES ME _____."

12.	Lazy	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
13.	Dead	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
14.	Angry	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
15.	Slow	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
16.	Addicted	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
17.	Calm	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
18.	Out of Control	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
19.	Silly	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
20.	Tired	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
21.	Horny	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
22.	Unhealthy	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
23.	Forgetful	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
24.	Funny	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
25.	Weak	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**

"MARIJUANA MAKES ME _____."

26.	Confused	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
27.	Cool	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
28.	Relaxed	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**
29.	Drowsy	**NEVER**	**SOMETIMES**	**USUALLY**	**ALWAYS**

APPENDIX E: IRB APPROVAL DOCUMENTS

University of Central Florida

Office of Research

March 6, 2003

Jacqueline Alfonso
Department of Psychology
College of Arts and Sciences
University of Central Florida
4000 Central Florida Boulevard
Orlando, Florida 32816

Dear Ms. Alfonso:

With reference to your protocol entitled, "Empirical Modeling of a Marijuana Expectancy Memory Network in Children as a Function of Grade and Marijuana Use," I am enclosing for your records the approved, executed document of the UCFIRB Form you had submitted to our office.

Please be advised that this approval is given for one year. Should there be any addendums or administrative changes to the already approved protocol, they must also be submitted to the Board. Changes should not be initiated until written IRB approval is received. Adverse events should be reported to the IRB as they occur. Further, should there be a need to extend this protocol, a renewal form must be submitted for approval at least one month prior to the anniversary date of the most recent approval and is the responsibility of the investigator (UCF).

Should you have any questions, please do not hesitate to call me at 823-2901.

Please accept our best wishes for the success of your endeavors.

Cordially,

Chris Grayson
Institutional Review Board (IRB)

Copies: Dr. Michael Dunn
IRB File

Office of Research
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