Pathways of Embodiment: Drug Use Among Adolescents in Popayán Colombia

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Pathways of Embodiment:

Drug Use Among Adolescents in Popayán Colombia

by

Sarah L. Fishleder

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Public Health Department of Epidemiology College of Public Health and Master of Arts Department of Anthropology College of Arts and Sciences University of South Florida

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Keywords: Substance Use, Evolution, Cognition, Structural Equation Modeling, Multidimensional Scaling

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Abstract

This research examines the interrelated biological and cultural factors that determine pathways by which recreational drug use is manifest to addiction in the lives of youth aged 12-18 in Popayán, Colombia. It utilizes existing data from mixed methods research conducted between 2004-2005 examining epidemiological risk factors, drug use, perceptions about drugs, and a biological phenomenon of the brain known as incentive salience. Perceptions and experiences related to drugs were gathered using structured methods. MDS and hierarchical plots of drug perceptions are presented in order to demonstrate the power of culture and expectation on perception and choice. Structural equation modeling was used to analyze quantitative health survey data and evolution-based pathways to addiction are mapped. Results confirm the importance of biocultural models in addressing addiction medicine.
**Introduction**

**Statement of Problem**

Most people use a potentially addictive substance at some time in their lives, but few actually become addicted (Kandal 1991). These few are highly susceptible to relapse and their successful functioning is often impaired (Nutt et al 2007). The changes in the brain that cause the transition from recreation to addiction are an important part of understanding unhealthy use, as are the social circumstances that those individuals face (Robinson and Berridge 1993, Robinson and Berridge 2008). Understanding the factors that shape drug perceptions is useful to determine the appropriateness of interventions, and in targeting efforts effectively.

Despite ecological factors that would intuitively point otherwise, patterns of drug use in Colombia are a surprise: rates are higher than other surrounding countries, yet are generally lower than the US. Little research has been conducted on this phenomenon (Brook et al 2002, Neumark et al 2011, Ross 2001): neither in understanding the cognitions of that lead to choice, nor in a biological or evolutionary assessment. Rather, research addresses the issue from a purely psychological or individualist perspective. With this thesis research, I examine the lives of youth aged 11-19 in Popayán, Colombia. I utilize data from mixed methods research examining epidemiological risk factors, drug use, perceptions about drugs, and the neuroanthropology of compulsive wanting (incentive salience).

---

1 The theory of *incentive salience* postulates that drugs change the brain circuits housed in the mesolimbic dopamine system that are involved in motivational behavior; and as a result, the brain reward systems become hypersensitive to drug-related stimuli. The concept is explained in further detail in Chapter 3. This sensitivity relates to the feeling of potential *reward*, as opposed to enjoyment (Robinson and Berridge 1993, 2001, 2008).
This analysis explores cultural cognitions$^2$ about drugs, and tests significant evolutionary predictors of drug use.

Chapter 1 places substance use and abuse in a global context, and then focuses in on how these issues fit specifically within the study setting, Colombia. It then discusses the strong association of youth and substance use before moving on to the study itself, conducted by Dr. Daniel Lende between 2004-2005. The two research sites are described, and background is given to the organization and methodology of the study. This chapter will orient the reader to the upcoming analysis.

Chapter 2 is focused on analyzing how youths perceive their experiences using drugs. It uses an anthropological perspective to draw upon one of the most common health models used today: the Health Belief Model. This model sets a framework for understanding determinates of health behaviors. It posits that modifying variables, cues to action and self-efficacy affect an individual’s perceptions about the seriousness of outcome, their susceptibility, as well as the perceived barriers and benefits of the behavior (Hayden 2009:31-35). Central to this chapter, and present in the Health Belief Model, is the concept of expectancy, which is a cognitive process that asserts that a person will make a decision because they are motivated by what they expect the outcome to be. Data consists of two types of structured methods: triadic comparisons and ranking of types of drugs. Analysis utilizes multidimensional scaling and PROperty FITing (PROFIT). Results highlight the power of culture and expectation on perception and choice.

Chapter 3 focuses on mapping pathways to addiction from an evolutionary perspective. Drugs are found nearly universally, and have been around since prehistory. Attempts to address and control unhealthy use has, generally, been unsuccessful: drugs are still everywhere.

---

$^2$ Cultural cognitions refers to a shared knowledge (de Munck 2011:1), and forged by, and symbolic of, larger aspects of their larger cultural context (D’Andrade 1995). This concept will be explored further in Chapter 2.
Evolutionarily speaking, in order to maximize fitness, organisms make strategic changes in response to stress and competition. Drugs offer both actual benefits and create the illusion of benefits. Modeling evolutionary pathways to addiction risk involves identifying and measuring shifting behavioral strategies and biological risk factors. From a biological perspective, the theory of *incentive salience* postulates that drugs change the brain circuits housed in the mesolimbic dopamine system that are involved in motivational behavior. As a result, the brain reward systems become hypersensitive to drug-related stimuli. This sensitivity relates to the feeling of potential *reward*, as opposed to *enjoyment*. Data consists of quantitative survey data, and analysis utilizes structural equation modeling to test the relationship of evolutionary factors with addiction risk. Results support the evolutionary based theories.

Chapter 4 concludes the thesis, offering a summation of main concepts covered in the earlier chapters and outlines recommendation and expected contributions to applied anthropology.

Rather than focusing on the political or clinical aspects of addiction, this thesis takes on the issue from an applied biocultural medical anthropological perspective. Biocultural anthropology examines the interactions of cultural and biological determinants with regard to physical and psychological health (Wiley & Allen 2009).

It accomplishes this through a focus on evolution, biology and culture. This analysis will combine the strengths of anthropology with the power of public health, and provide novel information and cohesive recommendations to inform interventions.
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Chapter 1: Background and Study Overview

Introduction

This thesis examines how adolescents in Colombia 1) think about drugs, and 2) map common evolutionary-based risk factors for dangerous use. The exploration of how adolescents think about drugs is based on common models of decision-making. It utilizes multidimensional scaling to analyze two types of structured methods. The exploration of risk factors is based on a quantitative survey. It utilizes structural equation modeling to test evolutionary factors as drivers of addiction risk. Methodology is based off previous work by Daniel Lende (Lende 2003) at a similar research site in Bogotá, conducted between 1999-2001. During that project, one of the instruments utilized in this analysis was developed. The structured methods portion was an addition in this project. Methods are described in greater detail later in this chapter. Data for this project was collected by Dr. Daniel Lende between 2004 and 2005. This chapter will outline substance abuse from a global perspective, from the Colombian context, and as it pertains to youth. It will then describe the two research sites and give a broad overview of the study. Lastly, it will describe the ethical compliance of the research. The field of public health is very effective at reaching many populations. It draws largely from epidemiology, and often utilizes biomedical-based behavioral models. Anthropology provides complementary insight into the unique cultural context, patterns of belief and health behaviors.
Descriptive Epidemiology: Substance Abuse, Youth and Colombia

Substance Abuse: A Global Overview

Unsafe substance use has the potential to damage health as well as social and economic standing on many ecological levels (e.g.: family, community and individual). The World Health Organization estimates total worldwide substance use to consist of 2 billion consumers of alcohol, 1.3 billion smokers, and 185 million users of other drugs (WHO 2014). Substance abuse is defined as harmful or hazardous use of psychoactive substances, which can lead to dependence syndrome. Dependence consists of repeated use, and refers to a range of psychosomatic and behavioral outcomes that manifest after repeated substance use (WHO 2013). The potential harms that problematic substance abuse in youth may have are varied, depending on the drug in question (Newton 2010). Measurements of harm brought on by substance abuse or drug misuse are generally accepted to fall into three realms: the physical harm of the individual caused by the drug (inclusive of both psychological and somatic conditions); the tendency of the drug to induce dependence; and the effect of the drug on the family, community and other social aspects of the user’s life (Nutt 2007).

The WHO estimates that alcohol, tobacco and illicit drugs collectively contributed to 12.4% of all deaths in 2000, and 8.9% of total years of lost life (WHO 2013). Alcohol and tobacco each contributed to 4% of the total Disability Adjusted Life Years (DALYS), and about 0.8% was attributed to other drugs (Rehm Taylor & Room 2006). Tobacco had the highest mortality risk of all the substances mentioned, and ranked to be the most important risk factor in developing countries. Alcohol was ranked the most important in developing countries, particularly in those with emerging economies (Rehm Taylor & Room 2006). The burden generally impacts men at higher rates. For example, men made up about 80% of the tobacco and
drug related deaths, and about 90% of alcohol related deaths. About 65% of alcohol related
deaths generally take place before age 60, and deaths related to illicit drugs mostly strike earlier
in life (WHO 2013). Tobacco related deaths generally are highest among the elderly (Rehm
Taylor & Room 2006).

The economic resources of the country have a great impact on the burden of substance
abuse, particularly in developing countries such as Colombia (Keefer & Loayza 2010, WHO
2013, Schmidt & Room 2012). In a 2012 systematic review, Schmidt & Room discuss common
themes related to alcohol-related harm in developing countries, and explores the reasons that the
burdens generally increases with economic development. He cites pressures from the alcohol
industry, which marks developing countries as up-and-coming pools of profit. The market that
emerges places a higher level of prestige on globally produced drinks. The division of alcohol
choice symbolizes the growing social bifurcation. This shift also marks a shift in control of
homemade alcohol, often made by women. As a result, women lose control of an economic
resource they might have once had. Other political and economic divisions are manifest, as
increasing alcohol revenue causes political leaders to accept levels of harm that would have
previously been unacceptable. Often, social movements emerge to counter this trend of
increasing alcohol consumption (Schmidt & Room 2012).

The illegal drug trade is, of course, international and interconnected. Despite high profits
in coca and opiate production, most countries that are able to produce these substances do not.
Countries may face much greater competition in the production of legal substance than in the
illegal market. Additionally, the level of violence associated with the drug trade is much higher
in certain countries than in others (Thoumi 2012). Although domestic policies in wealthier
countries may be aimed at curbing harm within their own borders, many policies affect the
economic and political stability of developing nations (Keefer & Loayza 2010). A general lack of wealth is one catalyst for a stronger presence of drug production (Cherry 2002), while other incentives come from social pressures (Thoumi 2012). Economist Dr. Francisco Toumi (2012) notes that wide discrepancies between informal norms (such as social pressures) and formal norms (such as law) encourage crime. This is particularly evident when the opportunity for fulfilling such social pressures is only attainable, for many, through illegal means. The intensity of the prohibition, often imposed by wealthier countries, actually increases organized crime and instability. Additionally, it is in the high consumption of the wealthy countries that provides the driving market for developing production countries (Keefer & Loayza 2010).

Adverse conditions associated with life in developing countries include lower education, greater unemployment, and lower standards of living. These factors impact the experiences of early childhood (Panter-Brick, Lende & Kohrt 2012). Exposure of children to psychoactive substances reflects such circumstance, and not only perpetuates the economic disadvantage, it also leaves biological and social marks (Panter-Brick, Lende & Kohrt 2012). Although such negative cycles are an undeniable reality, it must be noted that such outcomes do not encompass the entirety of the drug use experience. The consequences can produce both pro-social and antisocial outcomes (Hirch, Galinsky and Zhong 2011). One poignant example of the multifaceted experience of heroin addiction is described by Angela Garcia, in her 2010 ethnography in the Espanola Valley. Here, she presents the idea of embodied loss, where no one is untouched by the melancholy of the surroundings. She notes that while her informants certainly struggled with the harshest parts of addiction, their experience with the drug also eased pain. It allowed them to build community and create an identity amid insurmountable poverty and seemingly infinite despondency (Garcia 2010). Certainly the experience of these addicts is more complex.
than the DSM would diagnose. Particularly when one recognizes the limitations of an overly-biomedical outlook, it is evident that while many negative outcomes occur, there may also be positive social interactions and community building (Hirch, Galinsky and Zhong 2011, Singer 2012). Given the intricacies impacting substance use, it is important to take on equally faceted measures of intervention equipped to address the entire web of factors, which is the approach taken here.

**Colombia and Substance Abuse**

Colombia is one of the first constitutional governments of South America, and is located in the northwest, connected to Panama. It is surrounded on two sides by water: the Caribbean Sea to the North, and the Pacific Ocean to the South. Colombia was originally inhabited by indigenous people until it was invaded by the Spanish in 1499. A series of governmental transitions finally culminated with the establishment of the Republic of Colombia in 1886. The country was a leader in unionizing Pan American efforts such as the Organization of American States. The country is ethnically and ecologically diverse, with decedents of natives, Spanish colonists, African slaves and immigrants from Europe and the Mediterranean. Despite ethnic similarities, most citizens are Catholic. Colombia consists mostly of a warm climate, with cooler conditions closer to the mountains. It is largely agricultural based, with some industrial production; however, a middle-income and an emerging economy contrast with the agricultural tradition. In fact, it is part of six majorly favored emerging markets collectively known as CIVETS. The acronym is made of Colombia, Indonesia, Vietnam, Egypt, Turkey and South Africa: countries known for a large young population and a vigorous economy based on multiple industries.
Substance use and abuse is a unique problem among the youth of Colombia (Brook et al 1998, Hall 1993, Ross 2001). Colombia has patterns of alcohol and tobacco use very similar to the United States. About 70% of youth in the United States had tried alcohol by their senior year of high school (CDC 2012-a), and rates in Colombia were about 74.2% (WHO 2007). In the United States, about 31.5% of high school students who smoked cigarettes were reported to be current smokers (CDC 2012b), while about 33.4% of Colombian youth smoked. However, statistics from the 2011 United Nations data on worldwide youth drug use show that while rates of drug use in Colombia are significantly lower than that of the United States, illegal drug use is still higher in Colombia than in neighboring Latin American countries (UNODC 2012:2, Degenhardt 2008).

As part of the 2012 World Drug Report, the United Nations Office on Drugs and Crime gives an overview of drug use in youth by region (see Table 1.1). Results show that the most abundantly used drug among Colombian youth is marihuana, with lifetime prevalence rates of approximately 9.6%, and 8.4% having used in the past year. In the US, the comparative youth rates were 33.4% had ever used, and 27.5% had used in the last year (UNDOC 2012). Rates of lifetime use in Bolivia were 6.2%, Peru was 2.0%, Ecuador 6.4%, and Venezuela 1.7%. Youth lifetime rates of ecstasy in Colombia were 4.3% having ever used, and 3.7% having used in the past year. The US statistics showed 6.4% had ever used, and 4.7% had used in the last year. Rates in South America estimate Bolivia to have 1.6% lifetime use among youth, Peru 1.2%, Ecuador 1.3%, Argentina 2.0%, and Venezuela 0.53% (UNDOC 2012). Reports estimated that in Colombia, 2.0% of youth had ever used cocaine. Comparatively, in the US, 3.7% had ever used cocaine. In Colombia, 1.3% had ever used heroin, and 1.2% had used it in the past year. In the US, 1.3% had ever used heroin, and 0.8% had used in the past year (UNDOC 2012,
Rates in Bolivia and Peru were 1.0%, Argentina and Ecuador were 0.9%, and rates in Venezuela were 0.4%.

Three ecological factors impact these rates. The first is a high availability of drugs through trafficking and production. The country has had a long history in the drug trade, and has been a leader in both drug production and trafficking for years (Cherry 2002). Colombia is one of the largest world producers of coca and its derivative cocaine (UNODC 2012:2). The country continues to produce substantial amounts of marihuana (UNODC 2012:67), and cannabis seizures rose from 209 tons in 2009 to 255 tons in 2010 (UNODC 2012:49). Many studies have found that the greatest factor significantly associated with increased risk is cultural prevalence, with most new users becoming exposed through peer-to-peer interaction (Kandel 1991). Results from nine school surveys based in South America demonstrated that, in line with high production rates, Colombian youth have higher rates of legal and illegal drug use when compared to other countries that participated in the survey (Inter American Drug Abuse Commission 2004). Two studies showed that drug availability is a major ecological factor for drug use in Colombia, but noted that these trends do not account for the actual pathways by which the user comes into contact with these drugs (Brook, Brook, Rosen & Montoya 2002, Brook et al 1998). The second factor is a middle income with high urban growth. A fast-growing urban area in the face of increasing globalization brings with it changes in employment, economic activity, education, housing and lifestyle (Rodrique 2013). A need for money often results in engagement in the drug trade (Cherry 2002, UNODC 2012).

The third factor is that Colombia retains similar patterns of risk in the urban environment as are present in other developing countries. For example, street-living and violence has repeatedly been shown to correlate with drug use (Ross 2001, Brook et al 2002, Brook et al
1998), and in Bogotá violence from peers and police was even perceived to be more dangerous than the threat of HIV among injection drug users (Ross 2001). This interesting intermediary position highlights something unseen: despite ecological factors that would logically lead to higher use, rates are relatively low. The reason behind these unintuitive rates warrants exploration.

*Substance Abuse and Youth*

Adolescence may be a universal biological and social phenomenon characterized by a not-quite-adult, unmated-yet-sexually capable, somewhat-dependent phase. Although youth as a social stage is a near-universal experience, this experience is manifest in different behaviors. What is considered to be key psychosocial developmental elements of youth is expressed differently according to ecological factors. Conversely, the same ecological factors produce different reactions (Shlegal and Barry 1991). Nonetheless, there are some areas in which youth is associated with certain behaviors. In particular, risk taking is one of them (Hill and Chow 2002). Shlegal and Hewlett spoke explicitly about the idea that risk-taking is an understood characteristic of youth when researched in Western cultures. This phenomenon has biological foundations, and was found to be linked to structural and hormonal changes in the developing brain (Shlegel and Hewlett 2011). Such biological states are correlated, and often directly likened to social and cognitive changes in status (Wothman 1987). Despite the fact that such behaviors vary across cultural groups, drug use is one such high-risk behavior positively associated with youth (Kandel 1991, Buscholtz 2002). Rates of any kind of substance use are twice as high in those aged 18-34, compared to those aged 35 and older. This higher rate
increases with the level of involvement in drugs (Kandel 1991). The potential harms of youth drug use are varied, depending on the drug in question (Newton 2010, NIDA 2010).

**Research Site**

*The City of Popayán*

Popayán, Colombia is a city of approximately 258,000 people, and is located between Colombia’s Western and Central mountain ranges (see Figure 1.1). It lies about 230 miles Southwest of Bogotá, the capital. It was founded in 1537, and has a long Colonial history. The city is well known for its architecture, and political life. It is the capital of the Colombian department (similar to the states of the US) of Cauca.

*Two Research Sites*

Data collection for this project took place in two sites from 2004 to 2005. The first site was at a small rehabilitation clinic specializing in young men, whose ages ranged from 13-19 year olds. Patients were a mix of clinical substance abusers, and those who were court-ordered to enroll as a consequence of drug charges. Most of the population at the clinic was lower to lower-middle class, and came from the entire surrounding region. The second site was a Catholic school, consisting of both male and female students ranging in age between 11-19. This population was drawn only from the city of Popayán, and consisted generally of middle class students. As would be expected, there were far less clinically categorized cases of substance abuse at the school. The differences of the populations will be accounted for during analysis. There are no additional inclusion or exclusion criteria, except as needed to protect the robustness of analysis.
**Study Overview**

This was a multi-phase, mixed methods study that reflected the replication and extension of research conducted earlier in Bogotá (Lende 2003). Quantitative methods consisted of a long survey that focused on risk factors that included all research participants at both sites. Qualitative phases consisted of short interviews with many, but not all, participants that aimed to determine how these adolescents perceived substance use. Primary domains consisted of broad questions regarding 1) alcohol, 2) marihuana, and 3) other drugs. Lastly, long, in-depth interviews were conducted with a few adolescents, which aimed to determine personal experiences with substance use, and risk factors. Key areas covered were: (1) ambivalence, (2) drug use as an individual and cultural practice, (3) a theory of compulsive wanting, (4) subjectivity (including both biology and individual experience), (5) embodiment, and (6) Colombia.

Additional analysis unique to the project in Popayán included the introduction of new quantitate portions, and the variation of the “long” survey (referring to the lengthy quantitative risk factor survey administered in Bogotá) to better test certain ideas and scales. First, two different versions of the surveys were created to test for ordering effects on the particular scales. Each survey retained the same information, but in different orders. Each version was administered to both research sites. In addition to the long survey, a second survey was given in two parts, with the data treated separately for each section. The first part was called the “repeat” survey, and recapped important sections of the long survey, and gathered information on perceptions of the meaning of friendship. The second part of Survey 2 was called the “friends” survey. Like its name suggests, this instrument also gathered information on perception of friends and friendship, and contained a section of two structured methods: triadic comparisons.
and ranking data. Notably, the two versions of the friends survey had a split-ballot design when it came to the ranking data. A set of twelve ranking questions appeared, split across both versions. In other words, the friends version A had a different set of ranking questions than did version B. However, since each survey was administered at both sites, responses to the ranking items were represented appropriately. In total, the friends survey examined the domains of friends, knowledge and attitudes about drugs, and cultural models around drug use. This thesis utilizes data from the Long survey and the Friends survey.

**Ethical Considerations**

There were no foreseeable risks to subjects for participating in this study, nor other ethical considerations. Participation was voluntary, and there were no incentives. Informed consent and assent was always gathered, and it was reiterated that the participant could choose to leave the study at any time. Research was, and continues to be, in full compliance with the board-certified IRB guiding principles. All data is de-identified and kept in password-protected computers. There is no chance of subject identification. There is no chance of compromise to sensitive or dangerous groups.

**Conclusion**

This chapter has oriented the research and given a comprehensive overview of the study design and research sites. The following chapters will begin the analysis of the data. Chapter 2 draws upon the structured methods of the Friends survey to shed light into how each of these groups perceived drugs. Chapter 3 utilizes data from the Long survey to map pathways towards hazardous use.
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World Health Organization  

Wothman CM.  
### Table 1.1: Epidemiology of Substance Use by Country and Drug as per 2012 UNDOC World Report

<table>
<thead>
<tr>
<th>Country</th>
<th>Marijuana Lifetime</th>
<th>Marijuana Past Year</th>
<th>Ecstasy Lifetime</th>
<th>Ecstasy Past Year</th>
<th>Cocaine Lifetime</th>
<th>Cocaine Past Year</th>
<th>Heroin Lifetime</th>
<th>Heroin Past Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>33.4</td>
<td>27.5</td>
<td>6.4</td>
<td>4.7</td>
<td>3.7</td>
<td>2.2</td>
<td>1.3</td>
<td>0.8</td>
</tr>
<tr>
<td>Colombia</td>
<td>9.6</td>
<td>8.4</td>
<td>4.3</td>
<td>3.7</td>
<td>2.0</td>
<td>1.7</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Bolivia</td>
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![Figure 1.1: Map of Colombia](image-url)
Chapter 2: Cultural Cognitions

Chapter Introduction

Little research has been conducted on understanding cognition and perception of drugs and drug use rates among Colombian youth, or the forces that perpetuate the use of drugs specific to this population (Brook et al 2002, Neumark et al 2011, Ross 2001). Cognitive anthropology and social epidemiology intersect within the Health Belief Model (HBM) defined above. The psychological concept of expectancy, refers to the phenomenon that a person will act because they are motivated by what they expect the outcome to be, based on life experience. This concept is present in the HBM, and is also applied across many other disciplines (Goldman 2006). This model sets a framework for understanding determinates of health behaviors (Hayden 2009:31-35). The cognitions that determine the decision-making process will help define various pathways to addiction.

Cognitive anthropology investigates the transmission and sharing of collective—as opposed to individual—knowledge (de Munck 2011:1) between groups. It focuses on what people know, how they think, and how that knowledge affects perceptions of the world (D’Andrade 1995). It is further distinguished by its methodologies, which borrow from linguistic anthropology and psychology (Colby 1996). Meanwhile, social epidemiology is concerned with social determinates of health. This includes the interactions of psychological conditions between the individual and the larger social group. Collective cognitions of health domains are instrumental in how groups perceive certain phenomenon, and the choices they make regarding
these phenomenon (Schwartz et al 1992, D’Andrade 1995). In other words, people draw on their own knowledge to produce expectations, respond to the rewards and negative experiences of their environment, make a health decision, and ultimately engage in a health behavior.

This chapter will examine cognitions of a group at high-risk of developing substance abuse problems: adolescents. It will open with a discussion of the relevant theory, giving a comprehensive overview of the Health Belief Model as it relates to substance use and anthropology. It will then present the concept of expectancy, which influences the parts of the HBM. The next section gives an overview of the methodology used to determine cognitions and beliefs about drugs. Datasets consist of structured methods; non-metric multi-dimensional scaling, hierarchical clustering and Property Fitting are used to analyze the structured data. The results of this analysis are given and discussed as they pertain to cultural cognition of drugs.

**Theory: Health Belief Model**

The mid-1990s marked the beginning of a large spike in the number of medical anthropologists working in collaboration with public health professionals (Yoder 1997:131-132). Although anthropologists have been criticized for lacking major contributions in health theory by not presenting an alternative model of behavior, most public health behavioral models are derived from a social psychology framework (Yoder 1997:132). These models are often too simplistic to truly capture the nuance of human health behavior (Buchanan 1994, Buchanan 1998), and generally operate under the assumption that changes in health related behavior is necessarily preceded by changes in belief (Yoder 1997:131). This section will first present one of the most common public health models used to explain behavior. It will critique the model from three distinct anthropological perspectives, and report examples from the literature pertaining to
drug use and addiction. Specifically, these anthropological perspectives include individualist (empiricist), cognitive, and interpretive (also known as meaning-centered) approaches. The section will then present the concept of expectancy, which influences the formation of the beliefs relevant to the model.

The need for a broader conception of theory and research is demonstrated in the widening breach between health theory and its successful practice (Buchanan 1994, Buchanan 1998). As anthropologist Benjamin Paul noted in 1963, “Directors of health programs, as agents of social change and community development, should understand the nature of certain gaps that recurrently impede realization of program objectives.” Understanding a population’s cognitions about drugs will identify the underlying divers of health behaviors, thereby uncovering the reason for any shortcomings in current health programs.

The Health Belief Model: Overview

The Health Beliefs Model (HBM) was first established in the 1950s by the Public Health Services (PHS)—the primary service sector of the Department of Health, Education and Welfare (HEW). This was the agency that would later become the United States Department of Health and Human Services. Researchers developed the HBM to determine the reason that although free tuberculosis screenings were offered by the PHS, people did not utilize them (Hayden 2009, BUSPH 2013). In trying to uncover the lack of success of this program, the researchers created a model that is one of the earliest, yet still is one of the most commonly used theories in public health and health education today (Rosensock 1988, Hayden 2009:31).

This theory is formed from a combination of both psychological and social theory. It is founded on the notion that health behaviors are rooted in a desire to be healthy, and that taking
actions will bring about wellness (BUSPH 2013). More specifically, the HBM postulates that health behaviors are determined by personal beliefs about a disease and the strategies available to avoid that disease. It has a two-section argument. It first argues that personal perceptions about susceptibility, seriousness, barriers and benefits determine health behaviors. After more research, the model was amended. Certain modifying variables, cues to action, and self-efficacy were said to shape the personal perceptions noted above (Hayden 2009:31-35).

Perceived susceptibility is the degree to which a person sees themselves to be at risk for a certain disease or negative health outcome. This can lead to both a reduction in hazardous behavior (when perceived risk is high) and an increase (when perceived risk is low). For example, a heroin user who feels that they are in danger of contracting HIV would be more likely to use clean needles than one who does not perceive the disease to be a real danger. Perceived seriousness is the individual’s conception of how severe or dangerous the particular health outcome is. This may include both the somatic ramifications, and how strongly the disease will affect the individual beyond the clinical severity. For example, an adult might feel that engaging in a drinking binge is less serious if they are living alone, than if they are the single parent to an infant. The term benefits refers to what the person feels they will gain from adhering to the medical advice. This includes how effective an individual understands the specific health behavior will be in preventing or curing the illness, and also includes non-medical benefits. Examples of perceived benefits brought by cessation of smoking may include improved breathing, or saving money on cigarettes. Perceived barriers refer to what a person believes stands in the way of performing a particular health behavior. These may include lack of resources, pathological fear, lack of understanding, or anxiety (Haywood 2009). For example, a barrier to cessation of drug use is the fear of social exclusion. Notably, perceived barriers have
been shown to be the single strongest factor in determining the success of behavior change (Janz and Becker 1984).

As noted, the HBM was later amended. This additional section includes *modifying variables*, which are various individual characteristics that may affect a person’s perceptions. These include culture, education, and personal experience. The next addition to the model is *cues to action*, which are any stimulus that cause a person act. These may be a friend’s advice, a disease epidemic, or the death or illness of someone close. The last evolution of the theory is *self-efficacy*, which refers to how certain a person is that they will carry-out some action successfully.

**Critique from an Anthropological Perspective and Existing Anthropological Literature**

This model is common in health behavior theory, and numerous literature—primarily focused on changing a local population’s health behaviors—has been published utilizing the framework. However, non-adherent choices (e.g.: not taking a vaccine, not getting regular mammograms, or using drugs), on the part of the population still plagued many health interventions (Yoder 1997, Rosenstock et al 1988). While public health officials focused in delivering the care programs, Anthropologists focused on determining what, from the local perspective, must still be accounted for (Paul 1963). Three anthropological approaches will be used here to critique The Health Belief Model as it pertains to addiction studies.
**Individual/Empiricist Approach**

**Definition**

The empiricist approach is grounded in rationalist, agency-based theories that draw upon sensory-derived knowledge. It holds that a correct reality exists in the natural world, independent of the viewer; and that this reality is merely named or perceived through the eyes of people (Gaines & Davis-Floyd 2004:98). Bryan Good (2006) describes in his essay *Medical Anthropology and the Problem of Belief* how anthropologists struggle with the debate on how to make sense of cultural views that clash with modern science. The question is often: should one take the views symbolically, or understand them as an expository system that serves as a primitive alternative to natural science? He notes that Evans-Pritchard’s explicitly empiricist ethnography of the Azande is the primary source this debate (Good 2004:11). In this population, negative health was often associated with witchcraft. Evans Pritchard (1937) writes about the Azande belief in witchcraft as a system based on objective observation, and interpreted by mysticism. He writes:

> It is an inevitable conclusion from Zande descriptions of witchcraft that it is not an objective reality. The physiological condition which is said to be the seat of witchcraft, and which I believe to be nothing more than food passing through the small intestine, is an objective condition, but the qualities they attribute to it and the rest of their beliefs about it are mystical. Witches, as Azande conceive them, cannot exist.

The empiricist perception continues into modern day, particularly as it intersects with the world of biomedicine. Good describes this approach as “organized around a distinction between those ideas that accord with objective reality…and those that do not. The language of knowledge is used to describe the former, the language of belief the latter” (Good 1994:13).
The empiricist perspective brings into salient focus questions of individual rationality such as: why would people not ascribe to the scientific truth of the biomedical system? Why do people make negative choices about their health? How can we make sense of this irrationality? (Gaines & Davis-Floyd 2004, Good 1994). Although anthropology is often associated with an emphasis on the cultural, the concept of selfhood is not absent. Indeed, some anthropologists argue explicitly that the excessive focus on shared cultural norms merely diverts attention away from—and on occasion denies (Sokefeld 1999:418)—the universal individuality of the human self. This self is inherently autonomous, and “endowed with agency and reflexivity (Sokefeld 1999:430).

*Critique of HBM from Individual/Empirical Perspective*

Likely because the HBM was created by Public Health Services, it fits very well within the empirical, individualist approach. Indeed, it reflects a similar worldview in its foundation. The HBM model emphasizes personal agency. Consistent with the empirical approach, it operates under the notion that people utilize this agency, and make rational, calculated choices. In this case, it assumes an economical evaluation that is invariably intended to maximize the subject’s good. Further, it assumes both belief and action are under the control of the individual. The original version of the HBM did not account for individual experiences that shape decisions (such as habit or addiction). Neither did it acknowledge that some health behaviors are made for non-health reasons, such as for status, social acceptance, or because of economic or environmental pressures. The inclusion of ‘modifying variables’ opened the model to these previously overlooked factors.
The model still has some fundamental flaws, even from a purely rationalist perspective. It operates under the assumption that health information is available to everyone equally. This availability not only includes basic access to information, but also assumes that people possess both a complete understanding of health information, as well as the resources to carry out that information. It also takes for granted that cues to action are widespread. According to the model, if such catalysts do not occur in an individual’s life, then they will simply not have the reactive experience of behavioral change. This study will explore in further detail how modifying variables and rational choice fit together to shape drug-related thoughts and behaviors within this sample of adolescents in Colombia.

Examples in Addiction Literature

Jean Schensul and colleagues’ 2000 ethnography fits well with the HBM. It exemplifies how people make calculations in determining whether to engage in drug use behaviors. This study utilizes focus groups and semi-structured interview methods to outline the perceived motivations for using high-potency marijuana. The first benefit noted by informants is that selling drugs is more profitable than working in the low-wage inner city jobs, and did not carry a strong threat of legal ramifications, provided the action is kept under certain volumes. The reasons given for curbing high-volume engagement was either a lack of the necessary social network which enabled dealing in higher volumes, or strategically maintaining “…a safe balance between salaried employment and involvement in illegal activities” (Schensul et al 2000:402). Second, having access to drugs is a means of gaining prestige and social capital, and serves as a symbol of social influence. Interestingly, Schensul notes that the reputation and scarcity of the cannabis strain sets user expectations, and the act and exhilaration of attaining rare strains often
overshadowed the experience of actually using it. She also notes cultural influences such as magazines, rap music and popular culture incentivize drug use by increasing glamor. Additionally, informants note a perception that limiting drug use to marijuana (as opposed to harder drugs such as crack or heroin) did not carry deleterious health effects (Schensul et al 2000:409). This study shows calculated, rational choices based on perceived benefits, barriers, susceptibility, and seriousness of outcome. It additionally demonstrates that modifying sociocultural variables and self-efficacy affects informant decisions. Notably, it also exemplifies that information or resources to stop using drugs may not be available to everyone. It did not display any cues to action, which supports the criticism that such cues may not necessarily be widespread.

Cognitive Approach: Embodied Forms of Culture

Cognitive Anthropology and Medical Anthropology

Cognition is what people know, how they think, and how that knowledge affects the perception of the world. Cognitive anthropology is a sub-discipline centered in the idea that these cognitions are representative forms of the larger culture. In short, it argues that there is a direct connection between culture and the way people think (D’Andrade 1995). Within medical anthropology, this approach argues that there is a relationship between cognitions about illness, and the “internalized cultural content” that shape worldview and health behaviors (Garro 2004:12). These collective health cognitions are instrumental in how groups perceive and respond to certain phenomenon, and ultimately dictate the choices they make regarding these phenomenon (Schwartz et al 1992, D’Andrade 1995).
Additionally, the cognitive approach examines cultural health models, and seeks to
determine how these models are formed into narratives, and how these narratives shape
performance of illness representations, as well as how they vary across populations (Garro
2004). The methods used are generally very concrete, consisting of quantitative techniques such
as cultural consensus, structured methods and graphical representations such as multi-
dimensional scaling or clustering models (Garro 2004, Shwartz et al 1992, D’Andrade 1995). As
a result of this methodological rigor, results are often seen in formal terms and dismiss the more
abstracted methods of interpretive and Geertzian approaches (Cash 1998). Thus, they are less
focused on actual lived experience and may not entirely capture the qualitative experience of the
informant (Garro 2004).

**Critique of HBM from a Cognitive Approach**

Cognitive anthropologists would criticize the HBM as ignoring the influence and
importance of cultural factors, also citing the fact that negative health behaviors are often better
understood as structural issues. Although the model contains a cursory nod to the importance of
culture, it generally uses proxy measures (such as ethnicity or income level) or draws upon very
broad ethnographic work. The lack of scientific methodology makes conclusions about cultural
consensus less reliable. Based on my reading of the literature cited above, cognitive
anthropologists would also argue that belief cannot be pinpointed with the vague references
found in the model. They would say that the model is flawed because it is almost entirely
descriptive, and does not actually offer a quantifiable or measureable approach to understanding.
Finally, the applied emphasis of the cognitive approach would be dissatisfied with the fact that
there are no explicitly discussed strategies that can be translated into cohesive behavior changes.
Examples of Addiction Literature

Presented here are two examples within anthropological addition literature that take a cognitive approach, and dismiss the economically calculated choices of the HBM. Niobe Way’s 1992 study of two high schools utilized both quantitative and structured interview methods. She found that despite no statistically significant differences in depression levels, there were significant differences in the associations between depression and substance use, as well as with the level of involvement of drugs. Way concludes that the differences in how these phenomenon were associated was due to different cognitions about the definition of ‘depression’ and ‘substance use’. She attributed these differences to the different social contexts of the high schools (Way & And 1992). Way’s quantitative and structured methodology is in keeping with the cognitive tradition. Way also does not imply in her work that the informants are making rational, calculated decisions, but rather focuses on perceptions influenced by larger social context. This supports the criticism that the HBM lacks appropriate acknowledgement of cultural influences. The second example of literature is Jauffret-Roustide’s 2009 research in France based on semi-structured interviews, participant observation and content analysis. She concluded that user’s cognitions were a more accurate representation of drug culture than were the opinions of clinical professionals, who often dismissed users into a patient role. Jauffret-Roustide argues that models of intervention and harm reduction must be centered on the perception of the drug user. Although her paper is primarily centered on user cognitions about harm reduction strategies, Jauffret-Roustide’s research emphasizes a free, rational individual. She does, however, acknowledge that the meaning of ‘free’ and ‘rational’ may be the product of
the clinical and professional systems of thinking. Jauffret-Roustide’s specific policy recommendations are also consistent with the cognitive approach.

**Interpretive/ Meaning-Centered Approach**

**Definition**

The interpretive or meaning-centered approach posits that there is an important connection between the illness representation and the illness reality, via the interpretive process (Good 1994:52-54). It is based on the illness experience of the patient. The approach resists formal definitions of illness, but rather argues that personal experience, cultural networks, and symbols represent the multi-dimensional quality of life (Whiteford 2004:308). This approach emerged with Arthur Kleinman’s work. He focuses on how people relate to illness, and the paradigms they create to explain these relationships. Kleinman asserted that disease was not an external, natural entity, but rather an explanatory model positioned within a particular cultural context (Kleinman et al 1978). This approach is less based on how people process and make decisions, and more rooted on how people interpret health experiences and make meaning from them. It focuses on the interactions between the individual and the larger context. It examines how explanatory models shape ‘reality,’ and fit in with current power dynamics (Good 1994:53-56). This approach was the first to define illness and disease as separate entities: where *disease* represented the malfunctioning of a biological or physiological system, and *illness* represented an experience that includes personal, interpersonal and cultural factors (Kleinman 1978:252-253). This distinction was essential in redefining Biomedicine as a unique cultural system, which was a unique perception of the Interpretive approach (Kleinman 1978). However, it is important to note that this approach does not dismiss the scientific merit of Biomedicine. Good says,
“Rather than either reifying or denying the significance of biology, the interpretive paradigm has taken a strongly interactionist and perspectiveist position. Biology, social practices and meaning interact in the organization of illness as a social object and lived experience.” (Good 1994:53)

**Critique of HBM from an Interpretive Perspective**

The HBM has some strong points from an interpretive anthropological perspective. This approach assumes the individual is rational, as they are capable of making meaning and creating a logical explanatory model. Similarly, the HBM also assumes a rational individual who makes a choice. The interpretive approach acknowledges that explanatory models are shifting and based on personal experiences of illness. However, the interpretive approach does not assert that the explanatory models directly motivate behavior. Although the HBM is based on the idea that people can shift their beliefs and subsequently their behaviors, it assumes that the beliefs motivate behavior. The interpretive anthropologist would also argue that despite cursory nods towards culture that HBM professes, it does not truly take into account the degree of influence that culture, power and general structural forces play in shaping individual worldview. The interpretive approach, with strong emphasis on the experiential, relies heavily on ethnographies in drawing its conclusions. HBM generally either draws extremely blanket conclusions based on ethnographies, or attempts to measure culture quantitatively via proxy measures. The interpretive approach would also criticize the HBM for being far too biomedically-centric and ethnocentric. The HBM dismisses alternative medicine, other belief systems, and different worldviews that may influence behavior with the argument that these systems are missing an objective reality—the one ascribed to by biomedicine. Although the HBM condemns these
behaviors as irrational, it does not assess the ‘irrationalities’ that might exist within the biomedical institution.

*Examples of Addiction Literature*

The first example of an interpretive approach in addiction literature appears in Richard Chenhall’s 2008 paper where he evaluates drug treatment programs in Australia. He concludes that the standard measures (such as length of time at the facility) do not accurately capture the healing experience of the patients. The time between milestone events and outcomes, in reality, is full of multiple levels of meaning for the patient: mutual supportive experiences, personal victories, and adaptations to failures and personal conflict (Chenhall 2008). In a similar vein, Angela Garcia discusses a meaning-centered approach in her descriptions of heroin addiction within the Hispanic community in the Espanola Valley. The author identifies the addiction experience to be multi-dimensional: not simply a lifestyle choice, a destructive pathology, or a consequence of structural violence, but rather, a lived, relational experience. She does not deny that the informants’ addiction destroys jobs, families and lives. However, she notes a more rewarding aspect of drug use that builds relationships, eases pain, allows a user to reconnect to a dispossessed past, and create an identity. Garcia asserts that there is no such thing as an isolated addict, reemphasizing the interconnectivity of the circumstance (Garcia 2010). Both of these papers show the nuance of the interpretive approach that is overlooked by the HBM, and display how progress and health behavior is the product of an extremely complex set of deeply rooted meanings derived from the personal and cultural contexts. It asserts this experience exists outside the world of biomedicine, where the HBM stops.
Expectancy

Appearing in many theories of human behavior, including the HBM and Anthropological schools of thought is the cognitive process of expectancy. However, it takes different names depending on the discipline. It is centered on the mental process of calculating the motivating aspects of a situation based on external circumstance, and making a choice. It asserts that the person will make a decision because they are motivated by their expectation of the outcome (Goldman 2006). Calvin and Bickerton (2000) describe the human brain as “always preparing for action, trying to guess what happens next and gathering sensory information in aid of tentative plans for action.” Expectancy can appear as both behaviorally and biologically integrated (Goldman 2006). Goldman describes expectancy as consisting of the six interrelated facets outlined below.

Goldman (2006) describes the first aspect of expectancy to be anticipation/prediction. In the face of ever-changing circumstances and despite inadequate evidence, people make choices that prepare them for the next circumstance. They do this because it is ultimately more evolutionary expedient than not anticipating. He notes, “This crucial aspect of expectancy defines its basic function, i.e. the nervous system has evolved to store information about experiences so as to anticipate (predict) and negotiate future circumstances.” (Goldman 2006:151) The second facet of expectancy is the comparison of stored information patterns to the current situation. This comparison is then used in the third facet, which is to anticipate and reduce the amount of information into a manageable and computable level. In the fourth facet, this information is then computed according to the external context, which leaves an imprint in the physical modes of interpretation (such as the neural conduits, the visual system or emotional
chemical response pathways). The fifth facet of expectancy is, in reality, identical to memory, because it is based on past circumstance. Although somewhat arbitrary distinctions can be made between explicit and implicit memory (conscious and unconscious memory), most memory patterns transcend these distinctions, and are represented in the measurements of both (see meta-analysis Reich, Below & Goldman 2010). Both implicit and explicit memory are used in the adaptation of expectation and the anticipation of events. The sixth and final facet of expectancy is the inseparability of various informational responses, such as emotion, cognition and memory. Humans evolved these mechanisms piecemeal to be bonded together quickly when needed. However, this evolution took place before modern contexts, so when searches are carried out for these disparate pieces of information, they are still run via the same archaic means: an associative search based on reward and punishment. Thus, appearing in concepts in the HBM and in anthropology, expectancy argues that external context generates a prediction of benefits, and serves as a mixture of cognitive process, motivation and emotion (Goldman 2006).

This approach still retains some flaws. It retains the concept of individual choice without presuming pure rationality, and does not necessitate that belief precedes choice. It contends that people make these choices to maximize their benefit, but speaks to a specific type of benefit: survival fitness. This incorporation of evolutionary theory—linking behavior and biology—makes the essential step forward: addiction is not simply a series of wrong choices, but includes an adaptation of physiology. Its emphasis on external circumstance maintains the importance of culture and context. More theoretical, this concept cannot speak to scientifically rigorous methodologies, not can it offer specific solutions to problems. However, its presence in varying forms across disciplines allows for a dialogue to develop regarding questions of human health behavior.
Conclusion

This section has critiqued one of the most common models to predict health behavior from three anthropological perspectives, and then related these theories to the specific health issue of addiction and drug use. It then presents the undercutting concept of expectancy as a means to connect these approaches. The assumption across all of these theories is that human behavior is affected by context, belief and thought. However, most current addiction programs do not effectively combine the emic understanding of a population’s cognitions to cohesive substance abuse programs. The gap in research and practice suggests that there is a need to explore how people think more closely. The purpose of this analysis is to bridge this gap in a way that is accessible to both anthropology and public health. It will accomplish this goal by gaining an emic understanding of adolescent’s perceptions of drugs though rigorous, testable methodologies. These methods will allow reliable, quantifiable conclusions to be drawn about how Colombian youth think about drugs, and thereby identify underlying factors that might be targeted by appropriate interventions.

Methods

Specific Data Collection Procedures

This study consists of a quantitative survey administered at two sites: an adolescent treatment center and a secondary school in Popayán, Colombia (please see broader overview of presented in Chapter 1). The treatment center housed boys from age 14-19, while the school was made up of both boys and girls, aged 11-19. The residents at the treatment center generally came from a more rural lower socioeconomic background, while the students at the school came from
middle-class families in a more urban area. Surveys were administered in-person, anonymously to volunteer participants. The instruments consisted of three sections: 1) basic demographics and patterns of drug use; 2) structured methods speaking to attitudes and perceptions about drugs; and 3) perceptions about friendship. The analysis found in this chapter draws upon only the first two sections. To control for order effects, two versions of the survey (A and B) were administered. Each version consisted of the same information in a different order, however each version contained a different set of ranking questions. Six appeared on each version, for a total of twelve ranking questions across both surveys. Each site was given both versions.

Basic descriptive statistics were analyzed using SPSS on the section of the survey geared to demographics and patterns of use. A subset of the data was matched on age and gender to determine if there were any significant impact on the study results. There was not a significant change in the results, so the full sample was used.

**Structured Data Methods**

*Structured methods* are a survey technique where participants are exposed to a standard set of stimuli from the same cultural domain (such as questions, images, words or any other object) so that responses are comparable across groups. These are generally used in conjunction with other interview or survey techniques. Analysis determines the relationships between the objects and identifies systems of thinking (Bernard 2011). Types of structured methods included in this analysis are triadic comparisons and rankings gathered from a paper survey. The final sample consisted of 132 students at the school, aged 11-19. The sample of the treatment center was 40 members, aged 14-19. Detailed demographics are presented below.
**Triad Tests and Rankings**

The method of triadic comparisons, or Triad Tests, shows an informant possible combinations of 3 stimuli from a predetermined list. In this analysis, all possible combinations were presented. The researcher asks them: “Which one does not fit? Which two fit together?” All possible responses are combined and the results are compared to determine how a culture perceives the stimuli. The triad data in this analysis was built using a balanced-incomplete (lambda-1) design, where all pairs of stimuli appear only one time throughout the questionnaire. Each informant received this survey, regardless of research site.

*Rankings* (also known as vectors) are a similar method in which an informant is asked to rank the stimuli according to some standard (e.g.: popularity, strength, or danger). These methods allow the researcher to determine how an individual perceives different domains. An ordinal vector can be built from the items according to certain values (called attributes). While a researcher could independently look up how strong each drug might be in a laboratory setting, doing so would take for granted that the people are privy to this empirical information and agree with it (Bernard 2011). Thus, it is more accurate to survey the population for their perceptions on how the items stack up. As noted, twelve ranking questions appeared across the two survey versions. Version A asked participants to rank the data according to: popularity, strength, association with the street, how much escape occurs, harm to health, and pleasure. Version B asked informants to rank the data according to: level of chemicals, negativity, the degree it changes how one feels, difficulty to handle, rejected by most people, and danger.

In this analysis, both rankings and triad tests were built from 8 words. These included the following types of drugs: *Basuco, Cocaina, Cigarillo, Boxer, Alcohol, Heroina, Marihuana, and Extasis*. *Basuco* refers to a cocaine derivative (made from cocoa paste), *boxer* is glue that is
inhaled, and extasis refers to ecstasy or MDMA, which is an amphetamine. Word lists were based on freelist data from pilot testing, which asked informants to name all the drugs they could think of. The eight most commonly listed words were identified and used in this analysis. Word lists for ranking methods were presented alphabetically to standardize responses and reduce bias.

Analysis of Structured Data

Analysis of structured data employed Anthropac software to perform non-metric multidimensional scaling and hierarchical clustering.

Non-Metric Multidimensional Scaling (NMDS) and Hierarchical Clustering (HC)

The results of informant triadic comparison data were combined together into an aggregate proximity matrix for analysis. There are two main methods for determining proximities from this data: multidimensional scaling and hierarchical clustering. Both of these techniques create a diagram displaying how the variables relate to each other, and illustrates their theoretical distances from one another. Non-Metric MDS is used when the available dataset is rank-order (rather than ratio) scaled. Because the data is non-metric, the diagram’s distance is calculated using the Euclidean distances between the units. The analysis manipulates the coordinates of the pairs so they fit as closely as possible to the actual measured object similarities. Thus, the output of pairs is distance-like, rather than real distance (Borg & Groenen 2005). Stress measures how far the graph is from perfectly proportional, with a lower stress level denoting a better representation (Bernard 2011). Stress levels below 0.1 are considered excellent, while stress levels above 0.15 are considered unacceptable (Borgen & Groenen 2005:47). The NDMS output resembles a map without a fixed or meaningful point in space (i.e.: moving to the right on the map does not mean East).
While the NMDS helps identify dimensions, clustering analysis are more effective at discovering smaller structures within the data. Clustering analysis was used to determine whether homogenous perceptions of drugs exist within the perceptual map (similar to method of analysis in Posey et al 2013) The initial similarity matrix is determined, and each item is considered its own cluster. The closest (most similar) pairs are then permanently linked together to form its own, new cluster. The new distances between the clusters are computed; and again, the closest clusters are merged. This is repeated until all items are clustered together into one, big cluster. This analysis utilizes *average-link clustering*, which means that when the distances are computed, the *average* distance each cluster’s members is used. The results are plotted into a tree diagram. The columns represent the drug, and the rows represent the level in which the clusters are merged. An ‘X’ is placed between the columns where two clusters are linked. A completed NMDS resembles a map, whereas a cluster diagram resembles a more detailed hierarchical tree that shows the ranked linkage of the groups’ relationships.

*Property Fitting (PROFIT) Analysis*

It is necessary to use a method to objectively test the hypothesis of the underlying dimensions created by the NMDS analysis. If a researcher were only to stare at the diagram and create an interpretation, the results produced would be a product of their preferential attentions. Although the researcher may be able to identify some general trends, the results would not be testable. Additionally, the exact direction in which the dimensions shift (i.e.: from stronger to weaker, from safest to most dangerous) may be misjudged. For example, the patterns might shift 75-degrees to the upper-right, rather than 90-degrees to the direct right. Or perhaps there are other patterns the researcher does not see that influence the shape of the data. *Property Fitting*
(PROFIT) assesses the patterns of the NMDS according to the scales that the population of respondents used to assess the similarities. This analysis runs a multiple regression using the NMDS coordinates as the independent variables, and the attribute as the dependent variable (Borgatti 1996). The PROFIT analysis produces an $R^2$ value, which reports to what degree the diagram’s pattern was influenced by the attribute. The means of each ranking is computed, and that mean is entered into the PROFIT program. PROFIT normalizes the ranking, and the resulting NMDS output now has two new points: the mean score of the ranking converted into an X-Y ordered pair, and the coordinate plane’s origin (coordinates 0,0). An arrow is drawn between these. The coordinates of the mean (known as the direction cosines) are a rescaling of the regression coefficients, and determine the direction the arrow faces. The arrowhead always points in the direction of the increasing attribute values. If the strongest value was coded as a higher number, the arrowhead follows the directional cosine; if the strongest ranking values were coded as a 1, the arrowhead goes the opposite direction of the cosine. In this analysis, codes of 1 were used to denote the highest rank. Perpendicular lines are drawn from the PROFIT arrow to each NMDS point (called the projection of location). An essential point to bear in mind is that the distance that each NMDS lies from the arrow is irrelevant: the only meaningful data is where its projection of location falls on the arrow. Those that are closer to the arrowhead are predicted to have a higher amount of that attribute. Given the relatively small sample size, a standard alpha of $p=0.05$ was set, and a cutoff of an $R^2$ value of 0.70 was set as contributing a reasonable amount of variance.
Results

The final sample consisted of 132 students at the School and 40 members of the treatment center. Overall demographics are presented in Table 2.1. About 70% (n=91) of the respondents at the school were male, while all of the respondents at the treatment center were male (n=40). Ages of participants at the school ranged from 11-19, with about 80% (n=101) between ages 11-13. At the treatment center, the age range was 14-19, with most (60%, n=24) between the ages of 16-19. At the School, about half (46%, n=52) had completed either 9th or 10th grade, and about 40% (n=44) had completed 7th or 8th grade. Education levels at the treatment center were more spread: about 11% (n=4) had not reached 4th grade. Less than a third (27%, n=10) had completed 7th or 8th grade, while about a fifth (n=7) completed 9th or 10th grade.

At the School, most (85.6%, n=113) had tried alcohol at some point, while almost all (95%, n=38) at the Treatment center had ever tried alcohol. Most at the school had also tried cigarettes (61%, n=81), while all members of the Treatment center who responded to that question reported having used cigarettes (100%, n=38). Only 9.1% (n=12) of students reported ever having used marihuana, and the same number reported having used any other drug. At the treatment center almost all (95%, n=38) reported having tried marijuana, and most (84.2%, n=32) reported having tried any other kind of drug. The most widely consumed substance at the school was alcohol (77.3%, n=92) and cigarettes (18.5%, n=22). About half of the students at the school reported that over the past year, they did not use their primary drug regularly (51.5%, n=67). The widest reports of regular use was once a week (30%, n=39) or several times a week (13.1%, n=17). At the treatment center, residents reported their most widely used substances were marijuana (46%, n=12) and any other drug (30.8%, n=8). Over the last year, Treatment center residents reported that they regularly consumed their primary drug almost every day.
(26.3%, n=10), more than once a day (13.5%, n=5), or more than 5 times a day (26.3%, n=10), while about 19% (n=7) reported not having used regularly. As noted in the methods section, a subset of the data was examined using a matched sample on age and gender, and there were not significant changes, leading researchers to include the full dataset. In reality, there was actually a reduction (by about 9%) in the amount of drug use reported when the younger boys and girls were removed from the sample.

**Triad Data Results**

**Sample**

As discussed in Chapter 1, data for this study was gathered at two sites: a school and a treatment center. Both triadic comparison datasets were assessed for completeness. A criterion was set such that any data not 90% complete was discarded. Not all respondents completed the triadic comparison section. The sample from the school originally consisted of 90 respondents, 6 of which responses were discarded for lack of completeness. No responses from the treatment center were discarded. Final dataset counts were as follows: school (n=84) and treatment (n=26).

**MDS**

The conceptual representation of drug cognition of each site was created using NMDS. Two-dimensional Kruskal stress in the School group was 0.072 (Figure 2.1), while two-dimensional Kruskal stress in the Treatment group was 0.057 (Figure 2.2). These Kruskal stress levels indicate excellent model fit. In the diagrams, those drugs perceived as most similar appear closer together, while those that are perceived as most different appear farther apart. For
example, Figure 2.1 shows informants from the treatment center perceive alcohol and cigarettes to be similar to each other, and heroin as very different.

The informants from the school appear to perceive alcohol to be the substance that is most different than the others, as it stands alone on the far left side of the matrix. In particular, alcohol is perceived as very different than the drugs ecstasy, heroin, cocaine, marijuana and basuco, which appear in a cluster on the right side of the matrix. Boxer (glue) and cigarettes appear approximately midway between alcohol and the cluster of other drugs, yet remain a significant distance from each other. In other words, boxer and cigarettes are closer to alcohol than the rest of the drugs are to alcohol. Although forming an equilateral triangle, boxer, alcohol and cigarettes remain a fairly large distance apart, and are not thought of as particularly similar to each other.

The diagram of the treatment center is more evenly spread out (see Figure 2.2). Remember that the actual space is meaningless, and it is the relative distance of the points from each other that matters in the analysis: the fact that alcohol appears on the left in one NMDS and on the left in the other does not matter. When compared to the School, heroin and alcohol still remains the pair that is farthest apart spatially. Boxer and cocaine had small changes, and remained relatively small distances from each other. Alcohol and cigarettes appear together on the far right side. The closest drug to alcohol and cigarettes is marijuana. Marijuana is approximately the same distance from cigarettes as it is from boxer. As with the School NMDS, a nearly equilateral triangle appears; however the points are made up of alcohol, boxer and marihuana. Ecstasy, cocaine and basuco appear in a downward band to the left of the boxer/marijuana pair, with cocaine in the center. Ecstasy falls close to Boxer, and Basuco close to Marijuana. Heroin appears by itself on the far left of the diagram.
**Ranking Data Results**

In examining the ranking data, the samples consisted of the following rates. At the school, Version A had 65 respondents, and Version B had 67 respondents. At the treatment center, Version A had 22 respondents and Version B had 18 respondents. Respondents were asked to rank the 8 substances on a scale from one to eight, with a score of one (1) containing the highest degree of that attribute and a score of eight (8) containing the least degree of that attribute. The means of the ranking are presented in Table 2.2.

**PROFIT Results**

Once the responses were plotted into NDMS, all 12 vectors were run though PROFIT analysis to objectively assess the patterns. The PROFIT regressions showed many of the vectors were significant and explained a degree of variance above the 0.70 cutoff. The PROFIT diagram is presented in Figures 2.3 and 2.4. The $R^2$ and directional cosines are presented on Table 2.3. The pattern of the NMDS plot from the School was explained most strongly by: popularity ($R^2=.767, P<.05$), strength of the drug ($R^2=.964, P<.001$), escape ($R^2=.961, P<.01$), harm ($R^2=.759, P<.05$), Negativity ($R^2=.928, P<.01$), the degree the drug changes what one experiences ($R^2=.992, P<.001$), the difficulty to manage the drug ($R^2=.938, P<.01$), the degree to which the drug is rejected by most people ($R^2=.898, P<.05$), the degree it brings pleasure ($R^2=.873, P<.01$) and its level of danger ($R^2=.907, P<.01$). All of these moved directionally northeast; except the vector changes what one experiences, which moved southwest. In other words, students at the school attribute values such as Escape, Danger, Difficulty to Handle, Pleasure, Negative, Rejected by People and Strength to the drugs in the order of: alcohol,
cigarettes, basuco, marijuana, boxer, cocaine, heroin and then ecstasy. They ranked the drugs in the opposite order when it came to how that drug would change what one experiences.

The pattern of the NMDS plot from the treatment center was explained most strongly by: strength of the drug ($R^2=.842$, $P<.05$), association with the street ($R^2=.761$, $P<.05$), escape ($R^2=.715$, $P<.05$), and the level of chemicals the drugs contain ($R^2=.771$, $P<.05$). The directions of each of these vectors varied: escape moved Northwest, Popularity and association with the street moved southeast, and strength and level of chemicals moved generally west. That is, treatment center residents perceived increasing association with street and popularity in the order of: ecstasy, heroin, boxer, cocaine, alcohol, basuco, marijuana, and cigarettes, but attributed the opposite order as it came to escape. They perceived strength and level of chemical in the order of: alcohol, cigarettes, boxer, marijuana, ecstasy, basuco, cocaine and heroin.

**Hierarchical Clustering Results**

Within the School (Figure 2.5), there are only two clusters. These include Alcohol/Cigarettes and Cocaine/Heroin/Basuco/Marijuana. Basuco/Marijuana form a subcluster. These clusters do not have clearly defined borders. The closest pair is cocaine and heroin, which are linked on level one (compare to NMDS in Figure 2.1). Level two links marijuana and basuco. These two clusters are linked on level three into a single cluster: Cocaine/Heroin/Marijuana/Basuco. Ecstasy joins the group on level four, and boxer on level five. Level six joins alcohol and cigarettes. There are now only two clusters left: Cocaine/Heroin/Marijuana/Basuco/Ecstasy/Boxer and Alcohol/Cigarettes. These are joined into one large cluster on level seven.
Within the Treatment Center (Figure 2.6), there are three major clusters, which are easily distinguishable. Cigarettes/Alcohol/Marijuana, Cocaine/Heroin/Basuco, and Boxer/Ecstasy. In this sample, alcohol and cigarettes are the closest pair (compare to NMDS in Figure 2.2). The next closest clusters are Alcohol/Cigarettes and Marijuana, and these are permanently joined with an ‘X’ between the columns on the second highest row (level two). This new cluster is Alcohol/Cigarettes/Marijuana. The next closest pairs are cocaine and heroin, and these are linked together on the third level. This pair is joined on level four with basuco. Ecstasy and Boxer form their own cluster on level five. Level six links the Ecstasy/Boxer cluster to the Alcohol/Cigarettes/Marijuana cluster. This is finally linked with the Cocaine/Heroin/Basuco cluster to complete the diagram.

**Discussion**

Not surprisingly, residents at the treatment center perceived drugs differently than students at the school. The school seems to clump marijuana and other drugs together, and assign more values to them. A large, tight cluster of data-points—such as appeared in the School’s response—implies a strong consensus between the informants. The Treatment center did not display strong consensus, implying that the residents did not think in the same way. They saw the various drugs as separate entities, and had fewer consensuses about linked values. The consensuses that did appear were different than of the school. Even the two vectors that were significant in both sites ranked the specific drugs differently. Ultimately, this paper shows how deeply the power of context and expectation run in human thought. Reducing the role of culture into an external variable does not adequately capture the facets that shape human cognition and choice.
One reason for the differences in cognition may be due to accessibility and legality of the substances. In Colombia, the legal age for both drinking and smoking is 18, although the laws are lenient. The fact that alcohol and cigarettes are available for purchase at the store may be a reason they appear different than other drugs to the students. Boxer appears relatively close to alcohol and cigarettes on the School’s NMDS diagram. However, the more detailed hierarchical analysis shows that it actually falls in the cluster with other drugs. The relative proximity to alcohol/cigarettes may be because it takes the form of glue. Thus, it is more easily accessible than black market drugs, and less costly. At the treatment center, several factors may move illegal drugs closer to alcohol and cigarettes. The treatment center would likely have greater access to drugs; and the fact that they are illegal may have less of a concern. Conversely, treatment residents may be attending the clinic because they are in legal trouble, and thus may have their attention focused on legal highs. This may draw legal substances closer to the other drugs on the diagram. Additionally, most of the residents reported having used their major substance almost every day or more. If they were sentenced to rehabilitation for a specific drug, or if that drug was a big part of their lives before treatment, their attention may be particularly focused on it. This would cause that drug of choice to be drawn away from the cluster.

As would be expected, the self-reported use shows that students at the school have less experience with substances than treatment center residents. At both sites, alcohol and cigarettes are the most commonly used substances. NMDS and hierarchical clustering at both sites show these drugs to be perceived as similar. At the School, relatively few (about 9%) had ever tried marijuana or other drugs. The unfamiliar substances are clustered together, and alcohol and cigarettes appear at the end of every vector’s ranking. The treatment center includes an extremely high lifetime rate of marijuana use (95%). Results of clustering show they group
marijuana with alcohol and cigarettes. Here, lifetime rates of other drug use are high (about 84%). There are greater differences perceived between each substance, and the substances appear in different orders within the vector’s rankings.

The PROFIT analysis (see Figures 2.1 and 2.2) shows how each site interprets the meaning of drugs by assessing the values each site assigns to them. The sources of information about drugs may explain differences in cognitions. The students, who were found to have many more significant attributes in the PROFIT analysis, are likely to have only second-hand knowledge about drugs (what they learned from peers or at school). In the treatment center, however, firsthand experience and different sources of information are a given, and this experience probably changes how drugs are thought of. Each site’s interpretation is mediated by their context. Students at the school may have healthy lives and strong families, and only know the more negative sides of drug use through the media or through seeing peers drop out of school. However, residents at the treatment center may have positive experiences with drugs. The substance may provide a respite from cold and hunger, or it might provide some community that did not exist before. Adolescents may feel resentful for having been sent to treatment. Conversely, they may feel remorseful for their past or scared for their future. Thus, their emotional connection to drugs may prevent them from assigning values with the same consistency that the students might. In other words, they would likely have a more nuanced understanding of the drug experience, and see different benefits and barriers. This is consistent with the concept of expectancy described in the theory section. This concept argues that experience and environment alters what one anticipates the outcome of a particular behavior to be. Choices are made to maximize benefit for the current situation, and are governed by both implicit and explicit forms of knowledge and memory. It follows logically that the residents at
the treatment center would have different expectations about drugs, and different anticipations about the reaction interacting with them would cause. These expectancies would have an impact on how they think and the choices they make around them.

In summation, at the school, it is clear that there is consistent cultural knowledge about drugs—this is a cultural domain they have learned about. With the treatment group, their knowledge is shaped by the role of firsthand experience, the gradated differentiation and uses that exist in a drug economy on the street. Also, being in treatment, they may come to recognize the dangers and problems related to drugs, which brings back the main cultural domains.

**Strengths and Limitations**

There are several methodological considerations that must be acknowledged. One of the questions that appeared on the survey asked, “How many times did you use your most widely used substance in the past 30 days?” Most residents at the center had not used for the past 30 days because they were living in treatment; however, some did return home at times. They would have had the opportunity to use drugs there. Some others interpreted this question to refer to the 30 days before treatment, and answered it according to that standard. Thus, the robustness of this question may have been compromised. Additionally, the school and the treatment center were very different settings. They were chosen for the purposes of comparison; and this aim was successful. The survey was able to include adolescents with problems and without, as well as non-users, users and abusers. However, the fact remains that the populations came from very different economic backgrounds. Even the subsample analysis matched on age and gender could not control for these socio-economic differences. Importantly, the sub-population analysis did
not dramatically change the results. In fact, filtering out girls and younger boys produced *lower* rates of drug use at the school. This was probably because these types of students (those presenting very high risk at very young ages) would have likely dropped out. Thus, they would not be reflected in the pool of older students.

Despite limitations to the study, the distinct backgrounds of the informants contributed to the varying worldviews of the two populations. This highlighted how explicit and implicit factors make up individual choice and belief. The structured approach made conclusions testable, quantitatively meaningful, and removed much of the bias from the researcher. For example, using the PROFIT analysis prevented the researcher from seeing patterns that were not there. Standardized stimuli allowed for fair comparisons to be made across the two populations. There is very little chance for recall bias, as all questions are about current perceptions, current life patterns and only included habitual events from the near past.

**Future Directions for Research**

Some ethnographic data currently exists as part of this project, including semi-structured and in-depth interviews. Detailed investigation of this data would be a logical first step in future research. Additional, ethnographic research might explore the conclusions of this analysis. For example, determining *why* each site ranked drugs the way they did, and what each vector means to them. There may be differences in how each site perceives the vector terms. One topic that is thus far unexplored is how the mode of drug consumption (i.e.: injected, snorted, smoked, inhaled) affects perceptions about the drug. This could be very valuable information relating to the drug-related infection, and may inform interventions such as needle exchange programs. Future projects could also attempt to capture cultural consensuses at the treatment center. This
would require starting back to free-listing methods to obtain a new set of vectors and perhaps a new set of stimuli.

**Conclusion**

This chapter has argued that while elements of the HBM such as rational choice and belief are present in human behavior, perhaps the most powerful aspects of the model are the modifying variables. The power of culture and expectation are deeply present in human thought and action. Ultimately, choice does not take place in a vacuum. The very disparate results from these two sites are evidence of the impact of the external context. The tight cluster of similar responses found in the school represented cognitions borne from a relatively similar set of circumstances, living situations, experiences, access to information and interactions with drugs. These modifying variables shaped what each of the informants thought and believed to be true about drugs. Each judged the concept of drugs from their own perspective, and anticipated the benefits and barriers according to their own knowledge and worldview. These cognitions are reflected in their choices regarding whether or not to engage with drugs. Students at the school carried more negative expectations about drugs, evidenced in the high number of significant attributes that came up in the PROFIT analysis. Correspondingly, few of them used. The treatment center, on the other hand, came from a more diverse background and had greater experiences with drugs, reflecting disparate cultural influences. Residents at the treatment center anticipated fewer negative values to be associated with drugs: each of them had, at one time, used drugs. In their current circumstance, residents expected barriers and negative consequences for using, and there was a small reported rate of recent use. Goldman (2006) states: “Nonetheless, the context shifts from moment to moment and survival depends on organismic
adjustments that proactively anticipate and prepare for the next moment, both biologically and behaviorally (these domains are, of course, really the same).”

This inseparability of biology and behavior is an essential point when examining phenomenon of cognitions and the brain. The echoes of evolution in the cognitive process cannot be ignored. The above analysis illustrates the depth to which knowledge and circumstance are written in human actions, and affect belief and choices. Context is very telling of choice and potential health outcomes. Although results presented here are limited to one study population, combining the evolutionary considerations and external context to help explain how people think and choose is a potentially powerful tool to understand human behavior pertaining to drugs. Being able to predict when and how substance use moves from recreational to problematic use would be a valuable means of integrating anthropology and public health to make a more effective model. However, the ability to predict these paths requires an understanding of how those substances affect the lives of the user. For example, if sniffing glue takes away the hunger and cold of living on the street, then can it truly be considered addiction to use it, even if The Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria are met? Using an interdisciplinary methodology will enable a contextual understanding of what dangerous use is, and allow common pathways to that outcome may be able to be mapped. This will be explored in the next chapter.

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Whiteford, L
Yoder, P.
### Tables and Figures

#### Table 2.1: Demographics of Survey Responses

<table>
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<th></th>
<th>School (n=132)</th>
<th>Treatment (n=40)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>91 (69.4)</td>
<td>37 (100)</td>
</tr>
<tr>
<td>Female</td>
<td>40 (30.5)</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-13</td>
<td>51 (38.6)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>14-15</td>
<td>51 (38.6)</td>
<td>15 (37.5)</td>
</tr>
<tr>
<td>16-19</td>
<td>30 (22.4)</td>
<td>24 (60.0)</td>
</tr>
<tr>
<td><strong>Last Grade Completed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; or less</td>
<td>0 (0)</td>
<td>4 (10.8)</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt; or 6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>17 (15.1)</td>
<td>15 (4.5)</td>
</tr>
<tr>
<td>7&lt;sup&gt;th&lt;/sup&gt; or 8&lt;sup&gt;th&lt;/sup&gt;</td>
<td>44 (39.0)</td>
<td>10 (27.0)</td>
</tr>
<tr>
<td>9&lt;sup&gt;th&lt;/sup&gt; or 10&lt;sup&gt;th&lt;/sup&gt;</td>
<td>52 (46.1)</td>
<td>7 (18.9)</td>
</tr>
<tr>
<td>11&lt;sup&gt;th&lt;/sup&gt; or above</td>
<td>0 (0)</td>
<td>1 (2.7)</td>
</tr>
<tr>
<td><strong>Have you EVER used the following substance?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>113 (85.6)</td>
<td>38 (95.0)</td>
</tr>
<tr>
<td>Cigarettes</td>
<td>81 (61.4)</td>
<td>38 (100.0)</td>
</tr>
<tr>
<td>Marijuana</td>
<td>12 (9.1)</td>
<td>38 (95.0)</td>
</tr>
<tr>
<td>Any Other Drug</td>
<td>12 (9.1)</td>
<td>32 (84.2)</td>
</tr>
<tr>
<td><strong>Have you used the following substance in the past 30 days?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>73 (55.3)</td>
<td>2 (5.1)</td>
</tr>
<tr>
<td>Cigarettes</td>
<td>35 (26.5)</td>
<td>7 (19.4)</td>
</tr>
<tr>
<td>Marijuana</td>
<td>4 (3.0)</td>
<td>7 (17.9)</td>
</tr>
<tr>
<td>Any Other Drug</td>
<td>4 (3.0)</td>
<td>7 (18.9)</td>
</tr>
<tr>
<td><strong>What is your most widely-consumed substance?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>92 (77.3)</td>
<td>2 (7.7)</td>
</tr>
<tr>
<td>Cigarettes</td>
<td>22 (18.5)</td>
<td>4 (15.4)</td>
</tr>
<tr>
<td>Marijuana</td>
<td>4 (3.4)</td>
<td>12 (46.2)</td>
</tr>
<tr>
<td>Any Other Drug</td>
<td>1 (0.8)</td>
<td>8 (30.8)</td>
</tr>
<tr>
<td><strong>In the last 30 days, how many times have you consumed your most widely used substance?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 times</td>
<td>48 (36.6)</td>
<td>22 (68.8)</td>
</tr>
<tr>
<td>1-2 times</td>
<td>43 (32.8)</td>
<td>3 (9.4)</td>
</tr>
<tr>
<td>3-5 times</td>
<td>20 (15.3)</td>
<td>1 (3.1)</td>
</tr>
<tr>
<td>6-9 times</td>
<td>11 (8.4)</td>
<td>1 (3.1)</td>
</tr>
<tr>
<td>10-19 times</td>
<td>3 (2.3)</td>
<td>3 (9.4)</td>
</tr>
<tr>
<td>20-39 times</td>
<td>2 (1.5)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>40 or more times</td>
<td>4 (3.1)</td>
<td>2 (6.3)</td>
</tr>
<tr>
<td><strong>During the last year, how often did you regularly (at least once a week) consume your most widely used substance?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I do not use regularly</td>
<td>67 (51.5)</td>
<td>7 (18.4)</td>
</tr>
<tr>
<td>Once a week</td>
<td>39 (30.0)</td>
<td>3 (7.9)</td>
</tr>
<tr>
<td>Several times a week</td>
<td>17 (13.1)</td>
<td>3 (7.9)</td>
</tr>
<tr>
<td>Almost every day</td>
<td>2 (1.5)</td>
<td>10 (26.3)</td>
</tr>
<tr>
<td>Once a day</td>
<td>1 (0.8)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>More than once a day</td>
<td>1 (0.8)</td>
<td>5 (13.2)</td>
</tr>
<tr>
<td>More than 5 times a day</td>
<td>3 (2.3)</td>
<td>10 (26.3)</td>
</tr>
</tbody>
</table>
Figure 2.1: NMDS of Informant Cognitions from School

Figure 2.2: NMDS of Informant Cognitions from Treatment Center
<table>
<thead>
<tr>
<th>Vector</th>
<th>Alcohol</th>
<th>Basuco</th>
<th>Boxer</th>
<th>Cigarettes</th>
<th>Cocaine</th>
<th>Ecstasy</th>
<th>Heroin</th>
<th>Marijuana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes experiences</td>
<td>3.22</td>
<td>3.41</td>
<td>4.64</td>
<td>4.71</td>
<td>4.33</td>
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T: represents the Treatment center
S: represents School
Figure 2.3: PROFIT Diagram School

Figure 2.4: PROFIT Diagram Treatment
Table 2.3: PROFIT Analysis Results

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<th>Treatment Directional Cosine</th>
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<td>T</td>
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*Significance < .06
*Significance < .05
**Significance < .01
***Significance < .001
Figure 2.5: Hierarchical Clustering of Informant Cognitions from School

Figure 2.6: Hierarchical Clustering of Informant Cognitions from Treatment Center
Chapter 3: Pathways to Addiction

Introduction

The issue of substance use and abuse has had a strange journey. Potentially addictive substances are everywhere, and drugs have been around since prehistory (Saah 2005, Sullivan & Hagen 2002). Attempts to understand their use has taken many turns, from positing that addiction is the result of an allergic reaction (i.e.: alcoholism was thought to be an allergic reaction to alcohol), to prosecuting addicts as criminals, to treating it as disease. None of these approaches have proven to be effective (Smith 2011). In humans, drug use generally take place in a social environment, yet many theories of addiction take on an individual or biomedical perspective (Lende 2012). The fact is, drugs make biological changes in the human body that produce certain sensations and emotions; and these sensations have been shown to be addictive to some, but not to others (Lende & Smith 2002, Smith 2011, Saah 2005). It is clear that a different approach must be taken to understand the ultimate and proximate mechanisms that motivate drug use. Evolutionary ecology takes on this novel perspective to explore the adaptive strategies of organisms and their environments, and examines how these interact with one another. As a supplement the above cognitive/social chapter, I draw upon three larger theories within this discipline—Life History Theory, Evolutionary Ecology, and Evolutionary Medicine—to understand the evolutionary considerations of substance abuse in humans. After a
detailed presentation of the theoretical framework, I will use three structural equation models to test five factors as pathways to addiction.

**Model 1: Stress and Early Trauma**

*Overview of Life History Theory*

One of the leading theories of evolution today is known as the *Life History Theory*. Life history, in general, is an age-based account of the organism’s entire life cycle. Life history milestones are based off of fecundity and mortality, and include events such as first reproduction, development, and lifespan (Hill 1993:79). This theory focuses on various aspects of evolutionary fitness. Its fundamental principle is the concept of *allocation*, which simply means that the same units of energy cannot be used for different purposes. Like money, once it’s spent, it’s spent. Therefore, trade-offs must be made between different potential energy investments such as growth, longevity, or reproduction (Hill 1993). For example, an organism cannot spend all of its energy reproducing and still have enough energy left to keep its body alive. Hill describes: “The two most fundamental trade-offs, which are at the center of all life-history theory, are those between current and future reproduction and between the number and fitness of offspring” (Hill 1993:80). All organisms, then, created some kind of equilibrium in their life histories between growth, life and breeding that allowed them to accomplish the fundamental goal: successful procreation.

These trade-offs can also be seen in the adaptive strategies of organisms living in various stress levels. Early environmental experiences shape the developmental trajectory of the organism to fit the conditions of adulthood (Chisholm 1999-A, 1999-B, Lende 2002). Chisholm notes that kittens born in nutritional shortages that are weaned earlier ultimately engage in
significantly higher levels of object play (the recreational activity most related to developing hunting skills). The researchers concluded that environmental and social cues from the mother cat directed the kittens to activities (play hunting) that would be helpful to thrive in the surroundings they would face as adults (Chisholm 1999-A:67-68). Life history theory as it pertains to addiction is expressed in the response to stress (Model 1). It is also present in the development of attachment models (explored in Model 3), and in the intensity of reproductive competition (explored in model 2).

**Stress and Early Trauma**

In the same way that the nutrient-deprived kittens showed higher levels of object play behavior, both acute and chronic stressors affect human behavior. Early childhood trauma has been repeatedly shown to be associated with higher risk of problem behavior, including drug use and abuse (Teicher & Samson 2013, Wang et al 2010, Smith & Saldana 2013, Pelton & Cellucci 2011). The amygdala serves as a biological mechanism for warning and creates a defense response. It causes the hypothalamic-anterior pituitary-adrenal cortex (HPA) to release stress hormones, primarily cortisol, into the bloodstream (King et al 1990). In circumstances where extreme levels of cortisol are released consistently, many negative psychosomatic health outcomes emerge which detract from the overall fitness of the individual (Volkmann & Weekes 2006, Taylor et al 2004). Additionally, the continued response to stressors as well as the constant looking for potential dangers burns up valuable energy stores that could otherwise be used for growth, survival or investment in progeny (Chisholm 1999-A). Although serum or salivary cortisol levels may be higher overall in stressful environments, early trauma has also been shown to reduce cortisol reactivity (the HPA response to stress and danger) leading to
decreased cognitive ability and increased levels of impulsive activities. This reduction in cortisol reactivity can be linked to antisocial inclinations, resulting in brain function that cultivates risky behaviors and thereby stimulates increased drug and alcohol use (Lovallo 2013). Particularly in the case of anxiety and depression, drugs are posited to be used to produce a short-term relief from higher levels of cortisol. King et al (1990) found lower cortisol levels among substance abusers, suggesting that substance use physiologically reduces the production of cortisol.

Chisholm (1999-A) cites three examples to altered development patterns relating to early stress and trauma. The first two deal with male behavior. The first is ‘Absent Father Syndrome,’ which he describes to consist of “persistent stealing, violence, egotism and sexual misdemeanors.” The second he calls ‘Young Male Syndrome’ referring to a socialization of fear and chronic stress, manifesting in greater quantities of aggression and violence. He said flatly, “Testosterone is a drug for taking risks” (p.178). Chisholm describes this socialized fear as shaping both male and female development, and so also presents itself as ‘Young Female Syndrome.’ In this developmental pattern, females will undergo the same risk taking in order to maximize survival when faced with harsh conditions. In the case of females, they may reach menarche at an earlier age, or choose to begin reproduction earlier and without securing a long-term partnership. Behaviors include engaging in higher rates of sexual activity and substance use (Chisholm 1999-A, Brennan and Shaver 1995). Lende & Smith (2002) pointed out that involvement with drugs is often exacerbated in populations that opt for short-term strategies to maximize chances of reproductive success and fitness.
Conclusion

The above theory is the foundation for the first structural equation model, related to the effects of Stress and Early Trauma on addiction risk. I have given an overview of the evolutionary considerations of addiction and drug use from a life history perspective. I showed how the physiological changes created by early trauma and stress affect behavior, and how substance use interacts with those changes. A life history perspective views substance abuse behaviors as a functional attempt to gain resources, reproductive success or social capital. It resonates with the idea that substance use is not necessarily deviant, and does not automatically imply a conscious choice. It also allows the analysis of differing reproductive adaptations in various ecological contexts (i.e.: long versus short-term reproductive benefits) and illuminates an ultimate-level explanation for human behavior.

Model 2: Competition and Benefits

Overview of Evolutionary Ecology

Evolutionary ecology’s primary goal is to explore variation, from the individual level to the systems level. It incorporates how different systems and species affect each other through their development and evolution. Further, it examines both contemporary and historical impacts on variation. The incorporation of these lineage-dependent and developmental processes allows the evolutionary ecologist to examine the adaptive importance and the ‘evolvability’ of various attributes of organisms (Fox 2001). For example, Dudley (2002) discussed how naturally fermenting fruit was part of insect and anthropoid diets for about 40 million years. He argues that the high caloric levels provided by the ethanol were evolutionarily advantageous, as was the stimulation of appetite that enabled maximum consumption of temporarily available nutritional
resources (Dudley 2002). Thus, the modern human ‘taste’ for alcohol was a trait that was selected for by evolutionary forces throughout the generations. Sullivan and Hagen (2002) argued that humans developed in a substance-rich environment, and indeed shared what they called “a deep time relationship,” referring to a millions-of-years-old co-evolutionary history between humans and psychotropic plants. They cite this lengthy relationship to be evident in the human ability to metabolize psychotropic plants, and the plant’s adaptations to create defenses that so deeply interfere with the function of large mammal biologies. They further point out the human metabolic ability to detoxify these plant chemicals, and point to the additional adaptation to ‘counter-exploit’ the defensive adaptations of the plant. One example of this counter-exploitation is the human ability to derive depleted neurochemicals (such as serotonin and dopamine directly from the plant (Sullivan & Hagen 2002).

The primary direct evolutionary benefits of substance use reported in the literature are sexual and competitive benefits (Lende 2008, Lende and Smith 2002). As noted in the section above, substance use is related to increased levels of competition and aggression, and directly correlates to feelings of increased power in physical altercation. This increased ability to fight is both a perceived and a direct benefit (particularly in males). As noted, substance use is associated with more desirable sexual situations and an overall increased sexual activity. Other direct evolutionary benefits of substance use relate to emotions, sociability, and social capital (e.g.: protection and survival advantages) (Lende and Smith 2002; Smith 1999; Nesse & Berridge 1997). The following section will focus on sexual and competitive benefits, and the evolution of social and emotional advantages to using drugs.
Intensity of Reproductive Competition

In keeping with the stressful factors, Life History Theory also posits that harsher environments, and those with greater intrasex competition, are more likely to produce organisms that undertake riskier reproductive strategies. These organisms are also more likely to trade long-term reproductive success for momentary higher-yields (Chisholm 1999-A). In the same way that high stress environments causes an organism to change benefit strategies, the intensity of reproductive competition is also shown to change behavior. Life history theory examines how this competition affects the costs and benefits of risk-taking (such as excessive substance use) (Hill and Chow 2002). Sexual selection includes intrasexual competition (most often male-male rivalry for access to females), but can also include the final female choice of partner. The dynamics of sexual selection are defined by the degree an organism invests in competition or offspring investment. When competition is intense, selection and adaptation force a greater investment of resources into rivalry in order to achieve successful reproduction (Geary 2002). In general, within human life history, females have a greater reproductive benefit from longer-term relationships. Older men, who often have more resources and a greater chance to reproduce, have a higher reproductive fitness than do younger males with fewer resources. Particularly in areas where resources are poor, younger men (with their resource handicap) must invest a great deal of energy in the competitive acts of winning a mate (i.e.: taking higher risks). In a sense they have everything to gain and nothing to lose when they engage in behaviors of greater danger. If they will otherwise fail anyway, a high-risk behavior provides at least a fighting chance to reproduce (Hill and Chow 2002, Geary 2002). Hill and Chow (2002) found that trends in the demographics of hazardous drinking behaviors matches the demographics typically associated with decreased reproductive fitness: young men, childless parental status, single
marital status, and resource-poor areas. Additionally, they note that excessive drinking is a pathway to other high-risk behaviors, such as harmful acts, being hurt by an act intended to be harmless, and overall negative health. These behaviors are utilized particularly when traditional pathways to reproductive success are blocked (Hill and Chow 2002).

**Emotions and Social Relationships**

Emotional systems were thought to have evolved neurologically for an evolutionary purpose. Specifically, they evolved as chemical signposts that guided the organism towards behaviors that improved fitness. Positive emotions served as reinforcements and incentives to advantageous behaviors, while negative emotions served as tools for avoiding and managing threats (Saah 2006). As the environment changed, the intended purpose of emotions became muddled, and these responses no longer have the same Darwinian impact (Saah 2006, Fisher 1998, Panksepp et al 2002). Although drug use today does not carry the same evolutionary advantages, it still targets the same system. Sometimes this creates negative reactions, while other times the reaction may be either neutral or positive (see Mismatch section below). Saah notes that in the current world there are fewer dangers, and so negative reactions may be archaic, and no longer apply. Therefore, drugs serve a positive role:

In modern humans, drugs that may block negative emotions may be more useful than the endurance of ancient warnings of harm, like pain and fever. Certain drugs can aid in pathology treatment, and while negative emotions may have been entirely necessary for the survival of ancient mammals, they may no longer be exclusively indicative of nociceptive or otherwise harmful stimuli (Saah 2006:4)

Panksepp et al (2002), however, argues that emotional systems are more complex, proactive and flexible. He flatly states about the relationship between emotions and drugs, “Obviously these
systems were preserved because they served some critical purpose other than promoting the vigorous intake of highly purified chemical compounds recently developed by humans.” As social creatures, mammalian emotion elicitors are particularly sensitive to social stimuli. In the absence of social bonds, a tendency to activate these emotional systems through psychotropic substances often develops. Panksepp et al further note that satisfaction with social bonds appears to be regulated in the same part of the brain which mediates addiction to opiates (Panksepp et al:463). Oxytocin is a well-known brain chemical that is a modulator of functions such as emotions, mood, social bonding, and sexual behavior. It is known widely as the ‘love hormone’ because levels increase when we are around loved ones and it plays a strong role in pairbonding and familial relations (Srnyai & Kovacs 1994, Sarnyai 2011). Evidence in animal laboratory settings has shown that both endogenously administered oxytocin and intracerebral administration of oxytocin-receptor antagonists were found to reduce tolerance, dependence and self-administration of opioids, and reduce chronic tolerance to cocaine (Sarnyai & Kovacs 1994). Later experiments discovered similar results with MDMA (ecstasy) and methamphetamines (Sarnyai 2011).

There are marked evolutionary advantages to strong pair, familial, and social bonds. Social living occurs when the benefit of an organism living with others outweighs the benefits of living by themselves. Specific benefits include increased resources and reproduction, and decreased morbidity and mortality. Another benefit is through ‘reciprocal altruism,’ where non-related peers exchange benefits (Lende & Smith 2002). As noted, the appearance of positive emotions (such as affection or feelings of community) is an indication that the action is evolutionarily beneficial (Saah 2006, Fisher 1998, Panksepp et al 2002). Fisher (1998) argues that sex drive, attraction systems and attachment evolved in order to help facilitate reproductive
fitness. Each of these emotional categories is correlated with neural activities evolved to direct aspects of reproduction: specifically, sexual union, mate choice and beneficial social/parenting behaviors. Drugs of abuse, she argues, increase concentrations of the correlated neurochemicals (dopamine and norepinephrine, among others) that facilitate the emotions of the abovementioned romantic systems. The result is feelings of sexual benefit and emotional closeness (Fisher 1998).

*SPFit Theory: Reproductive Desirability*

As outlined above, drugs are directly related to the evolutionary benefits of sexuality and reproduction, however drugs may also affect reproductive fitness in altering self-perception of desirable mating characteristics. Rooted in evolutionary theory and psychobiological constructs, David Newlin introduces this novel theory called the *The Self-Perceived Survival Ability and Reproductive Fitness (SPFit) Theory*. The author argues that neurological perceptions of survival ability and reproductive fitness have a propensity to be sensitive to false activation by drugs of abuse. This theory emphasizes an internalized self-perception of fitness, rather than the reward feelings or the actualization of fitness. This discussion of perceived fitness benefits, as distinct from direct benefits, is present in the literature (Lende and Smith 2002; Smith 1999; Nesse & Berridge 1997). It also is consistent with Fisher’s discussion of neurochemicals and attachment that will be discussed in the theory-baser of next model. Newlin also posits that the mesolimbic dopamine system is the biological base of SPFit, and this brain center motivates survival and reproduction rather than a feeling of reward.
Conclusion

The theoretical components of this model took an evolutionary ecology perspective. It discussed behavioral changes that result from stressful environments where resources are few and competition is fierce. Specifically, it discussed how emotional and social motivators for drug use evolved through the interactions of brain function, physiological drug affects, and the evolving cultural environment. It discussed the direct evolutionary advantages and disadvantages of emotions. It also discussed the buffering effect that oxytocin appears to have on many types of drug dependence. The section reviewed the evolutionary advantages of social bonding, and highlighted how substance use creates feelings of social bonding. It lastly discussed perceived evolutionary benefits in the form of the SPFit theory. Humans and mammals appear to have lived near sources of drugs for millions of years. Examining substance use through this evolutionary ecological perspective highlights the multifaceted effects of drugs, forged though these ancient interactions of biological, social, emotional, environmental, psychological and chemical influences.

Model 3: Reward Pathology and Attachment Models

Overview

The field of evolutionary medicine is not a formal field in the same sense that biology or biomedicine is a formal field. Rather, evolutionary medicine is a group of concepts that can be used to analyze the various facets of medicine (Searns 2012). In essence, evolutionary thought is applied to medical issues in a way that seeks to create a deeper understanding of health and disease. It considers the human body an incredible part of the natural selection process that still retains some evolutionary flaws. Evolutionary medicine examines why people get sick, rather
than the biological mechanics that cause the health problem. It asks: given an eternity of evolution, why aren’t our bodies more efficiently designed to fend off diseases? (Nesse 2001, Searns 2012, Brune 2013). Taking an ultimate-perspective, evolutionary medicine is centered on determining the evolutionary forces causing biological mechanisms, which enable diseases to strike (Nesse 2001, Searns 2012, Lende 2002). Within the scope of this chapter, it examines the reason people are vulnerable to addiction.

There are several other ways the theoretical approaches of evolutionary medicine are different from other medical fields. Evolutionary medicine posits that diseases, as we know them, exist today because of flaws in human form. In order for a trait to be considered evolutionary, three characteristics must be met: it must be inheritable, there must variation in phenotypic expression, and it must have some effect on evolutionary fitness. Rather than focusing on the malfunctioning of the human body (i.e.: disease), it is focused on adaptation and uncovering the underlying Darwinian traits. It attempts to determine the initial evolutionary pressures that caused the characteristic to appear in the first place, and uses this information to explain why the maladaptive traits persist today. Evolutionary medicine also takes into account that our modern world is not what our bodies adapted to so long ago. As in evolutionary theory, the field is not focused on how organisms optimize health, but rather on how they ensure survivability and representation in new generations. This section will discuss two areas of evolutionary medicine applied to substance abuse issues: mismatch theory, and evolutionary psychology (what would later develop into neuroanthropology).
Mismatch and Rewards

The concept of an evolutionary mismatch is the theory that an organism may have developed an evolutionarily advantageous trait in one environment (generally referred to as the environment of evolutionary adaptedness, or EEA). However, the modern environment has changed dramatically from the one that selected for the human form. The organism still possesses the previously beneficial trait (this may be behaviors or physical characteristics) in the new environment. Thus, these adaptive characteristics are ‘mismatched’ in the contemporary situation, and the organism does their best to live with them. As noted above, these may be detrimental, neutral or advantageous. If it is detrimental, the characteristic has not yet been ‘selected out’ or extinguished evolutionarily in the new environment (Frankenhuis 2012, Searns 2012). Drugs, of course have some positive benefits, and are indeed the base of the biomedical pharmaceutical industry. However the pure form, the abundance, and the powerful methods of administration of drugs are a novel environmental phenomenon (Nesse & Berridge 1997, Durrant et al 2009). Literature shows evidence for both behavioral and biological evolutionary ‘mismatches’ relating to drug use.

An example of biological mismatch can be seen within the operation of the reward system of the mammalian brain. This operates largely on a motivation system based on rewards, specifically: ‘liking’ or ‘wanting.’ These rewards act as an intracellular signal to alert us of the things we need for survival. Disturbances in this signal result in chemical imbalances and negative emotions (Saah 2005, Durrant et al 2009). The mismatch theory argues that psychoactive substances artificially affect these natural reward systems, and stimulate the mechanisms in the brain that induce pleasure or block pain (Nesse 1994, Durrant et al 2009). As drugs impact the brain’s natural reward system, they interact in three ways. They may: 1)
activate the natural reward system in the brain, 2) change the way the reward components function (e.g.: intensify the feeling of wanting), or 3) generate new brain processes (e.g.: withdrawal states) (Kelly 2002). According to this theory, the brain system did not evolve to use drugs: rather, drugs generate the same neurological response as stimuli legitimately offering an evolutionary advantage such as nutrition, social bonding and sex (Panskepp et al 2002, Durrant et al 2009). Nesse and Berridge (1997) describe how the substance enters the brain system without going through an adaptive processing system. They clearly sum up, “drugs of abuse create a signal in the brain that indicates, falsely, the arrival of huge fitness benefits.” Like other theories, this one centers dopamine as the primary mediator of the neurological process of addiction. It argues that dopamine generates reward regulation by activating the cortico-mesolimbic system. It also argues that dopamine creates withdraw symptoms via a clash inside the dopaminergic system when stimulants are no longer introduced. Problems with this theory arise because in reality, dopamine does not only mediate positive reward, but also mediates negative reinforcement. In other words, dopamine alters one emotional state to another, regardless of it being positive or negative (Saah 2005). Dopamine is described in other theories (see Incentive Salience below) as mediating feelings of wanting.

Behavioral mismatches are also present in modern humans. Anthropologists often take a social and meaning-centered approach to describing phenomenon such as substance abuse (Burrell & Jaffe 1999; Saniotis 2010). Humans have had a long history with mind-altering substances, and there is evidence that early hominids had knowledge of, and intentionally consumed psychotropic plants as instruments for cognitive enhancement, ceremonies, and social recreation/bonding (Sullivan and Hagen 2002, Sanitos 2010, Muller 2011). Many of these purposes are still the motivators for substance use today (Burrell & Jaffe 1999), but in a modern
context these actions may now lead to adverse health consequences that were not known in the EEA (Saah 2005, Sanitos 2010). Daniel Lende (2008) highlights this point in a discussion in his book chapter regarding the effect of evolution and modern behavioral problems:

This approach places emphasis on examining how modern environments shape the maladaptive responding of evolved traits. …Sharing drugs with friends, part of establishing social relationships and long-term reciprocities, should also not be overlooked as another way in which drug taking becomes established. These behavioral and environmental factors can favor the move from the initial goal of drug use to compulsive involvement with drugs.

In the case of drug use, a behavioral mismatch is evident. The beneficial social bonding occurring from shared substance use can now lead to harmful outcomes in cases addiction and dangerous use, not safe recreational use. In a sense, what was sacred gave way to the profane. However, substance use does not carry an objective, adaptive benefit or detriment that is consistent across time and context (Lende 2008, Burrell & Jaffe 1999) and so the mismatch model (both biological and behavioral) has flaws.

Evolutionary Psychology and Neuroanthropology

Evolutionary psychology is a subsection of evolutionary medicine that applies evolutionary theory. It views psychological traits as a set of mechanisms created by natural selection to maximize fitness. Evolutionary psychologists believe that there are universal, specialized circuits within the human mind that work to solve a specific adaptive problem. These circuits are called modules (Cosmides & Toby 1997). However, as it pertains to substance abuse, there is no such module, because there is no adaptive problem solved by substance users taking copious amounts of drugs. Nor does this theory account for the impact of culture (Lende
Thus, in the case of substance abuse, the concept of evolutionary psychology had to be extended to include these missing pieces. Neuroanthropology applies an evolutionary approach to examinations of the brain and nervous system, and uses this information, along with cultural influences to explain human behavior, generating what Lende calls ‘the encultured brain’ (Lende & Downy 2013). Within neuroanthropology, a major approach to addiction is the theory of *incentive salience*.

In keeping with the influence of its discipline, this approach does not simply observe how organisms respond in certain environments, but rather is centered on determining why they make the decisions they make through the lenses of biology, evolutionary psychology, evolutionary medicine, and the surrounding social environments. This theory is an adaptive approach that examines how the reward and decision making process interact within these fields to enhance the fitness of the organism. It shifts the focus from drugs, and instead looks at the mechanisms by which the organism makes decisions within the environment it lives in (Lende 2008).

This theory argues that the mesolimbic dopamine system is an evolved system to help with decision-making, and is particularly shaped by two ancient behavioral patterns: looking for food and social bonding (in particular, sexual partners). Both foraging and searching for a mate consist of the same two phases of the neural reward system: wanting (seeking) and liking (consuming). However, an interaction in the mesolimbic dopamine system causes brain systems to go haywire. The theory asserts that addictive drugs have the ability to alter neural cells, as well as the circuits involved in motivational behavior and reward. As a result of these changes, the brain system is sensitized to the feeling of potential reward—not the actual euphoria of using drugs. Thus, the feeling of drug *wanting* becomes the most prominent neurological stimuli. This entire process is mediated by the social context (Robinson and Berridge 1993, 2001, 2008).
drug user’s attention is most focused on the salient stimuli, and they engage in behavior that generates more such stimuli.

Contrary to its role in the mismatch theory, dopamine is seen as mediating the ‘wanting’ centers of the brain, and rightly repositions the neurotransmitter as an incorporated action rather than a wired response (Saah 2005). It forces the attention to be centered on the wanting/seeking, not the actual liking/consumption of substances. Thus, there is motivation to take action, but no signal of satiation. Something resembling a behavioral mismatch is evident here, and in the foraging of pleasurable psychotropic plants. In the evolutionary past, there were fewer sexual and nutritional resources (Lende 2002). When these were rare, they were extremely valuable as they reduced stress, hunger, and fatigue—in fact, it may have been beneficial to consume excess during the rare occasions the resource was available. The limitation of resources did not necessitate a selective need for self-control and regulation of consumption. Today this type of endless searching behavior is maladapted, and seen as compulsive drug seeking and binging (Lende 2008). This theory applies the evolutionary design model to explain the mesolimbic dopamine system as an evolved system that aids in decision-making that gets pushed towards substance abuse (among other behaviors) through the forces of enculturation (Lende 2008).

Models of Attachment

As noted above, a tenet of evolutionary psychology is the adaptation of different psychological traits to maximize fitness. Belsky, Steinberg and Draper (1991) argued that the attachment process is one means by which offspring adapt to the conditions of their local environment. Secure attachments are protective against high levels of cortisol through the conditioned reduction of anxiety responses to subjective, phenotypic experiences of fear.
Although they cannot change the objective reality of the living environment, parents may lessen the experience of fear (and thereby decrease cortisol levels) though responsiveness and sensitivity to their child’s stress. In unhealthy familial situations, the attachment model (i.e.: the parents and family) may be the source of stress. The level of investment by parents improves or detracts from the long-term fitness of their offspring (Chisholm 1999-A:152-153). It is important to note that it is the function, not the structure of the family that determines healthy attachment models. For example, a non-traditional family or a family with few resources that provides a loving, supportive home is less likely to produce a child with attachment disorders than is a wealthy or traditional home with higher levels of martial discord, abuse or other negative familial patterns (Chisholm 1999-A:158-519).

Evidence exists that the strongest link between attachment disorders and substance abuse exists in fearful attachment models (Schindler et al 2009, Schindler et al 2005). Shaver and Mikulincer (2002:154) describe that under stress, fearful attachment models often results in the breakdown of deactivating strategies and inhibition to admit particular attachment needs or threat-related cues. They describe:

Fearfully avoidant individuals simultaneously want closeness to attachment figures but also feel unable to trust and rely on them. This may cause their attachment systems to remain activated while their behavioral strategies suggest deactivation.

Schindler et al found that one of the most relevant physiological effects of drugs in this context is the emotional activation/deactivation. He outlines differing effects, according to the type of drug used. Sedating substances (opioids, alcohol, benzodiazepines and cannabinoids), he argues, result in a deactivation of emotions and detachment from a non-beneficial social environment. Stimulants, on the other hand (ecstasy, cocaine or types of amphetamines) activate the cognitive
and emotional processes. Hyper-activating social seeking neural areas stimulates the missing feelings of social closeness that are evolutionarily advantageous (Schindler et al 2009). Recall that stressful environments lead to use of short-term evolutionary strategies (Chisholm 1909-A, Chisholm 1999-B). Rosa et al (2010) found that substance-abusing daughters with low levels of attachment with their mothers engaged in more uncommitted sexual acts under the influence. Lende and Smith (2002) present another example of how early attachment problems lead to outcomes that foster drug use and addiction. Development of closed internal models causes the individual to become cognitively less receptive to new information and more inclined to engage in repetitive behaviors. These actions, sparked from less sophisticated cognitive strategies, may influence continued drug behavior (Lende & Smith 2002).

**Conclusion**

The components of this model examine the ultimate reasons for substance abuse from an evolutionary medicine perspective. It described the underlying reasons why people use substances, rather than simply the proximate biological causes. It draws upon the mismatch theory to explore why people are vulnerable to addiction. This theory presents substance abuse as a no-longer-useful artifact of a previously advantageous trait, and one that mimics the neurological feelings of reward for performing an action of evolutionary benefit. I then presented another aspect of evolutionary medicine that examined similar phenomenon from a neuroanthropological perspective. This described how the mesolimbic dopamine system—originally evolved to help with decision-making—malfunctions. It becomes sensitive to neurochemicals that signal ‘wanting,’ as opposed to satiety and enjoyment, ultimately leading to compulsive behavior. The model also gave an overview of attachment models developed in
childhood, and outlines how disorders pertaining to these models may influence substance use. It argued the inherent drive to maintain active emotional systems, even through drug use. Taking an evolutionary medicine perspective shows how adaptive traits can interact, and provide a means to analyze the function and outcomes of certain processes, which lie at the heart of drug abuse behavior.

**Section Conclusion**

This section has used three larger theories within evolutionary reproductive ecology to understand the evolutionary perspectives that account for the presence of substance use and abuse in humans. Examining addiction through an evolutionary lens has strong implications for clinical and social policy, and has the potential to improve these in a realistic and effective way. This perspective points to a novel method of analyzing addiction behavior, and enables examination of drug abuse separate from the long-failed individual, biomedical approach. The evidence here shows that physiology is a very real, and centralized quality of the addiction experience, and this biological condition is a challenge that health professionals should be aware of. The next section will test the theories noted above to empirically assess its validity in a population sample using three models.

**Methods**

**Specific Data Collection Procedures**

Two versions of a pen-and-paper risk-factor survey were administered at two separate research sites in Popayán, Colombia. Chapter 1 gives a detailed overview of the study, including administration and the main domains of the survey. Detailed descriptions of the specific
variables used in the analysis are given below. Surveys contained identical information in different orders in an effort to control for order effects bias. The domains covered by the survey consisted of general demographics, common risk factors, patterns of drug use, and motivations to use drugs. The first research site was a treatment center for boys, aged 13-18. The residents generally came from a rural environment and a lower socioeconomic background. The second research site was a secondary school, made up of both boys and girls, aged 11-18. The students had generally a middle-class background from urban areas. All survey responses were de-identified, and entered into a single database for analysis.

**Analysis**

*Overview of Structural Equation Modeling*

Structural Equation Modeling (SEM) is a family of statistical techniques similar to linear regression that is used for testing and estimating relationships. However, relationships between the variables are plotted graphically, and the analysis performs regression and correlation assessments on sets of equations simultaneously. Thus, SEM is able to test both single regression models, and much more complex ones. It is primarily confirmatory: researcher will utilize SEM if they wish to test if a certain theory is valid. They would not use it to find a new theory or model; rather they come in with the model in mind *a priori*. The major goal of SEM is to determine if the empirical evidence from the sample supports the theoretical model. The output gives an index of how well the model fit, as well as the strength and significance of parameter estimates, covariances, and standard errors.

*Latent variables* (also called unobserved variables or factors), are the theoretical constructs of the study, and cannot be measured directly. These are represented with ellipses in
the diagram. *Observed variables* are called indicators, and are variables measured by the data. The different measured variables make up the latent variables (similar to factor analysis).

*Endogenous variables* are, in essence dependent variables. They are influenced by other variables in the model and have at least one path (arrow) leading into it. *Exogenous variables* (independent variables) are usually determined by something outside the model, and do not have an arrow leading into them. *Error terms* correspond to measured variables, and are represented by circles marked with an ‘e.’ They represent the corresponding variation due to measurement error. Similarly, *disturbance terms* are small circles marked with a ‘d’ and represent the unexplained variance from the latent variables within the model. Model *parameters* are the characteristics of the model that are unknown and must be estimated from the data. Parameters are represented by bi or uni-directional arrows in the model and can include the structural coefficient, the regression weight or the variance and covariance of the variables. Some paths leading from latent variables are set at ‘1’ by necessity, as this fixed value sets the measurement metric for the latent factors and residuals. An important aspect to keep in mind when examining models is that the latent (unobserved variable) is having an effect on the measured variables. In other words, the measured variables are dependent on their respective factors. Rebecca Weston (2006:728) describes, “Because latent variables are thought to be the unobserved constructs that underlie indicators, unidirectional arrows indicate a direct effect of latent variables on measured variables.”

*Recursive* models display all parameter arrows flowing in one path, and imply a degree of directionality—although causation should not be interpreted unless there is a longitudinal dataset. The goal of SEM is to construct and identify a model. Identification exists when the number of parameters is less than or equal to the sample moments, leaving zero or more degrees
of freedom. An unidentified model exists if the parameters may not be determined from the observed data; that is, there are not enough datapoints to estimate the parameters of the model. A just-identified or saturated model occurs when the parameters equals exactly the sample moments, leaving zero degrees of freedom. An over-identified model is the ideal outcome, and occurs when there are more known than free parameters.

The numbers displayed above the arrows in the final model represent the power of the parameter. The path between observed or latent variables is the regression coefficient, while the arrows from the latent to the observed variables indicate loading of the variables into the latent factor. When interpreting, these path parameters should be treated as regression coefficients. A negative sign indicates a negative association, and a positive sign indicates a positive association. Strong correlations would be values of .8 or above, while weaker correlations would be below .4. On the outcome path, a weaker value carries more weight (e.g.: while a path of .3 going into the outcome variable may be considered weak, an outcome path of .3 is considered stronger). The variance of each predictor variable is displayed above the rectangle. Absolute model fit is assessed by a chi-square test. A well-fitting model will yield a low, non-significant chi-square estimate, however this cannot be used as the final test. Discrepancies in normality and sample size will yield a higher chi-square, and factors outside the model itself can produce an insignificant result. Assessment of fit should be supplemented with an examination of the relative fit tests. The tests and relevant cutoffs used in this analysis are presented in Table 2.
Data Screening

SEM makes certain assumptions, and thus data must be carefully screened before being tested in the model to ensure proper testing. Inappropriately screened data may result in a failed fit test, even if the model is theoretically sound. SPSS software was used to screen the data. First, patterns of missing data were assessed using Little’s MCAR test, and variables were confirmed to be acceptable for analysis. Missing data was handled by AMOS software by estimation of means and intercepts. Second, multicolinearity between the variables was assessed using the Variance Inflation Values (VIF) and Tolerance indices. Tolerance values were confirmed to be greater than 10%, and VIF values were confirmed to be less than 10. Outliers were assessed using the Outlier Labeling Method with a g-value set to 2.2. Three outliers were identified on the Competitive Benefits variables, however as these values were not extreme, they were left in the sample. Three variables had an arbitrary scale that included negative values. These variables were transformed to include only positive numbers. Some variables had opposing scales: for example, Time on the Street was measured with an increasing score meaning increasing amount of street life, while the measurement of Risk-taking had a negative score that meant a greater level of risk-taking. Such variables were back-coded to report in a consistent direction, with higher scores theoretically indicating higher levels of the latent variable. Normality was assessed by examining skew and kurtosis levels, as well as histogram and scatterplot outputs, and data was transformed using a logarithmic function (LOG10) when appropriate. Heteroscedacity and linearity were assessed using residual scatterplots. After this screening, data was determined appropriate for analysis.
Models and Variables

In order to test the theories presented in the introductory section, I built a model that loaded measures from the survey into latent variables, and tested the outcome of addiction risk. Due to power constraints, the model was tested in three theoretically distinct parts. AMOS software was used in all analysis. No model modification was used, except to adjust covariance of errors to meet the identification requirements of the model. Covariance of variable errors was restricted to those that were closely related theoretically, while covariance of disturbance terms was not adjusted to achieve model fit, and were allowed to covary only if theoretically consistent.

Addiction is the outcome variable. In the foundational study of this analysis, Lende (2005) dichotomized the addiction outcome based on meeting a set of criteria regarding the frequency of substance use, number of attempts to quit, and total problems related to substance abuse. However, SEM and AMOS necessitate a continuous outcome variable. Thus, Lende’s methodology was used (drawing on the same variables: frequency of use, cessation attempts and amount of social problems), but results were not dichotomized. The result was a single variable with a higher score indicating increasing risk of addiction. The range of scores was from 0-42, with a mean of 8.98 and a standard deviation of 10.77.

Model 1: Stress and Early Trauma

The theoretical background of Model 1 describes how stress and early trauma lead to altered development patterns and high-risk behaviors. This model tests the effect of early environment, traumatic experiences and stress. The following four measured variables loaded
into the latent variable of Stress and Early Trauma, whose relationship with addiction risk is calculated.

*Early Trauma* was a sum of 10 items speaking to adverse events before the age of 10. Such events included divorce, various forms of physical abuse, sexual abuse, experiencing death or economic crisis. A higher score on this measure implied greater levels of early trauma. There were no missing responses in this category. Responses ranged from 1-15, with a mean of 4.13 and a standard deviation of 2.84.

*Time on the Street* was a 1-item question asking how much time, if any, they had spent on the street. The score was based on a scale of 0-8, with 0 indicating they had never lived on the street, and 8 indicating they had spent more than 6 months. Thus, the higher scores show more time on the street. There were 4 missing responses in this category. Responses ranged from 0-8, with a mean of 1.24 and a standard deviation of 2.16.

*Total Violence Experienced* consisted of four variables. Questions spoke to how often the adolescent had experienced violence such as being threatened with a weapon, being hit or shot, being cut, or having been hit or having something thrown at them. The higher scores showed more violence. There were 0 missing responses in this category. Responses ranged from 0-19, with a mean of 3.29 and a standard deviation of 3.53.

*Early Age for Adult Behaviors* was a written-in age that reported the age where students first drank alcohol with their friends (i.e.: outside of their families). This variable was back-coded such that a high score indicated an earlier age for adult behaviors. For those who had not ever drank, the response was set as the highest age in the sample (18). This would not likely skew the data, since the variable attempts to capture the earliest performances of adult behaviors,
and thus it was not appropriate to set these values as missing. There were 0 missing responses in this category. Responses ranged from 4-18, with a mean of 7.01 and a standard deviation of 2.92.

Model 2: Competition and Benefits

The theoretical base of Model 2 notes how different ecological environments cause different behavioral strategies that are advantageous in the particular environment and improve fitness. Model 2 tests how two latent variables (Intensity of Competition and Evolutionary Benefits) that affect addiction risk. Because of the close relationship of these factors, their disturbance terms were set to covary. Six different measures of adverse environments, risk strategies and evolutionary benefits are used as indicators.

The following variables loaded into the latent factor Intensity of Competition:

Relative Disadvantage. This was a 1-item measure that asked how much the respondent felt they had, compared to their peers. Responses were set on a range of 1-5 with a higher score indicating greater feelings of disadvantage. There were 5 missing values in this measure, with a mean of 2.12 and a standard deviation of 1.12.

Risk Taking was a sumscore across five variables measuring how the respondent related to risk, and how they felt about taking risks. This variable was back-coded such that a higher score indicated more risk-taking. There were 35 missing responses in this category. Responses ranged from 1 to 21, with a mean of 11.10 and a standard deviation of 3.36.

Total Delinquency was a sumscore for a 9-item measure indicating how many times in the last 12 months the participant had deliberately damaged property, stolen from a store, been in a serious physical fight, hurt someone so bad they had to go to the hospital, stole something worth more than 10,000 pesos (equaling about $5.50 in 2005), threatened someone with a
weapon, carried a weapon, been in a group fight, and sold drugs. There were no missing responses in this category. Responses ranged from 0 to 36, with a mean of 6.29 and a standard deviation of 8.094.

The following variables loaded into the factor of *Evolutionary Benefits*.

*Competitive Benefits.* This two-item measure assessed the level of evolutionary benefits that was experienced when using drugs. The questions asked, “Have you ever won a fight or contest due to drinking?” and “Have you ever been involved in a pleasant sexual situation because you have been using?” Responses ranged from 0-10, with a higher score indicated a greater amount of benefit in these areas. There were no missing responses. The mean was 6.29 and the standard deviation was 8.10.

*Perceived Benefits.* This was a 10-item measure that spoke to the degree of benefit that the user perceived drugs to have. Questions included how much drugs took away loneliness and pain, made them feel better, and commanded more respect from others. A higher score indicated a greater amount of perceived benefits. There were 0 missing responses in this category. Responses ranged from 4-50, with a mean of 31.91 and a standard deviation of 10.288.

*Drug-Using Friends.* This was a single question asking how many of the respondent’s friends have used drugs other than alcohol and marijuana, and was included as a measure of the community associated with using drugs. A higher score indicated greater numbers of drug-using friends. This was an ordinal measure that had a range of 1-4, with a score of 1 meaning they had no drug-using friends. The mean was 1.94 and the standard deviation was 1.00.
Model 3: Reward Pathology and Attachment Models

The final model tests the effect of two latent variables (Reward Pathology and Attachment Models) on addiction risk. The theory described at the start of the chapter discusses how the human vulnerability to substance abuse is likely an evolutionary artifact and a brain system gone amuck. Lastly, it describes the mal-adaptation of various attachment models to maximize environmental fitness. While related concepts, these two factors did not have a theoretically close enough relationship for their disturbance terms to be allowed to covary.

The variables that loaded into Reward Pathology consisted of the two indicators described below.

Motives. This was a 10-item measure that assessed the reasons respondents had for using. Respondents were asked the level they agreed with positive motivators for using, such as having more fun, feeling better, escaping, relaxing and giving something to do. There were 0 missing responses in this category. Responses ranged from 0-50, with a mean of 28.17 and a standard deviation of 12.08. A higher score indicated higher levels of agreement with the positive motivators.

Salience was a sumscore for an 8-item measure, rating how much they agreed with statements speaking to incentive salience. This variable was back-coded such that a higher score meant a greater presence of incentive salience. Questions spoke to the three primary themes: 1) feelings of wanting; 2) attention (being able to focus on other things, only being able to think about consuming); and 3) time (wanting to consume immediately, feeling unable or able to wait to consume). There were 0 missing responses in this category. Responses ranged from 0-40, with a mean of 26.77 and a standard deviation of 11.55.

The following two variables loaded into the factor of Attachment Models.
*Early Relationship with Mother* was a sumscore across twelve variables. Questions spoke to the relationship the child had with his mother, such as being distant, reliable, troubled, or affectionate; and asking the subject to rate how well on a scale of 1-4 the adjective described their relationship. This variable was back-coded such that a higher score indicated a more strained relationship with their mother, while a lower score indicated a stronger and more positive relationship. There were no missing responses. Responses ranged from 1-29, with a mean of 10.33 and a standard deviation of 6.87.

*Relationship between Parents* was a series of 6 items describing the relationship between parents as seen through the child’s eyes. Measures included terms such as affectionate, troubled, reliable, understanding, or distant. This variable was back-coded such that a higher score would represent a more strained relationship, while a lower score indicated a better, stronger relationship. There were 0 missing responses in this category. Responses ranged from 1-19, with a mean of 6.52 and a standard deviation of 4.10.

**Results**

The final sample consisted of 224 participants from both research sites: 183 from the school, and 41 from the treatment center. Overall demographics are presented in Table 3.1. The mean addiction risk measure at the school was 5.16 with a range of 0-39. The mean score of addiction risk at the treatment center was 25.3, with a range of 8-42. About three-quarters of all respondents were male (recall the treatment center consisted of all males) (n=167, 75.9%). A third (n=73, 33.3%) was aged 11-13, while about 40% (n=86) were aged 14-15, and 27% (n=60) were aged 16-18. Three quarters (n=159, 73.3%) lived at home and about 15% lived in an institution. Almost a quarter (n=41, 22.8%) had completed 4th or 5th grade, a little more than a
third (n=69, 38.1%) had completed 7th or 8th grade, and over a quarter (n=63, 28.1%) had completed either 9th or 10th grade. The majority of respondents reported that their primary substance was alcohol (n=123, 63.4%) or cigarettes (n=36, 18.6%). Similar numbers reported primarily using marijuana (n=19, 9.8%) as other drugs (n=16, 8.2%). Most reported not having used their primary substance in the last 30 days (n=88, 40.6%), about a quarter reported having used one or two times (n=58, 26.7%) and some reported using three to five times (n=31, 14.3%). The rest of the population reported greater levels of use. Most reported not having used their substance regularly (n=101, 45.7%), less than a quarter (n=49, 22.2%) reported having used about once a week, and some (n=24, 10.9%) reported using several times a week. The rest of the population reported using substances with more regularity, as noted in Table 3.1.

**Model 1: Stress and Early Trauma**

Model 1, testing the effect of stress and early trauma on addiction is presented in Figure 3.1. Both absolute and relative goodness-of-fit measures are presented on Table 3.2. Parameter estimates are presented in Table 3.3. The chi-square value of 5.51 with eight degrees of freedom is non-significant at the .05 level (p=0.421). This suggests that the absolute model fit is acceptable. Additional evidence corroborating this finding is given by other tests of relative model fit. Tests confirming relative good fit were CFI (1.0), NFI (.960), IFI (1.0), TLI (1.0), RMSEA (.00) and Hoelter (545). This was a recursive model, and all parameters measured in this model were found to be significant to <.001. Each had at least moderately strong relationships. Among the factor loadings, violence (β =.782, R²=0.61) and time on the street (β =.682, R²=0.47) had the strongest parameter estimates and variance, followed by early adverse events (β=0.433, R²=0.19) and lastly early age for adult behaviors (β=0.30, R²=0.09).
measures loaded in the expected direction: higher amounts of experienced violence, more adverse event, greater time on the street and earlier ages for substance use were consistently positive with the factor of stress and trauma. This implies a positive relationship (increasing levels of the indicator variables correlated with a higher level of stress). The errors of violence and time on the street were allowed to covary, but were found to be insignificant. Stress and early trauma was found to be significantly associated with the final outcome variable, and directionality was consistent with hypothesis (higher stress and early trauma indicated higher levels of addiction risk). The factor had a moderate impact ($\beta = .322$), and the final variance explained by this single factor is 10% ($R^2 = .10$)

**Model 2: Competition and Benefits**

Model 2 tested the effect of two latent variables, intensity of competition and evolutionary benefits on risk of addiction. The SEM diagram is presented in Figure 3.2. This model was also found to have a good absolute fit according to the chi-square test ($\chi^2 = 13.81, p = .168$) with supporting evidence from many tests of relative fit (CFI = .988, NFI = .962, IFI = .989, TLI = .966, RMSEA = 0.43 and Hoelter = 290). All fit measures are presented on Table 3.2, and parameter estimates are presented in Table 3.3. As in the last model, all parameter estimates were significant. Overall, both factors were also found to be significant and had an almost identical path estimate (intensity of competition, $\beta = .27$; evolutionary benefits $\beta = .29$), with a strong combined variance, explaining about 40% of the outcome of addiction risk ($R^2 = 0.40$). The positive path coefficient was consistent with the anticipated directionality, implying that increasing factor scores (higher competition and more benefits to using) were associated with
greater levels of addiction risk. The disturbance terms of these factors were allowed to covary, and were found to be significant (p<.000) with a correlation coefficient of 1.489.

The loadings into the factor of intensity of competition found moderate relationships with total delinquency (β =.610, R²=0.37), and a weak relationship with relative disadvantage (β =.17, R²=0.03). These variables were consistent with the anticipated directionality: with greater delinquency and stronger feelings of comparative disadvantage associated with higher levels of competition. The variable of risk taking (β =-.41, R²=0.17), however, showed a moderate negative correlation, thus loading in the opposite direction as the other indicator variables. This implied less risk-taking behaviors were associated with greater competition levels. Risk taking and delinquency were allowed to covary, but was found not significant.

The variables that loaded into the factor of evolutionary benefits had a stronger relationship. As noted, all variables were significant. Parameter estimates had at least moderate associations, and had a substantive portion of their variance explained. The relationship with competitive benefits (β =.633, R²=0.40) was strongest, followed by perceived benefits (β =.558, R²=0.31) and drug-using friends (β =.515, R²=0.27). These parameters all maintained the hypothesized positive direction; implying increasing indicators were associated with greater evolutionary benefits. The errors of the variables of competitive benefits and perceived benefits were allowed to covary, and were found to be significant (p=.023) with a parameter estimate of .364.

**Model 3: Reward Pathology and Attachment Models**

Model 3 tested the factors of reward pathology and attachment models on addiction risk. The SEM diagram is displayed in Figure 3.3. This model also passed multiple goodness-of-fit
tests. The chi-squared value of 11.61 (p=.05) showed a good absolute fit, and this measure was corroborated by several relative fit tests (CFI=.954, IFI=.957, Hoelter=213). Fit measures are presented on Table 3.2, and parameter estimates are presented in Table 3.3. Overall, the parameter estimates of the reward pathology factor into addiction risk was strong and significant ($\beta = .88$, $p<.000$), while the factor of attachment models was not significant and showed an extremely weak correlation ($\beta = -.01$, $p<.688$). These two factors had a strong combined variance explained of about 77% of the outcome of addiction risk ($R^2=0.77$). The positive path coefficient of reward pathology was consistent with the anticipated directionality, and implied higher measures were associated with greater addiction risk.

Within the reward pathology factor, all variables were significant with salience showing a strong relationship ($\beta = .70$, $R^2=0.50$) and motives for using showing a weak relationship ($\beta = .33$, $R^2=0.11$). Both of these parameters were consistent with the direction expected, and loaded positively into their latent factor, implying greater levels correlated with higher levels of reward pathology.

Relationship with mother and the relationship between parents were found to be non-significant in the factor loading. It should be noted that one additional constraint was required for model identification. Knowing from previous iterations that these two indicator variables were not significant, equivalence of these indicators of was assumed, and both were constrained at ‘1.’

**Discussion**

The purpose of this analysis was to test if five evolutionary-related factors proved to be significant pathways for addiction risk in this population. All three models were found to be
good fits, and, overall, had at least moderate-strength significant parameters. These outcomes add evidence to the theories presented in the start of this chapter, and substantiate the claim that evolutionary factors are a driving force towards addiction. Each of these outcomes are discussed in more detail below.

*The Effect of Stress and Trauma*

Although the factor of stress and trauma alone accounted for a relatively small amount of the variance within addiction risk (14%, a mild but significant relationship), the extraordinarily good model fit speaks to its validity. Results show that high experiences of violence, early adverse events, and living on the street are strongly correlated with higher levels of stress. As noted in the theoretical foundation, higher cortisol levels cultivate risky behaviors; and substance use is associated with a short-term decrease in cortisol levels. Thus, there are external (adverse conditions) and physiological (high cortisol-levels) factors influencing the choice to use. The evidence suggests that adolescents in such stressful conditions may use substances, to some degree, as a means of coping with stress.

It also appears that total violence experienced and life on the streets has stronger relationship with stress than does specific traumatic events. Results indicate that more immediate trauma and risk has a greater impact on substance abuse; that is, total violence and life on the streets are closer in time to the substance abuse. This also implies that chronic (or at least long-term), rather than acute experiences are more associated with stress and trauma. However both chronic and acute adverse experiences had stronger associations than the age at which adult behaviors are manifest. The small amount of variance explained in this variable suggests that there may be another factor that has greater influence. In other words, it is likely that this
population is using substances at a young age for a reason other than stress or trauma. An alternative explanation might be that in risky circumstances, it may be expedient to build social capital through risky or adult behaviors. Support for this alternative is offered by the results of Model 2.

*The Effect of Competition Intensity and Evolutionary Benefits*

The underlying theory of this model is that in areas where resources are scarce and competition is fierce, different behavioral strategies are taken to achieve benefits and enhance fitness. Results support this theory, as the factors of competition intensity and evolutionary benefits showed substantial and significant parameter estimates, and an overall contribution to addiction risk of about 40%. The strong correlation of the disturbance terms shows that the variances of the factors overlap (i.e.: that these factors measure something in common that extends beyond the constructs they represent). This demonstrates that drug-using environments foster more opportunities for fights and sex. It further indicates how competition and advantages share a deep interconnection related to evolutionary pressure.

Results show that as respondents perceive that they have less than their peers, delinquent behaviors increase. This implies that alternative benefit strategies are being used in this population when a disadvantage is sensed. Evidence is strong in support of the model, despite the unexpected direction in which risk-taking behaviors loaded into the factor competition intensity. Possible explanations for this may be that a significant portion of the sample was in a drug treatment center, and these respondents may have begun to diminish the value they give to risk taking. In order to test this conjecture, independent sample T-tests were conducted against the risk-taking scores these two groups (T=3.455, p=.002). The school was found to have
significantly higher scores (means are presented on Table 3.1), supporting the supposition. Conversely, these populations may define the concept of risk differently. In the most intense environments, taking risks may have been normalized among those students facing the worse conditions. This is plausible given that delinquency and relative disadvantage loaded positively into the competition intensity factor. Regardless, the variance explained in the variable of risk-taking was moderate and significant.

Stronger evidence came from the loadings of the indicator variables into the latent factor of evolutionary benefits. In accordance with the SPFIT theory, the concept of evolutionary benefits contributes to self-perceived feelings of power, respect and sexual desirability. Likewise, it contributes to actually having experienced sexual or competitive advantages from using. The correlation of these error terms also implies that there is a shared measure of some kind of deeper evolutionary advantage. Having drug-using friends may offer adolescents social connections or a community that were not otherwise available. The social capital forged from the drug experience may offer a fitness advantage in the form of protection, subsistence, and positive emotions. This may also be a factor that has a larger influence on the age this population begins to use, as noted in the discussion of Model 1.

The Effect of Reward Pathology and Attachment Models

Although ultimately passing many goodness-of-fit tests, this model was an overall close call. This was likely due to the non-significance of the latent variable attachment models. It may be that the indicators of this factor were not strong measures, or that other exogenous indicator variables were missing that should have been included. Either way, its contribution
will not be able to be taken into account. This test does not provide evidence supporting attachment models as a factor in addiction risk.

The latent variable reward pathology, however, gave evidence of a strong relationship with addiction risk. Given the lack of contribution from the first factor, the substantial (77%) of final variance explained appears to be almost entirely because of the factor of reward pathology. Salience, in particular had very strong, significant relationship. This adds to the increasing evidence that incentive salience plays an important role in addiction theory, and highlights the physiological foundation of addiction disorders. Additionally, the strong, significant correlation further endorses the Salience scale as a valid field measure.

Although still significant and in the direction expected, the strength of the relationship of motives was surprising. One possible explanation could have been that this variable was skewed by a reduction in treatment residents’ motivations to use. That is, those with the highest addiction risk may show fewer motivations because they are currently serving time at a compulsory treatment program. However, an independent sample T-test refuted this, and showed that the treatment center had significantly stronger motivations for using drugs (T=-8.49, P<.000). Another explanation may be drawn from the results of Chapter 2. This concludes that the members of the school have a more consistent cultural outlook towards drugs, which was, overall, more negative. It follows logically that they would see less motivation for using, thus reducing the impact. The relative weakness of this variable in comparison to the salience scale may even suggest that the biological aspects of addiction are stronger than the cognitive; or perhaps suggest that the cognitions are so ingrained that they go beyond conscious thought and are embedded biologically. As such, both a biological pathology of reward, and a socio-cultural perspective should be taken into account.
Alternative Models

Although good model fit and strong parameter estimates fit the data extremely well, it is important to remember that other models may also fit the data equally well (or better). The primary alternative would be to run all parts of the model as one. However, power constraints in this particular dataset prevented this. When attempted, the model was unidentified even with the bare minimum parameter estimates and the exclusion of the latent variable attachment models. A second alternative might separate the factors of reward pathology and attachment models. Perhaps with higher power or additional indicator measures, these latent variables would have been testable on their own. However, when run as separate models both became saturated, so in order to be able to assess fit and obtain estimates of either variable, this option was ruled out. Lastly, a third alternative would include the direct measures of the exogenous variables to the outcome variable. However, when tested on this particular dataset, all models model became unidentified, and thus this alternative was also ruled out.

Strengths and Limitations

Limitations of this study include the relatively small power, which limited the parameters available to estimate at one time. Three models were run, separated by theoretical constructs. A single model would have allowed examination of the combined variance of each factor, and reduced any Type 1 error that might have occurred from running multiple models. The factors of attachment models and reward pathology may have benefited from additional indicators or different measures entirely. As with all cross-sectional data, this analysis lacked the advantage of the longitudinal design, and so the directional deductions that this type of analysis offers are merely constructs. Lastly, deductions about biological factors did not have the benefit of
biological tests, and instead relied on proxy measures. This, however, is common in such analysis, and the proxy measures held up in reliability tests.

Strengths of the analysis involve the use of short, high salience instruments validated in the same population. Additionally, there was not a strong risk of recall bias, as the survey asked for current perspectives and large life events, rather than specific memories. Another strength of this analysis is that it measured addiction as risk measured on a continuum, rather than a dichotomized outcome; yet it still drew from the main diagnostics (repeated use, problems associated and challenges quitting). Despite DSM criteria, the definition of addiction is still somewhat amorphous and does not adequately account for the differing facets of circumstance, and for inherent evolutionary powers of substance use. An additional strength is the incorporation of SEM. Because SEM analyzes multiple parameters at once, it offers researchers a glimpse of the bigger picture, rather than individual variables. Further, there is a reduction in Type 1 error when compared other types of regression analysis. Lastly, although it cannot prove causation, the design of the model allows for deductions of directionality.

*Future Directions for Research*

Additional research projects might be undertaken with greater power. Longitudinal studies might also be undertaken to gain additional empirical evidence of causation. Further, both ethnographic and biological tests could be given to assess the bicultural model more accurately. Some qualitative data does exist in this project that is yet unanalyzed. Assessment of this data may offer more evidence in support of evolutionary theories from a different perspective.
Conclusions

This analysis gives supporting evidence to the impact of the factors of stress and trauma, competition intensity, evolutionary benefits, and reward pathology on addiction risk. The fact that these factors were found to be significant with at least moderate strength associations adds empirical validation that there is a strong evolutionary influence on substance abuse risk.

The topics covered in this analysis highlight the potential potency that an alliance between public health and anthropology may offer. The power that public health possesses to develop and deliver health programs is much greater than medical anthropology could hope for. However, the critical perspective of medical anthropology allows a step back from purely biomedical-based programs: its holistic approach allowed for the inclusion of this type of evolutionary-based research, after all. Additionally, an integrated emphasis on contextual understanding also allows for the control of the ‘cultural factor’ that is present in many public health models.

The chapter above presents the reoccurring motifs of emotion, stress and forging for survival and benefit amidst adverse conditions. It also implies the power of physiology. The salience of these themes makes them prominent areas upon which to target treatments, when and if appropriate. Rather than cracking down on users, alternative models might target reducing stress and competition in extreme environments, or in attempting to shift the tangible benefits that drug bring. Promoting an onslaught of health information, or threats such as ‘jail time’ may appear too abstract and distant. If the motivator for sniffing glue is to reduce stress related to violence or cold from living on the street, better alternatives to discouraging the behavior might be to offer the individual a better choice, such as a safe place to go to avoid these factors.
Recommendations are given in greater detail in Chapter 4. Rather than promoting cessation, alternative ways to achieve the same benefits might be suggested. Acknowledging these evolutionary considerations should contribute to other disciplines, and thus enable not only better interventions, but also a healthier relationship with psychoactive substances in general. The data suggests that there may be no cure for the phenomenon of humans using drugs due to its long, co-evolutionary history. It sits deeply in the evolution of who we are. However, understanding the underlying reasons for addiction may enable successful management of substance use, and prevent it from transforming into something dangerous: true addiction or dangerous consumption.

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Sanyai, Zoltán.  
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Smith, D. K., & Saldana, L.  
Smith, David E.  
Smith, E.O.,  


Tables and Figures

Table 3.1: Demographics of Risk Factor Survey Participant

<table>
<thead>
<tr>
<th></th>
<th>Total Sample (n=224)</th>
<th>Mean (min-max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addiction Risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>5.16 (0-39)</td>
<td></td>
</tr>
<tr>
<td>Treatment Center</td>
<td>25.3 (8-42)</td>
<td></td>
</tr>
<tr>
<td>Risk-Taking Behaviors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>11.48 (3-21)</td>
<td></td>
</tr>
<tr>
<td>Treatment Center</td>
<td>8.86 (1-16)</td>
<td></td>
</tr>
<tr>
<td>Motives for Using</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>25.85 (0-49)</td>
<td></td>
</tr>
<tr>
<td>Treatment Center</td>
<td>38.51 (14-50)</td>
<td></td>
</tr>
<tr>
<td>Research Site</td>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>183 (81.7)</td>
<td></td>
</tr>
<tr>
<td>Treatment Center</td>
<td>41 (18.3)</td>
<td></td>
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<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>167 (75.9)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>53 (24.1)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-13</td>
<td>73 (33.3)</td>
<td></td>
</tr>
<tr>
<td>14-15</td>
<td>86 (39.3)</td>
<td></td>
</tr>
<tr>
<td>16-18</td>
<td>60 (27.4)</td>
<td></td>
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<tr>
<td>Where do you currently live?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At home with parents</td>
<td>159 (73.3)</td>
<td></td>
</tr>
<tr>
<td>With another relative</td>
<td>14 (6.5)</td>
<td></td>
</tr>
<tr>
<td>In an institution</td>
<td>32 (14.7)</td>
<td></td>
</tr>
<tr>
<td>I live independently (alone or with friends)</td>
<td>5 (2.3)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>7 (3.2)</td>
<td></td>
</tr>
<tr>
<td>Last Grade Completed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th or less</td>
<td>7 (4.0)</td>
<td></td>
</tr>
<tr>
<td>5th or 6th</td>
<td>41 (22.8)</td>
<td></td>
</tr>
<tr>
<td>7th or 8th</td>
<td>69 (38.1)</td>
<td></td>
</tr>
<tr>
<td>9th or 10th</td>
<td>63 (28.1)</td>
<td></td>
</tr>
<tr>
<td>11th or above</td>
<td>1 (.6)</td>
<td></td>
</tr>
<tr>
<td>What is your most widely-consumed substance?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>123 (63.4)</td>
<td></td>
</tr>
<tr>
<td>Cigarettes</td>
<td>36 (18.6)</td>
<td></td>
</tr>
<tr>
<td>Marijuana</td>
<td>19 (9.8)</td>
<td></td>
</tr>
<tr>
<td>Any Other Drug</td>
<td>16 (8.2)</td>
<td></td>
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<tr>
<td>In the last 30 days, how many times have you consumed your most widely used substance?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 times</td>
<td>88 (40.6)</td>
<td></td>
</tr>
<tr>
<td>1-2 times</td>
<td>58 (26.7)</td>
<td></td>
</tr>
<tr>
<td>3-5 times</td>
<td>31 (14.3)</td>
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<tr>
<td>6-9 times</td>
<td>16 (7.4)</td>
<td></td>
</tr>
<tr>
<td>10-19 times</td>
<td>10 (4.6)</td>
<td></td>
</tr>
<tr>
<td>20-39 times</td>
<td>7 (3.2)</td>
<td></td>
</tr>
<tr>
<td>40 or more times</td>
<td>7 (3.2)</td>
<td></td>
</tr>
</tbody>
</table>

During the last year, how often did you regularly (at least once a week) consume your most widely used substance?

| I do not use regularly | 101 (45.7) |
| Once a week            | 49 (22.2)  |
| Several times a week   | 24 (10.9)  |
| Almost every day       | 17 (7.7)   |
| Once a day             | 10 (4.5)   |
| More than once a day   | 9 (4.1)    |
| More than 5 times a day| 11 (5.0)   |

<table>
<thead>
<tr>
<th>Table 3.2: Absolute and Relative Fit of All Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF</td>
</tr>
<tr>
<td>Cutoff</td>
</tr>
<tr>
<td>Model 1</td>
</tr>
<tr>
<td>Model 2</td>
</tr>
<tr>
<td>Model 3</td>
</tr>
</tbody>
</table>

*Indicates model fit is acceptable according to the parameters of the test
Table 3.3: Parameter Estimates for All Models

<table>
<thead>
<tr>
<th>Variable</th>
<th>β</th>
<th>B</th>
<th>SE</th>
<th>CR</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1: Stress and Trauma</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Age of Adult Behavior</td>
<td>0.300</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time on Street</td>
<td>0.682</td>
<td>2.416</td>
<td>.912</td>
<td>2.648</td>
<td>.008</td>
</tr>
<tr>
<td>Early Adverse Events</td>
<td>0.433</td>
<td>1.083</td>
<td>.299</td>
<td>3.623</td>
<td>&lt;.000</td>
</tr>
<tr>
<td>Total Violence</td>
<td>0.782</td>
<td>3.143</td>
<td>1.153</td>
<td>2.725</td>
<td>.006</td>
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<tr>
<td>Addiction Risk</td>
<td>0.322</td>
<td>1.935</td>
<td>.614</td>
<td>3.153</td>
<td>.002</td>
</tr>
<tr>
<td><strong>Model 2: Competition and Benefits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delinquency</td>
<td>.610</td>
<td>1.00</td>
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<tr>
<td>Relative Disadvantage</td>
<td>.175</td>
<td>.040</td>
<td>.014</td>
<td>2.905</td>
<td>.004</td>
</tr>
<tr>
<td>Risk-Taking</td>
<td>-4.15</td>
<td>-2.88</td>
<td>.040</td>
<td>-7.184</td>
<td>&lt;.000</td>
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<tr>
<td>Addiction Risk</td>
<td>.274</td>
<td>.029</td>
<td>.013</td>
<td>2.264</td>
<td>.024</td>
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<tr>
<td>Drug-Using Friends</td>
<td>.515</td>
<td>1.00</td>
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<tr>
<td>Perceived Benefits</td>
<td>.558</td>
<td>10.698</td>
<td>1.477</td>
<td>7.243</td>
<td>&lt;.000</td>
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<tr>
<td>Competitive Benefits</td>
<td>.633</td>
<td>2.439</td>
<td>.344</td>
<td>7.081</td>
<td>&lt;.000</td>
</tr>
<tr>
<td>Addiction Risk</td>
<td>.292</td>
<td>.299</td>
<td>.173</td>
<td>1.727</td>
<td>.044</td>
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<tr>
<td><strong>Model 3: Reward Pathology and Attachment Models</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motive</td>
<td>0.327</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salience</td>
<td>0.705</td>
<td>2.002</td>
<td>.472</td>
<td>4.238</td>
<td>&lt;.000</td>
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<tr>
<td>Addiction Risk</td>
<td>0.879</td>
<td>.059</td>
<td>.033</td>
<td>3.571</td>
<td>&lt;.000</td>
</tr>
<tr>
<td>Relationship between Parents</td>
<td>.156</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship w/Mother</td>
<td>2.185</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Addiction Risk</td>
<td>-.009</td>
<td>-.008</td>
<td>.019</td>
<td>-.402</td>
<td>.688</td>
</tr>
</tbody>
</table>
Figure 3.1: SEM of Stress and Trauma

Figure 3.2: SEM of Competition and Benefits
Figure 3.3: SEM of Reward Pathology and Attachment Models
Chapter 4: Conclusion

There are inherent human mechanisms that interact with psychotropic substances that shape cognition and actions. The use of substances can have negative consequences on different levels of society worldwide, and stems from multiple ecological foundations. Certainly some violence exists surrounding the use and trade of substances. There are also political, social and economic factors that have both pro- and anti-social consequences. Chapter 1 outlined many of these pressures, and gave context specific to the study’s location. It also gave an overview of the study’s design and implementation. Colombia presents a unique case. Despite high production and opportunity, rates of substance use among youth are generally lower than the US, and a little higher than neighboring countries. This is likely due to a high availability, the combined forces of a middle income with high urban growth, and patterns of risk consistent with developing countries. The condition of youth is a nearly universal condition that stems beyond social facets, with biological, physiological and evolutionary roots. Habits such as substance use are often correlated with this time of life. In order to capture a full spectrum of risk and addiction, the current study surveyed two research sites in Popayán, Colombia: a drug treatment center and secondary school. Data explored cognitions about drugs, and mapped evolutionary-based factors of addiction risk.

Biomedical models such as the Health Belief Model often treat culture as an external factor or modifying variable. However, Chapter 2—focused on the analysis of cognition about drugs—showed that this singular ‘factor’ may be one of the most important influences on how
people think. The cultural context shapes expectations, and thereby delineates action. The completely disparate results of these two (very different) research sites serve as evidence of how deeply cognitions vary according to environment. The students at the school came from a very similar background and had similar expectations surrounding drugs. They made similar assessments: drugs increasingly led to both pleasure and escape, yet changed who you were; they were increasing strong, dangerous, difficult, negative, and were rejected by society. This outlook and expectancy was reflected in the overall choice not to use drugs other than alcohol and cigarettes. However, what is valuable means different things in different contexts. Residents at the treatment center had more diversity in their background, and the results showed fewer consensuses in perceptions about drugs. Further, they had more experiences in an environment where using was advantageous, and thereby anticipated more benefits. Thus, they—quite rationally—did not see drugs in the same negative light.

The tendency to work to make life easier is as old as the world, and substances offer both perceived and actual benefits. Substance use in humans has Darwinian origins (Lende & Smith 2002, Saah 2005, Lende 2008). Chapter 3 analyzed different pathways to addiction, and showed evidence of evolutionary factors significantly impacting the risk of addiction. Factors included behavioral, emotional and biological responses to Stress and Trauma, Intensity of Competition, Evolutionary Benefits, and Reward Pathology. Stressful environments and early trauma cause physiological and developmental changes that shift behavior patterns towards substance use. Intensity of competition causes organisms take on strategies to maximize evolutionary benefits of survival and reproduction. These strategies often include drug use and other high-risk behaviors. Reward pathology refers to the malfunction of brain circuits that cause feelings of reward, such as those brought by drugs. These factors speak to the long history, and
physiological base, that addiction has. Indeed, context is not only written in choice and action, but in biology as well.

**Recommendations and Expected Benefits to Applied Anthropology**

Form breeds nature. Inherent human mechanisms make the use of psychotropic substances relate closely to the human form; and this breeds our nature of consistently using across time. The results of this analysis add evidence to what history and evolution have already suggested: that drug use will never go away. However, we can learn from this. The best choice in addressing the problems that surround unhealthy use is to focus on harm reduction. Despite a biological foundation, culture has the power to shape cognitions and choice, which point to this as our sharpest tool. The results of this thesis increase understanding of the cognitions and experiences of Colombian youth regarding drugs, and highlights potential pathways that recreational use turns to addiction. The mapping of these pathways cohesively identifies biological and ecological risk factors, and tests the theory of incentive salience in a real-world context. Additionally, this knowledge helps identify the perceptions, modifying variables and cues to action outlined in the Health Belief Model that determine drug-related decision-making in this population. Evidence showed that firsthand experience with drugs, learning, expectation and gradated differentiation and uses that exists in a drug economy on the street all were important modifying variables and cues to action. Understanding the motivational factors that drive youth towards drug use enable successful intervention programs when appropriate (Neumark et al 2011). Further, this analysis gives the unique contribution of an evolutionary perspective, which is relatively uncommon in applied anthropology. Indeed, an evolutionary
perspective towards health and health programs, one that is also sensitive to cultural considerations, captures the essence of applied bio-cultural medical anthropology.

Of course, there is no one solution to solving the problems of substance abuse. It is important to take into account the unique context of the individual and understand their motivations for using. In this analysis, we have seen that substance abuse runs deep, but is generally an attempt to do their best in a challenging ecological climate. In areas where resources are scare, adolescents used substances and did not think about doing so as a bad thing. This is because it provided more benefits than harms to them, in their situation. An alternative to current strategies of the War on Drugs may be to provide the opportunity to change how drugs relate to individual’s lives. Rather than being a desirable, advantageous choice, the perception could be that drugs have specific, relatable consequences. The abstract concept of long-term prison time or saying that using supports terrorism is less relatable than fines, therapy, and other forms of restitution. Diminishing the feelings of community created by using might be accomplished by restricting (rather than prohibiting) substances in such a way that using fosters feelings of exclusion. Also, providing a warm place to go that has food may actually be more appealing way to take away cold or hunger than sniffing glue may be to many adolescents.

Of course, these considerations are merely the radical roots of a solution. The development of intervention programs must be fostered in conjunction with the community. After taking community input in the initial program design, integrating an evaluation element allows for a continuous feedback loop. This will enable the intervention to make adjustments that ensures it is continuing to meet the needs of the population and community. If a community wanted to also integrate a research component, additional projects such as ethnographies, longitudinal studies and new surveys that have more direct biological measures could be implemented via methods
that involved the community with the intervention, such as community participatory research. As always, the form of these programs would differ according to the ecological make-up, needs and desires of the community.