CONSILIENCE AND LIFE HISTORY THEORY: FROM REPRODUCTIVE STRATEGY TO SELF-REGULATION TO ANTAGONISTIC ATTITUDES AND BEHAVIORS

by

Christopher J. Wenner

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As members of the Dissertation Committee, we certify that we have read the dissertation prepared by Christopher Jonah Wenner entitled Consilience and Life History Theory: from Reproductive Strategy to Self-Regulation to Antagonistic Attitudes and Behaviors and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy

____ Date: 6/29/10
W. Jake Jacobs

____ Date: 6/29/10
Varda Shoham

____ Date: 6/29/10
Aurelio Jose Figueredo

____ Date: 6/29/10
Judith V. Becker

____ Date: 6/29/10
Lee Sechrest

Final approval and acceptance of this dissertation is contingent upon the candidate’s submission of the final copies of the dissertation to the Graduate College.
I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

____ Date: 6/29/10
Dissertation Director: W. Jake Jacobs

STATEMENT BY AUTHOR

SIGNED: Christopher J. Wenner

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DEDICATION

This Doctoral Dissertation is dedicated to

W. Jake Jacobs

for countless reasons

(conventional & atypical)

beyond

what I am willing to expose here.

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ABSTRACT

The research described here examines individual differences in Life History (LH) strategy, antagonistic social attitudes/behaviors (e.g., social deviance), and self-regulation in adolescents and young adults from community and university populations. The primary hypotheses were that (1) LH strategy and self-regulation abilities are positively associated, (2) LH strategy and antagonistic attitudes/behaviors are negatively associated, (3) self-regulation mediates the relations between LH strategy and antagonistic attitudes/behaviors, (4) antagonistic attitudes and antagonistic behaviors are positively but moderately associated, (5) and that self-reported self-regulation and neuropsychological test scores of self-regulation correlate positively. The first four predictions were supported; the fifth prediction was not. The current research contributes to our understanding of self-regulation's role within LH strategies and antagonistic attitudes/behaviors. Further, the identified near-orthogonality of neuropsychological test scores and self-report scores of self-regulation ought to be of interest to clinical science.

INTRODUCTION

Theoretical Framework

The research described here examines individual differences in social cohesion and cognitive components of Life History (LH) theory, antagonistic social attitudes and behaviors (e.g., social deviance), and self-regulatory components of executive functions in adolescent humans. These focal components of study are nested within a line of research that is, itself, subsumed by a long-standing research program that has developed a psychometric measure of social and cognitive components of LH theory, the “K-Factor.” We have identified, established and written extensively on the psychometric validation of the K-Factor (Figueredo, Vásquez, Brumbach & Schneider, 2004; Figueredo, Vásquez, Brumbach, & Schneider, 2007; Figueredo, Vásquez, Brumbach, Schneider, Sefcek, Tal, Hill, Wenner, & Jacobs, 2006; Figueredo, Vásquez, Brumbach, Sefcek, Kirsner, & Jacobs, 2005)

The over-arching approach guiding the present work is “consilience,” a systematic unification of knowledge - a scholarly advancement first suggested by William Whewell (1840) and elaborated by Edward O. Wilson (1998). They proposed that scientists and other scholars integrate their knowledge base and areas of study to optimize understanding and progression of seemingly disparate fields. Our adoption of consilience has led to the merging of clinical neuropsychology and evolutionary psychology – both of which depend on the literatures of behavioral genetics, criminology, personality and developmental psychology. As such, we have created a conceptual and data-based research program with an appreciation for the phylogenetic and ontogenetic histories that contain the ultimate and proximate causes of human behavior – namely social cohesion (i.e., LH strategies), socially antagonistic behavioral strategies (i.e., “deviant” attitudes and behaviors as well as and criminal behaviors), and self-regulation (i.e., a primary neurologically-based executive function).

In a 1963 document evaluating the breadth and foci of Ethological science Nico Tinbergen proposed, “*the biological study of behaviour*” (italics his; 1963, p. 411) as a succinct characterization of the field. He suggested that ethology remain an inductive science and maintain a concentration on behavioral measurement. In a salute to Konrad Lorenz, Tinbergen emphasized that ethology was able to “look at behaviour through the eyes of biologists” (p.411). Synchronous with consilient thinking, Tinbergen suggested that a complete understanding of an ethological or behavioral question address and integrate four domains: evolution, survival value, mechanistic causation, and ontogeny. These first two domains address “ultimate” views of a causal understanding: 1) knowing why an organism’s behavior arose via natural selection over phylogenetic time, and 2) understanding why, if at all, the behavior is of survival or reproductive value (i.e., a behavior may occur as a mismatch between our current and ancestral environments). The final two questions address proximate views of causal understanding: 3) knowing how causal mechanisms function (e.g., physiological and neurological function), and 4) understanding individual development over ontogenetic time. A complete causal understanding of an organism’s behavior demands that all four domains be theoretically addressed, researched, and integrated.

With E.O. Wilson and Tinbergen in mind, we build the consilience scaffolding presented here upon an LH theory foundation, in which human phylogenetic history (i.e., the Environment of Evolutionary Adaptedness; EEA) provides a genetic base for the development of body and brain (Figueredo et al., 2006; Tinbergen, 1963; Wilson, 1998). Then, our brain and interfacing body interacts with and solves a lifetime of unique adaptive problems which ensures our reproductive success and, hence, our genetic survival (Hill & Kaplan, 1999; Ellis, Figueredo, Brumbach & Schlomer, 2009). Endeavoring to solve adaptive problems is not trivial because individual organisms occupy a plethora of ecological niches that overlap in space and time (i.e., our environment; see Bronfenbrenner's (1979) Ecological Systems Theory of development for a comparable perspective). Solving problems of social navigation (e.g., familial attachment, friend- and mate-bonding, successful mating, and parenting), and resource acquisition (e.g., food, money, surplus time) with our inherited physical and psychological phenotypes sometimes call upon or even necessitate socially antagonistic behavioral tactics that many would deem unsavory.

In our work, careful selection of nomenclature that identify "bad behavior" is prudent, particularly in light of the growing recognition that such behavior often occurs as a means to solving gene-level adaptive problems. By *socially antagonistic behavioral strategies* (Figueredo & Jacobs, 2010) we refer to behavioral suites that are (typically unconsciously) intended to solve adaptive problems via methods commonly deemed disagreeable by our Western societal majority (i.e., our rule-setting slow-strategists); or at least those behaviors that this majority espouse as disagreeable, deviant (i.e. *social deviance*), and maybe even worthy of legal sanctions.

Borrowed from Malamuth's (1996) *Confluence Model*, we use the term *antagonistic* to describe social behaviors that are mutually inconsistent among affected conspecifics. In sum, Malamuth's *Confluence Model* describes rape predispositions (i.e., promiscuity and hostility) within more general dispositions people have towards social interactions with members of the other sex. He describes a continuum of sexual strategies ranging from *convergent interests* to *divergent interests*. Males who have convergent and shared reproductive interests with their female counterpart base their relationship and interactions on mutually consistent, or *mutualistic* behaviors. On the other hand, males who engage in divergent strategies approach their intersexual reproductive behaviors and relationships as mutually inconsistent, or *antagonistic*.

While he uses different language, Malamuth (1998) describes a developmental model in which people might be more inclined to adopt these different strategies as part of different life history (LH) strategies. Slow LH strategists may be more prone to develop convergent interest (mutualistic) sexual strategies because doing so is more fitting within long-term reproductive relationships. Fast LH strategists may be more prone to adopt divergent (antagonistic) sexual interest strategies because doing so fits poorly within long-term reproductive and sexual relationships.

The proposed extension of this model by Figueredo and colleagues (Figueredo & Jacobs, 2010; Figueredo, Gladden & Beck, 2010) describes parallels of these sexual strategies as general social strategies; slow LH strategists are more inclined to develop generalized *mutualistic social strategies* and fast LH strategists are more inclined to develop generalized *antagonistic social strategies*.

Some antagonistic behaviors may be conformable behind closed doors (e.g., marijuana use), quietly recognized as virtually normative (e.g., adolescent sexual behavior), and often situationally acceptable (e.g., being violent to prevent harm to self; automobile speeding to a hospital). When many antagonistic behaviors cluster to form a temporally extended LH strategy, however, they are readily identifiable as socially and culturally antagonistic.

Historically, developmentalists have described such “problem behavior” as “behavior that is socially defined as a problem, a source of concern, or as undesirable, by the norms of conventional society…and its occurrence usually elicits some kind of social control response” (Jessor & Jessor, 1977, p. 33). Other authors refer to these or subsets of these behaviors as risk-taking (Baumrind, 1987), delinquent (Rowe, Vazsonyi, & Figueredo, 1997), deviant (Rowe & Rogers, 1989), antisocial (Moffitt, 1993a), criminal (L. Ellis, 1988), or in unique cases, psychopathic (Hare, 2003). When occurring before adulthood and when viewed as pathological, the combination of many of these behaviors may be clinically identified as Conduct Disorder or Oppositional Defiant Disorder; when occurring in adulthood such behaviors may be identified as Antisocial Personality Disorder (American Psychiatric Association, 2000). Moreover, people who commonly engage in antagonistic behaviors typically also have measureable sensation seeking and impulsive personality traits (Zuckerman & Kuhlman, 2000). Sometimes, however, antagonistic behavioral strategies are beneficial and reflect environmental adaptations, as

I will describe later. In contrast to antagonistic behavior, mutualistic behavior closely parallels conventional behavior, which has been defined as "…behavior that is socially approved, normatively expected, and codified and institutionalized as appropriate for adolescents and youth" (Jessor & Jessor, 1977, p. 35).

Antagonistic behaviors and social strategies may be considered such because of their correlations with future outcomes (i.e., risk factors). For example, many of these behaviors are risky–that is, behaviors that appear to increase risk for undesirable outcomes (particularly undesirable by slow strategists who aim for delayed pregnancy, morbidity and mortality). Many outcomes appear to be "negative" and have "adverse" outcomes – ranging from legal problems through substance use; (unintended) teenage pregnancy, high-school drop-out, and STD contraction from early and careless sexual behaviors. Many behaviors deemed antagonistic, however, receive this blanket nomenclature entirely because of the person's age, such as status offenses. Sometimes, however, the possible gains of taking risks outweigh possible costs, with "risky means" often resulting in "desirous ends" - desirous in terms of short-term gains and reinforcers (e.g., orgasm) and long-term biological gains (e.g., multiple offspring from multiple partners).

Proximately, whether antagonistic or not, ideographic behavioral strategies form our ontogenic life histories (Draper & Harpending, 1982) which influence our reproductive and inclusive fitness (i.e., by increasing the probability of pushing our genes into future generations via offspring and other genetically related kin such as siblings, nieces, and nephews; Stearns, 1992; see also Dawkins, 1976), our reproductive success (i.e., quantity and quality of gene-level offspring; Stearns, 1992), and hence have an ultimate genetic influence on our descendant's phylogenetic life history; Belsky, Steinberg & Draper, 1991; Ellis, 2004; Figueredo et al., 2006; Rowe, 2000). Thus, in a generational cause and effect chain, our ancestors and our own experiences influence our life history; in turn, our life history has a direct influence on our descendants (see also Ellis et al., 2009 for an extensive review and description).

Life History Theory

Genesis of Life History Theory

Life history (LH) theory was born of evolutionary biology to describe the diversity of life cycles between species (Hamilton, 1966; MacArthur & Wilson, 1967). More recently, LH theory has been used to describe distinctive variations of developmental timing and traits within species (Stearns, 1992), particularly humans (Hill & Hurtado 1996; Hawkes, O'Connell, Blurton-Jones, Alvarez, & Charnov, 1998; Kaplan, Hill, Lancaster, Hurtado, 2000; Smith & Tomkins, 1995).

The study of LH centers on two fundamental principles. The first principle is natural selection. Natural selection favors resource allocation strategies that optimize bioenergetic resource distribution throughout one's life history and across environmental conditions. Sexual selection, a subtype of Natural selection, refers to reproductive effects of mating competition, both intersexual (i.e., between males and females) and intrasexual (i.e., between competing males or competing females), in which conspecifics vie for the highest quality mates with which they might attract, secure, and reproduce. The second principle is that of trade-offs of time and bioenergetic resources imposed on species and individuals by the finite limits of these resources (see Stearns, 1992).

Although the work of Euler (1760) and later Darwin (1859) laid the foundation for LH theory, it burgeoned during the mid-twentieth-century via the work of Hamilton (1966) and MacArthur and Wilson (1967), becoming firmly established as a field of its own in the latter part of the century (Partridge & Harvey, 1988; Stearns, 1992). Partridge and Harvey (1988, p. 1449) provided a clear definition of LH foundation as "the probabilities of survival and the rates of reproduction at each age in the lifespan," which alludes to the demographic and nomothetic nature of the theory and its roots within population genetics. Later, Stearns (1992) identified the core traits identified in LH analyses, "Life history evolution makes the simplifying claim that the phenotype consists of demographic traits – birth, age and size at maturity, number and size of offspring, growth and reproductive investment, length of life, death – connected by constraining relationships and tradeoffs…including those between current reproduction and survival, current reproduction and future reproduction, number, size, and sex of offspring."

The effects of shifts in fertility and mortality on populations are core variables within LH study. Unavoidable constraints on time and energy allocations place constant pressure on population growth; more of one thing necessarily means less of something else. Time and energy allocations that increase or decrease fertility or mortality invariably alter the same variables within a cohort or later in immediate descendents. Resulting changes in fitness depend on the age at which these changes take place (Hamilton, 1966). Therefore the allocation of resources (i.e., time and energy) impacts the life histories of target populations as well as their immediate descendents.

Building upon this simplified description of LH analyses and variation, r/K selection theory has become the most extensively studied variation of LH theory. MacArthur and Wilson (1967) and later Pianka (1970) built upon Dobzhansky's (1950) notion that populations will "crash" when subjected to extremely variable environments. The idea is that mortality is independent of population density and individual differences in competitive abilities. Given these conditions, natural selection leaves features that maximize the intrinsic rate of population growth (r). In relatively constant and stable environments, populations saturate carrying capacity, denoted as ‘K’ (i.e., K is the conventional symbol for this variable in mathematical models of density dependent population growth). Density-dependent mortality rates differentially affect individuals, depending on each individual’s allocation of resources. Under these conditions, natural selection favors increased competitive abilities. Each kind of selection produces contrasting genotypic and corresponding phenotypic characteristics between species (Pianka, 1970). K-selected species, for example, demonstrate developmentally “slower” life histories relative to developmentally “faster” r-selected species – with a recognition that degree of K- or r-selected traits between species span a continuum, with ‘K’ and ‘r’ denoting each pole. The more K-selected the species, the more the species invest in each offspring, leading to fewer offspring, relatively slow development, delayed reproduction, greater competitive ability, larger body size, and longer lives.

Within taxonomic groups, life history variation among mammals consistently falls along a fast-slow continuum and the theoretically derived r/K continuum (Roff, 1992). However, although some criticize r/K theory for relying on inconsistent data across studies and theoretical coherence (see Stearns, 1992), empirical research consistently shows “fast-slow” variation in life histories and correlations between developmental timing variables. Further, these inconsistencies in the data are largely accounted for by the addition of predation pressure along with population density pressure, as described by Reznick and colleagues (Reznick, Butler, Rodd, & Ross, 1996; Reznick, Rodd, & Cardenas, 1996; Reznick & Shaw, 1997). While r/K theory as a causal model has seen a number of revisions (Stearns, 1992; Reznick, Bryant, & Bashey, 2002), it has continued to gain support as an organizing theory of life-history traits (e.g., Rushton, 2004).

Contemporary Life History Theory

LH theory has more recently been used to describe variation in reproductive strategies (Chisholm, 1993) and associated phenotypic traits within species, particularly humans, which fall on the slow end of the continuum (Hawkes, O'Connell, & Jones, 2003). As it pertains to humans, LH theory posits that variations in human traits follow a dimensional pattern similar to that of the inter-species variation described above. Among these traits are phenotypes that are the focus of behavioral trade-offs, as introduced above.

Trade-offs. A core feature of contemporary LH theory is that of differential resource trade-offs (Kaplan & Gangestad, 2005). People are equipped with a finite amount of time and bioenergetic resources to solve adaptive problems. LH strategies are the correlated and coordinated suites of trade-offs that individuals make over their life-span. Optimal LH strategies are the trade-off decisions made (typically made non-consciously) based on environmental contingencies. The fit between these synchronous phenotypic behavioral strategies and features of the environment determines fitness.

LH theory incorporates fundamentals of natural selection and trade-offs in many core components of human nature including but not limited to multiple domains of social cohesion (e.g., sexual and romantic pair-bonding/attachment, child/parent attachment and altruism), age and rate of sexual maturation, rate of offspring reproduction, morbidity, rate of aging, and mortality. The environmental features that shape development of ontogenetic LH strategies typically include but are not limited to peer, parent, sibling, and extended family relationships; school, neighborhood, and extended community quality and safety; and socioeconomic status and residential mobility (Ellis et al, 2009).

In general, LH theory seeks explanations for variations in probabilities of survival and reproduction across the lifespan with emphases on relations among the timing and rates of these variables. Many LH researchers focus on the molecular and physiological mechanisms of timing and rate of growth, development, reproduction, and aging. Most LH scientists, however, target fitness-related effects – that is, whether the presence or degree of focal LH variables result in a relatively increased, decreased, or unchanged reproductive fitness –that is, the probability the individual will have future generations of descendants. These effects form the basis of theoretical explanation of why natural selection adjusts the timing and rate variables across and within species. The field aims to identify fitness costs and benefits, that is, the trade-offs that explain individual differences of life histories between and within species. Within-species research, such as the human research described here uses multiple lines of evidence to weave comprehensive profiles of human biology, including anatomic and behavioral components (in the broadest sense) that are often attended to within psychological study.

Most broadly, resource demands of survival and reproduction are necessarily in competition; resources allocated to one endeavor diminish available resources for the other (Hill & Kaplan, 1999; Roff, 2002; Shennan, 2002, Stearns, 1992). As such, the primary trade-off necessarily occurs between somatic and reproductive efforts. Somatic effort rests at one end of this dimension of this trade-off whereas reproductive effort rests at the other. Somatic effort refers to the enhancement and maintenance of individual health and growth for survival of the individual organism. Reproductive effort refers to bioenergetic and material resources devoted to producing and maintaining vehicles (i.e., children) for survival of the individual's genes.

The second trade-off, within somatic effort, is between maintenance and growth/development. Maintenance involves all energy directed toward staying alive, maintaining the body, and preventing morbidity. The quality and quantity of investments in maintenance determines age-specific mortality schedules (i.e., probabilities of death; Worthman, 2003). Growth and development involves allocation of resources to somatic, social and cognitive processes and abilities. Trade-offs in early ontogenetic development establish growth trajectories that will strongly influence life-time maintenance costs (Bogin, Kapell, Varela-Silva, Orden, Smith, & Louky, 2001).

Within reproductive effort, the third and most fundamental trade-off is between current and future reproduction. Effort put into reproducing now will use energy and resources that cannot be used or saved for future reproduction. Reproduction includes finding, attracting, and retaining a mate, sexual reproduction, sustaining and maintaining offspring (e.g., lactation, parental care, protection, socializing).

The fourth trade-off comes in the form of reproductive timing; allocating limited resources towards current reproduction diminishes resources held in reserve for future reproduction and resulting offspring. Ample data on human adolescents point to trade-offs between life-course timing of reproduction, as well as somatic growth and reproduction. Adolescent mothers, compared to adult mothers, have fewer available bioenergetic resources for offspring production. Typically, adolescent mothers have smaller body mass and transfer less of their body weight and calories to fetal weight gain and development than do adult mothers (Garn, LaVelle, Rosenberg & Hawthorne, 1986). Also, offspring of adolescent mothers, more than those of adult mothers, are at increased risk of congenital abnormalities, prematurity, birth complications, retardation, and stillbirths; similarly, these young mothers also have higher rates of prenatal morbidity and mortality than do adult mothers (Black & DeBlassie, 1985; Luster & Mittlestaedt, 1993). Trade-off analyses, however, reveal that when a female bears a child at a young age (i.e., while an adolescent), the adolescent mother reduces her over-all probability of dying childless because of the shorter time duration from her birth to her first offspring's birth, as well as less time exposed to all sources of mortality. Further, by giving birth during the second decade of life, the young mother has a potentially longer reproductive lifespan. Moreover, birth at a young age increases the total possible number of offspring within her lineage, by way of shorter generation time (Ellis, 2004).

The fifth trade-off is between LH traits specific to morbidity/mortality and quantity of offspring. Bioenergetic resources and time availability naturally constrain our "options" to have fewer offspring in whom we invest much, or more offspring in whom we invest less. Higher investment leads to offspring who tend to have increased health and developmental and mortality outcomes (Ellis, et al., 2006; Kaplan & Gangestad, 2005; Stearns, 1992). Extant data indicate the quality-quantity trade-off is particularly pervasive in pre-industrial societies (Strassmann & Gillespie 2002).

A number of environmental variables and child rearing experiences influence these trade-offs that are based on behavioral domains and the effects of these domains. These variables include peer relationships, school characteristics, neighborhood quality, socioeconomic status, and child-parent relationships. LH traits and associated variables are all directed toward maximizing reproductive fitness and include growth rates, pubertal timing and onset of sexual behaviors, adolescent pregnancy and childbirth, number of sexual partners, family size, child-rearing styles, morbidity and mortality. These variables directly influence LH trajectories such as rates of reproduction and associated patterns of growth, aging, mating, and parenting behavior.

Trade-offs between time and bioenergetic resources allow individuals' LH strategies to adapt to immediate environmental conditions. By way of phenotypic plasticity, natural selection has allowed for LH strategy adjustment ontogenetically - but remaining within their species typical range, as determined by phylogenetic selection. This occurs in the form of LH trade-offs in which individuals "make optimal decisions" about resource distribution specific to maintenance, growth and development, and reproduction in environmental circumstances (Chisholm, 1993). An easy way to conceptualize these trade-offs is by way of a conceptual slow-fast continuum of the LH strategies one might implement.

Slow and Fast Life History Strategies. LH strategies develop as functional responses to environmental conditions. This occurs in two ways. LH strategies take form phylogenetically as species-typical responses to ancestral environmental conditions such as resource prevalence (e.g., food, shelter), social resource prevalence (e.g., mate availability, prevalence and proximity of kin availability), and local risks (e.g., disease, predators, competing conspecifics, and novel events such as drought). These varying environmental conditions act upon our genetic diversity to produce individual differences in LH strategies. LH strategies also develop ontogenetically as modal responses to species' environmental and developmental conditions; these developed strategies vary tremendously with individual differences in genetic propensity and conditions throughout the life-course (Ellis et al, 2009).

LH theory assumes that psychosocial traits develop as functionally intertwined reproductive strategies by way of natural and sexual selection pressures. LH theory claims that natural and sexual selection shape many aspects of an individual's approach to adaptive problems presented by the physical and social environment causing specific psychosocial traits to co-occur and present as clusters (Rushton, 1985; Thornhill & Palmer, 2004).

People who live in harsh environments respond to stimuli that signal constrained morbidity and mortality. Harsh environments are those that directly effect morbidity and mortality and have been described as, "…the rates at which external factors cause disability and death at each age in a population. LH theory ascribes primary importance to the effects of extrinsic morbidity-mortality (external sources of disability and death that are relatively insensitive to the adaptive decisions or strategies of the organism) on LH evolution." (Ellis et al., 2009, p. 206). Further, people who live in unpredictable environments respond to stimuli that signal highly erratic rates of morbidity and mortality. Unpredictable environments are those that are variably harsh across time and have been described as, "…the rates at which environmental harshness varies over time and space. Environmental unpredictability favors the evolution of various bet-hedging strategies" (Ellis et al., 2009, pg 207).

As such, people who develop in harsh and unpredictable environments tend to evolve "fast" trait clusters (i.e., LH strategies) that allow for maximum utilization of time and bioenergetic resources for reproduction. These trait clusters include early sexual maturity, relatively indiscriminate mating choices, multiple offspring, and low parental investment. On the other hand, those who live in controllable and predictable environments develop "slow" reproductive traits that include later sexual maturity, relatively discriminate mating choices, few offspring, and high parental investment (Kaplan & Gangestad, 2005).

Ample data indicate that other traits in personality and individual differences have adaptive value and accompany the aforementioned differential reproductive traits and influence LH strategies. These include attachment (Belsky, 1999; Belsky et al. 1991), sex differences in attachment (Del Giudice, 2009), pubertal maturation (Ellis, 2004), physical and psychological health (i.e., "covitality;" Figueredo et al., 2007), and "big five" factors of personality (Figueredo et al., 2007). For example, we believe that slower strategists are more inclined to engage in long-term thinking, monogamy, adhere to current Western social rules, and have high levels of social support. On the other hand, faster strategists are hypothesized to have trait clusters that involve impulsivity, short-term thinking, promiscuity, risk taking, and poor social support (Bogaert & Rushton, 1989; L. Ellis, 1988; Geary, 2002; Rushton, 1985, 1987; Rushton & Bogaert, 1988; Thornhill & Palmer, 2004).

Dominant values in industrialized societies tend to favor slow strategies and view fast strategies as undesirable, likely because these values are held by slow strategists who maintain high social status and influence. Nonetheless, industrialized societies hold a wide range of social and environmental niches that are amenable to a comparably wide range of reproductive strategies. As such, even in our own society, we find LH strategies ranging from fast to slow. Because people use a range of reproductive strategies that largely depend on individual differences in genetic history and local environmental conditions, we recognize that no specific strategy is superior to another; rather, “successful” strategies are determined by the fit between individual strategy and is measured by reproductive and inclusive fitness.

Many studies and analyses conducted by my research group have characterized a variety of LH parameters that include clusters of social, reproductive, sexual, and parental behavior (Figueredo et al., 2004, 2005, 2006). These parameter estimates, based on a series of latent variable models, represent a single a higher-order multivariate factor, the K-Factor. This research program stems from and builds upon an ongoing program of study that describes and predicts individual differences in human reproductive LH strategies.

Common Life History Factor. LH theory predicts that functional cognitive, affective, and behavioral trait clusters that produce reproductive strategies will be amenable to detection via multivariate correlational techniques, such as factor analysis and structural equation modeling. By moving beyond univariate correlational analyses, LH predictions and subsequent multivariate analytic approaches have the potential to reveal reproductive behaviors, personality, cognitive, and other traits that cluster together and thus describe individual differences in how people approach sexual and social relationships, how they treat their children, and other important social behaviors.

We have established strong psychometric validity of the K-Factor, including construct, (Figueredo et al., 2004, 2005) convergent (Figueredo et al., 2006), cross-cultural (compared to Mexican samples; Tal et al., 2006) and incremental validity over similar constructs such as impulse control (Figueredo et al., 2006).

Our research group has identified relations between the K-Factor and a variety of variables predicted by LH theory. These include ontogenetic effects of harsh and unpredictable environments (Brumbach, Figueredo, & Ellis, 2009), a range of antagonistic social behaviors (Wenner, Figueredo, & Jacobs, 2005), adolescent sexual restrictedness (Brumbach, Walsh, & Figueredo, 2007), assortative mate pairing across cultures (Figueredo & Wolf, 2009), romantic relationship satisfaction (Olderbak & Figueredo, 2009; Olderbak & Figueredo, 2010), sexual coercion (Gladden, Sisco, & Figueredo, 2008), morality and religiosity (Gladden, Welch, Figueredo, & Jacobs, 2009), general health, the Big Five personality traits, antagonistic attitudes, and general cognitive ability (Figueredo et al., 2007; Gladden, Figueredo, & Jacobs, 2009), and water conservation behavior (Tal, Hill, Figueredo, Frías-Armenta, & Corral-Verdugo, 2006).

The K-Factor is based on measures of individual differences in human LH strategy that consists of sexual, reproductive, parental, and social cognitions and behaviors. These include use of twin data (Figueredo et al., 2004) from the National Survey of Midlife Development in the United States survey (MIDUS; Brim, Baltes, Bumpass, Cleary, Featherman, Hazzard, Kessler, Margie, Lachman, Markus, Marmot, Rossi, Ryff, & Shweder, 2000), in which we found that this higher-order K-Factor was 68% heritable and accounted for 82% of the genetic variance of three lower-order factors (described below). Also, data from university samples identified this single latent common factor and that this factor, as it is associated with personality, accounted for 92% of the variance in indicators of LH strategy (Figueredo et al., 2005). Comparable cross-cultural results were also found in a sample of non-student adults in Hermosillo, Mexico (Tal et al., 2006).

Paramount in this endeavor were further analyses conducted using the MIDUS data set (Figueredo et al., 2007). My group constructed scales with the MIDUS data to measure LH strategy that were based on three cognitive and behavioral dimensions theoretically specific to LH features: personal, familial, and social. The first theoretically based dimension, personal function, included traits such as planfulness based on former experience and long-term thinking. The second, familial function, included parental and nepotistic effort including giving and receiving of altruistic gestures with one’s parents, children, romantic partner, and kin. The third, social function, included similar forms of reciprocal altruism, but with members of one’s extended social network including community members and friends. Factor analyses of these scales revealed a single common factor, the “K-Factor” that accounted for 70% of the reliable variance.

Both genetics and environment influence LH strategies, comprised of predictable psychosocial traits that cohere into behavioral profiles designed to solve adaptive problems of survival and more importantly, reproduction that people use. Hence, a comprehensive research program with an *exhaustive* measurement of LH theory necessarily involves resource allocation measures specific to somatic, reproductive, mating, and parental effort; as well as reproductive success and physical traits (Belsky et al., 1991; McArthur, & Wilson, 1967; Rowe, 2000; Rushton, 2000; Shennan, 2002).

The multivariate measure of LH strategy employed within our research program, the K-battery, however, focuses on quality of social relationships; specifically parental investment (given and received), nepotistic investment (given and received), long-term mating investment (given and received), reciprocal altruism towards friends and community, religiosity, and long-term planning. Although it is not an exhaustive LH measure, it captures well these core and central elements. LH strategy, as measured by the K-Factor, is associated with a number of antagonistic attitudes and behaviors.

Gladden, Sisco, and Figueredo (2008) found that self-reports by college students indicate that a slow LH factor comparable to the K-Factor (as measured with the 199-item *Arizona Life History Battery* (*ALHB*; Figueredo, 2007; described below) is negatively correlated with sexually coercive attitudes and behaviors. Similarly, our group also found a negative correlation between a similar LH factor (as indicated by measures of Mate Value, Emotional Intelligence, Executive Functioning, Short-Term Mating, Mating Effort, and Antagonistic Social Strategies) and a Negative Androcentrism factor (e.g., antagonism towards women, sexist attitudes, and acceptance of rape-myths). These findings suggest that a slow LH strategy is associated with decreased hostility and negative attitudes towards women, perhaps because slow LH generally inhibits socially antagonistic attitudes and behaviors (Gladden, Figueredo, Andrzejczak, Jones, & Smith-Castro, 2009).

Moreover, our group also found cross-cultural evidence for a comparable relation between LH strategy and negative ethnocentrism. Self-report data indicate that slower LH individuals have less negative ethnocentrism towards multiple outgroups. Slower LH individuals from the United States had less negative ethnocentrism towards Arab and Mexican Immigrants; slower LH individuals from Costa Rica had less negative ethnocentrism towards Afro-Costa Ricans and Nicaraguan Immigrants (Figueredo, Andrzejczak, Jones, Smith-Castro, & Montero-Rojas, 2010).

The current research and embedded hypotheses build upon the view that faster LH strategists are more disposed toward antagonistic social strategies, consistent with other recent findings (e.g., Gladden, Figueredo, & Jacobs, 2008; Sefcek & Figueredo, 2010).

Slower LH strategy is expected to be associated with decreased sexual competition because of the reduced mating effort and reduced intrasexual competition associated with slower LH strategies. Research by Olderbak and Figueredo (2009) indicates that when both members of a heterosexual romantic couple rate themselves as slow LH strategists, there is a strong correlation between the K-Factor and relationship satisfaction. This may be due to reduced mating effort and reduced intrasexual competition.

Our group expanded on these findings to investigate the relations between LH strategy and intimate partner violence (IPV; Figueredo, Gladden, and Beck (2010). Using structural equations modeling, they used the ALHB (Figueredo, 2007) as the predictor variable; as mediator variables they used the Brief Rating Inventory of Executive Function (Gioia et al., 2002), the Multidimensional Sociosexual Orientation Inventory (Jackson & Kirkpatrick, 2007), the Mate Value Inventory (Kirsner, Figueredo, & Jacobs, 2003), and the Culture of Honor Revenge Scale (Figueredo, Tal, McNeill, & Guillén, 2004). Then, as a secondary mediating variable they developed a Psychopathic and Aggressive Attitudes factor, measured by the Levenson Psychopathy Scales (Levenson, Kiehl, & Fitzpatrick, 1995), the Reactive-Proactive Aggression Questionnaire (Raine at al., 2006), and the Mating Effort Scale (Rowe, Vazsonyi, & Figueredo, 1997). Finally, the developed an IPV factor as the major criterion variable which was comprised of the Revised Conflict Tactics Scales (Straus, Hamby, Boney-McCoy, & Sugarman, 1996), and the Relationship Behavior Rating Scale - Revised (Tanha, Beck, Figueredo, & Raghavan, 2010). This model explained 32% of the variance in IPV.

The results of this study found that slow LH strategy was associated with decreased IPV through multiple pathways. All of the pathways were indirect effects, and most pathways were mediated through psychopathic and aggressive attitudes. Slower LH strategy was positively associated with executive functions and mate value. Slow LH strategy and higher executive functions were both negatively correlated with short-term mating; slower LH strategy and higher executive functions were both negatively associated with Culture of Honor revenge ideology; short-term mating was positively correlated with Culture of Honor revenge ideology; higher executive functions were negatively correlated with psychopathic and aggressive attitudes; short-term mating, higher Culture of Honor revenge ideology, and higher mate value was positively correlated with psychopathic and aggressive attitudes; higher psychopathic and aggressive attitudes were positively correlated with IPV, while higher mate value was negatively correlated with IPV.

As such, slow LH strategy was negatively correlated with IPV, but this relation was mediated through lower psychopathic and aggressive attitudes which were indirectly and positively correlated with slow LH via a increased executive functions, lower short-term mating, and lower Culture of Honor revenge ideology.

The correlational results of this study suggest that slow LH strategy, as measured by the K-Factor, may causally perform as an inhibitory mechanism against IPV. While these results and the results of the other recent K-Factor research described above are correlational, they reduce our uncertainty about their causal nature. Slow LH strategy act upon IPV in ways comparable to inhibitory effects slow LH strategy may have on sexual coercion, intrasexual competition, intersexual competition, negative androcentrism, negative ethnocentrism, and antagonistic behaviors over-all.

In sum, the behaviors subsumed by a slow LH strategy may be incompatible with antagonistic social strategies. This incompatibility speaks directly to the probabilistic increase in functionally and reproductively adverse effects of antagonistic social strategies on long-term mating strategies, parental investment in offspring, and social cohesion and reciprocal altruism among kin and non-kin.

Antagonistic Social Strategies

Evolutionary Theories

People have life histories because they have successfully solved a series of adaptive problems in the broad domains of survival and reproduction (Darwin, 1871). Some environments and individual behavioral profiles allow for the execution of conventional and statistically normal life history strategies in which people solve problems with minimal risk to self and others and minimal social rule-breaking. We suggest, however, that many environments and personality profiles are not prone to such a fit, such as unpredictable and harsh environments and fast strategists (Brumbach, Figueredo, & Ellis, 2009) that are either adapted to such environments or are not amenable to a conventional fit in a given environment. Fast strategists, we suggest, often resort to use of antagonistic behaviors that sometimes cohere into fitness enhancing life history strategies.

Maximizing Fitness. Selection pressures have provided the human brain with an array of abilities for solving adaptive problems that reoccur in contemporary domains. As described above, all organisms face trade-offs and bet-hedging situations that influence growth, maintenance, and reproduction; there is tremendous range in ways people can maximize fitness by altering their trade-offs. Trade-offs in domains such as resource and mate acquisition occur by way of mutualistic or antagonistic behaviors. To be sure, *all* trade-off decisions and consequent behaviors are a gamble and pose “risks,” perhaps in the common form of opportunity cost, or, more specifically placing all of one’s eggs in a single proverbial basket by intentionally having a single child and banking on the "promise" that that descendent will succeed in continuing to produce descendents. Antagonistic behaviors may prove to be worth the "extra" risk depending on one's environmental context, particularly as they pertain to trade-offs in behaviors that target reproduction. Mating effort is a core domain that warrants elucidation.

Mating effort is the amount of time and bioenergetic resources devoted to attracting and retaining a mate (Rowe, Vazsonyi, & Figueredo, 1997). Because males can potentially produce more offspring than females, and because of the massive sex difference in requisite parental investment (Trivers, 1972), there is a very large sex difference in potential reproductive rates, and hence, differential reproductive effort. Because females in most species invest more in offspring than males, males vie for reproductive access to females through intra-sexual competition and inter-sexual attraction (Darwin, 1871; Trivers 1972). It has been heavily documented in dozens of countries that males invest much more of their bioenergetic resources into finding sexual partners than do females (Low, 2000; Schmitt, 2005). Differential mating strategies are often used, in which people use coordinated sets of evolved behaviors to select, attract, and retain sexual partners (Buss & Schmitt, 1993; Gangestad & Simpson, 2000). All else being equal, males will aim for mate quantity and females will aim for mate quality. As such, females are a valuable resource (much more than males are for females) for which males compete (Schmitt, 2005).

Nonetheless, the high degree of male parental investment leads women to desire mates with resources that they are willing to share with her and her offspring (Buss, 1989). These resources increase her and her offspring's chances for survival and reproduction. Thus, in competition for women, men will also compete for resources with which they may attract women. The more resources men have, the greater their potential fitness in terms of mate quantity, quality, and variation. For males, an increase in the number of sexual partners holds promise for an increase in reproductive fitness (i.e., quantity of offspring), while the selectivity of females in choosing mates (e.g., for genetic quality and ability and willingness to share resources) increases their reproductive fitness (i.e., quality of offspring). Indeed, men of high wealth and status enjoy more sex partners and more frequent copulations than men of low wealth and status (Kanazawa, 2003; Pérusse, 1993).

Maximizing Fitness Antagonistically. As defined and described above, antagonistic social behaviors encompass a broad range of behaviors from relatively benign sensation seeking to relatively malignant psychopathy. I cluster this broad range of behaviors because many of them are deemed “antagonistic” only because of values imposed by heavily influential “top-down” thinkers such as policy makers, behavioral health professionals, and other slow strategists. These ‘antagonistic’ behaviors are often identified as wrong or disordered without regard to their probability for harmfulness or dysfunction to self, others, or society (Wakefield, 1992a, 1992b, 1999), environmental fit (see Wakefield, Pottick & Kirk, 2002), or reproductive and inclusive fitness benefits (Stearns, 1992). I also cluster these behaviors because they often overlap conceptually (Figueredo et al., 2006), statistically (Jessor & Jessor, 1977), and share common features such as impulsivity, and are often immediately reinforced (see Mishra & Lalumière, 2008).

A LH analysis suggests antagonistic social behaviors serve as adapted responses to identifiable environments. Natural and sexual selection, over multiple generations, leaves these antagonistic behaviors remaining as viable tactics (i.e., isolated or few behaviors) and strategies (i.e., long-standing suites of behaviors) with strong fitness enhancement. For example, if one decides to postpone reproduction in a harsh and unpredictable environment with a foreshortened "time horizon" (i.e., death; Mishra & Lalumière, 2008, p. 142) that contains mortality threats (e.g., violent crime, severely abusive parents, food scarcity), the person may be severely truncating their reproductive options. As such, an optimal reproductive strategy may be to reproduce early and perhaps with multiple partners to increase the probability of producing multiple offspring with genetic variance. Such variance increases the probability that at least some of one's offspring will have phenotypic qualities that, because these qualities fit well with novel or changing environments, will increase reproductive fitness (i.e., continue to push their genes into future generations).

People who accurately assess their environments, their time horizons, and adjust their behavioral strategies accordingly, are inclined to have greater reproductive fitness. For example, a fast strategy that "targets" more immediate and short-term reproductive gains rather than long-term and potentially greater gains (over one's reproductive life-span) may result greater reproductive fitness. Harvey and Zammuto (1985) supported such "future discounting" by demonstrating that even across mammalian species, life expectancy at birth is associated with female's age at first reproduction.

People with accurate valuation of their environment (e.g., threats to morbidity and mortality) and self (e.g., health and behavioral liabilities) as indicators of a foreshortened time horizon may engage in behaviors that maximize immediate pay-offs at the expense of potentially greater, but probabilistically unlikely, future gains. Engaging in antagonistic social behaviors such as illicit polydrug use, reckless driving, theft, fighting and other “competitive” risk taking, may result in harm to self or death, yet these antagonistic behaviors often serve as means for acquiring status and mates among conspecifics, in principle producing elevated reputation and material goods acquired in the service of gaining reproductive opportunities. Indeed, high rates of sexual behavior in adolescence and resulting childbearing and antagonistic behavior frequently co-occur (Lalumière, Harris, Quinsey & Rice, 2005). When one has poor prospects for social and material gains or later reproduction, the benefits of adopting these antagonistic behaviors may far outweigh the costs.

Further, if environmental unpredictability modulates antagonistic behaviors, we expect positive correlations between the two. Hill and colleagues (Hill, Ross & Low, 1997) found this to be so in self-reported sexual, health, and financial risk-taking behaviors among college students. Indeed, these students held beliefs that their future was less predictable and time horizon shorter than students who reported fewer risk behaviors. This group also found that early histories of unpredictability such as parental divorce and family unreliability were associated with acceptance of risk-taking behaviors (Ross & Hill, 2002). An alternative causal hypothesis is that these traits may be inherited. Unreliable parents may also be prone to engaging in antagonistic behaviors and pass these and related traits on to offspring (Cadoret, Yates, Troughton, Woodworth, & Stewart, 1995). The third and most likely causal hypothesis is that there is an interaction between genes and the environment (Kreek, Nielsen, Butelman & LaForge, 2005; Rowe, 1994).

Antagonistic psychological adaptations to solving problems, although overlapping, appear to cluster within specific domains (Kruger, Wang, & Wilke, 2007). Factor analysis by Kruger et al (2007) identified five domains of antagonistic risk taking behaviors that are directly relevant to LH analysis. These are mating and resource allocation, between-group competition, within-group competition, fertility and reproduction, and environmental challenge. This section uses these domains to outline ultimate causes of antagonistic behaviors and LH strategies as means to adaptive problem solving in contemporary contexts.

Mating and Resource Allocation. Particularly in the absence of contraception, male reproductive success benefits from an increased number of sexual partners. There are individual differences in male mating effort (Rowe, Vazsonyi, & Figueredo, 1997) with some males strategizing by seeking to mate with one or very few long-term partners, and other males strategizing with many short-term partners (Belsky et al, 1991). Risks of increased number of partners increases probabilities of contracting sexually transmitted diseases and acquiring jealous partners or other pursuants may become violent, with possible fatal consequences for the cheater (Buss, 2000; Wilson & Daly, 1998) or pursuant (Daly & Wilson, 1988). Such risks to morbidity and mortality are distinguished from other less acute bet-hedging risks. Risks also include gambled or squandered allocation of time and material resources devoted to costly signaling (i.e., attracting) potential mates.

Tradeoffs with more mating effort and less parental effort should be associated with riskier antagonistic behavioral strategies (Low, 2000). Selection pressures produced the risky antagonistic behavioral strategies of young males in particular because they served as an alternative strategy to accrue social status and resources vital in mating competition. Such strategies are believed to have enhancing reproductive success (Wilson & Daly, 1992), and in fact high mating effort and adolescent childbearing are associated with greater rates of antagonistic behaviors (Lalumière et al., 2005).

Because accumulation of material resources increases men's reproductive value more so than women's (Buss, 1989), we find that men will engage in mutualistic and criminally antagonistically means for material acquisition more so than women (Kanazawa 2005; see also Kanazawa, 2008 for a thorough review on theft). High mating effort that incorporates potentially very costly behaviors and low parental effort that omits potentially very beneficial conventional behaviors occur at peak levels during adolescence. This may be due to an increase in peak intrasexual competition among males.

Between-Group and Within-Group Competition. Mating effort in males is commonly exhibited as competitive behaviors, and once men are reproductively able, they may resort to antagonistic behaviors to aid in their reproductive competitiveness (Kanazawa, 2008). Inter-group competition may have been the most substantial selection pressure in recent history (Alexander, 1979), including warfare, gang violence, and sporting competitions. Such risky (but perhaps not socially antagonistic) behaviors that involve imminent risk to self may in fact be adaptive – serving as honest signs and displays of physical and psychological competence requisite in displays of intersexual and intrasexual mating competition. These competencies may be desirable to conspecifics as indicators and vehicles of status acquisition, and desirable to potential mates as indicators of genetic competence (prowess to be passed along to potential offspring), status, and resource holding (Lalumière & Quinsey, 2000; Zahavi & Zahavi, 1997).

Competition for social status occurs among men and women, but is more prevalent among men, perhaps because male social status is more closely related to mate value (see Buss, 1994), number of mates (Hill & Hurtado, 1996) and reproductive success (Betzig, 1986) across cultures. Further support for these ideas can be seen in literatures that investigate antagonistic behaviors among adolescents and young adults.

For example, age-specific valuation of morbidity and mortality shifts during late adolescence (Hill & Chow, 2002). Competition for resources, status, and mates peaks at age 18-24, which is precisely when we see risk-taking competition peak among males (Wilson & Daly, 1985). Taking risks via antagonistic strategies may result in substantial fitness gains, and even when they do not, the potential fitness benefits of resource and mate acquisition may be well-worth the risks. Indeed, in a review by Daly and Wilson (2001), adolescent males were more likely to engage in risk-prone behaviors in the presence of their peers, and gang leaders and other dominant males were described as having more mates than conspecifics.

A short or truncated time horizon and its accompanying steep future discounting often predict extreme interpersonal competition and conflict. For example, Wilson and Daly have documented that homicide becomes exceptionally prominent in male-male competition over status and mates (Wilson & Daly, 1992, 1997). Wilson and Daily examined the relations among homicide rates and reproductive timing with average neighborhood life expectancy, reporting an inverse relationship between homicide rates (as an outcome of competition for resources, status and mates) and local life expectancy – which held even after statistically accounting for homicide as a contributor to local life expectancy. Similarly, neighborhoods with the lowest life expectancy were home to adolescent mothers with the highest birth rates (Daly, Wilson & Vasdev, 2001).

Following competition, those individuals who emerge with increased status, long-term mates, and offspring, a shift in behavior often occurs. Risk-taking behaviors decrease and these and other forms of mating effort shift to parental effort (Hill & Chow, 2002).

Fertility and Reproduction. Because the ultimate evolutionary pay-off is differential reproductive success (i.e., reproductively outcompeting conspecifics) rather than survival, selection has produced an inherent drive to consider trade-offs specific to somatic effort and resource accrual as well as reproduction and fertility. An example would be the "ticking clock" phenomena, in which many women approaching menopause consider allocating resources to reproduction while their childbearing abilities remain; and many older men consider their mortality and remaining time to invest in reproduction (particularly parenting).

Environmental Challenge. Environmental challenge is less relevant to the use of antagonistic behaviors for survival or reproduction – perhaps with the exception of competition within the most harsh and unpredictable environments. Many modern people continue to face mortality risks specific to predators, parasites, and accidents (Hill & Hurtado, 1996), and foraging strategies continue to influence survival outcomes (Kacelnik & Bateson, 1996).

Although environmental factors influence trade-off decisions and development of mutualistic and antagonistic LH strategies, so to do intrapersonal factors such as heath and cognitive abilities like self-regulation and intelligence (Lalumière et al., 2005).

Embodied Capitol and Antagonistic Behaviors. Embodied capital, or lack thereof, -relative to that of conspecifics- may explain some people's tendency toward antagonistic behavioral strategies. Embodied capital is the traits and characteristics people have, such as physical prowess, attractiveness, personality traits, and abilities that increase competitive advantage for solving adaptive problems in resource and mate (Lalumière at al., 2005). People low in embodied capital within a given environment may have a stronger discounted future, perhaps a foreshortened time horizon, and find themselves at a competitive disadvantage relative to conspecifics in competitive situations. Resorting to antagonistic strategies may serve as a means to bolster their capital and increase their competitiveness. Daly and Wilson (1997) demonstrated that neighborhoods with higher income disparities had higher homicide rates. Homicide as a "cheating" strategy may have been used as a means to increase competitive advantage. Mate value, as a form of embodied capital, may play a similar role, particularly in the mating marketplace (Kirsner, Figueredo & Jacobs, 2009).

Development of antagonistic strategies includes risk factors such as parental abuse, poor nutrition, poor neurological development, and environmental unpredictability (Harris et. al., 2001). These risk factors may cue neurological development to allow for faster antagonistic strategies that will bring adaptive advantage in similar future environments. In line with LH strategies that trade-off immediate short-term gains for a shorter life-span, life-long antagonistic behaviors have been associated with early mortality (Laub & Vaillant, 2000). Another prominent form of embodied capitol may be intelligence (Herrnstein & Murray, 1994).

Developmental Theory

This section outlines proximate causes of antagonistic behaviors and LH strategies as means to adaptive problem solving. Developmental scientists have proposed two developmental LH pathways that involve antagonistic social strategies (Mishra & Lalumière, 2008; Quinsey, Skilling, Lalumière, & Craig, 2004). These are adolescence limited delinquency and life-course persistent offending (Moffitt, 1993a).

Dual Taxonomy. Moffitt's (1993a) dual taxonomy of socially antagonistic behaviors is perhaps the most influential ontogenetic theory of adolescent and adult delinquency and offending. Trajectories and constellations of related antagonistic behavioral strategies tend to have qualitatively different associations within two identified groups of 'delinquent' youth: the Adolescent-limited (AL) Offender and the Life Course-Persistent (LCP) Offender (using Moffitt's nomenclature).

Adolescent-limited offenders are characterized by limited antagonistic trajectories that do not outlive the adolescent years, as well as limited, brief, and minor forms of criminal repertoires. Their lives are not wrought with antisocial behaviors, an associated lifestyle, or an extensive array of social wrong-doing. Rather, their socially antagonistic acts tend to be situation-specific with mutualistic behavior comprising much of their time (Moffitt, 1993a).

The LCP Offender is characterized by a more complete life history of socially antagonistic behaviors. Their anti-sociality begins early in life and continues throughout adulthood (Berg & DeLisi, 2005; Farrington, 1991; Loeber & LeBlanc, 1990). Their anti-social behaviors generalize broadly (Farrington, 1982; Farrington, Snyder, & Finnegan, 1988; Gottfredson & Hirschi, 1990; Hirschi & Gottfredson, 1994; Jessor, 1998), are more frequent (Loeber, 1982; Moffitt, 1990), and are more likely to situationally generalize (Mitchell & Rosa, 1981) than their adolescent-limited counterparts. In short, life course-persistent youth are deeply involved in a *lifestyle* of antagonistic and often criminal behaviors that continue well into adulthood.

Adolescence-limited delinquents often engage in behaviors that are status offenses legally imposed by nature of their age, and they desist from delinquency very quickly as a result of shifting natural contingencies (Moffitt, 1993a). In contrast, life course-persistent delinquents exhibit antisocial behavior long before adolescence. Antisocial behaviors for this type of offender tend to arise out of an interaction between individual traits and early-environmental effects. Moffitt (1993a) identified neuropsychological deficits such as hyperactivity and impulsivity, which are risk factors for young children to later engage in aggression and violence. These traits are associated with constrained cognitive, emotional, and behavioral development (Moffitt, 1993b, 1997; Moffitt, Caspi, Dickson, Silva, & Stanton, 1996), male delinquency (Moffitt, Lynam, & Silva, 1994) and life-course persistent antisocial behavior (Raine, Moffitt, Caspi, Lober, Stouthamer-Loeber, & Lynam, 2005).

Stability. Reminiscent of LH theory, the stability of antagonistic behaviors includes the temporal persistence of a behavior, or style of interacting (Wright, Tibbetts, & Daigle, 2008). Two elements of LH strategy are evident here, beginning with temporal markers. First, human development is necessarily and inextricably linked to the passage of time, punctuated by critical age-related developmental markers such as puberty, age at sexual debut, age of first pregnancy and childbirth (Ellis, 2004). This temporal perspective places individuals along a continuum of developmental advancement; that is, from “slow” to “fast” physical and sexual development as previously described within LH theory (Ellis et al, 2009).

Second, developmental stability makes reference to behavioral persistence. Longitudinal analyses suggest this persistence in antagonistic behaviors holds ontogenetically in both sexes, for people on AL and LCP paths (Odgers, Moffitt, Broadbent, Dickson, Hancox, Harrington, Poulton, Sears, Thompson, & Caspi, 2008). This includes many personality traits common to life course-persistent delinquents that emerge early in life and remain stable over their life history, such as impulsiveness, inattentiveness (Caspi & Silva, 1995), and aggression (Hirschi & Gottfredson, 1994). Moreover, the identification of aggression early in life is a strong predictor of a range of problems in adulthood (Caspi & Bem, 1990; Sampson & Laub, 1993; Moffitt, 1990; Wilson & Herrnstein, 1985). Indeed, early problem behavior identified as early as age 4 predicts measurable individual differences in frequent and serious adult criminal behavior. An initial review of 16 longitudinal studies on aggressive and criminal behavior by Olweus (1979) found a disattenuated correlation of .79 between these behaviors during early childhood and late adolescence. Thus, level of aggression in childhood accounted for nearly 64% of the variance in aggression in late adolescence. These numbers held for teacher ratings and other forms of direct observation. Moreover, antagonistic behaviors typically occur in clusters along their stable trajectories.

Clusters of Socially Antagonistic Strategies

Independent nomothetic literatures in the behavioral sciences point to clusters of correlated antagonistic social behaviors that naturally occur in current industrial society (Figueredo et al., 2006). Generality, or clustering, of antagonistic behaviors extends beyond criminal versatility and preference for risky behaviors and extends well into other domains and consequences of their lives. LH theory accounts for this clustering of antagonistic behaviors because it postulates such clustering as coordinated sets of naturally and sexually selected adaptive LH traits.

The literatures on criminality, delinquency, and drug abuse describe clusters of antagonistic behaviors. People who engage in criminal and delinquent behaviors also tend to abuse legal and illicit substances, experience familial problems such as father absence, underemployment or unemployment, drop out of high school, have social distress, get pregnant or get someone else pregnant as a teen, and experience psychopathologies.

Criminal and delinquent behavior as well as juvenile recidivism (Cottle, Lee, & Heilbrun, 2001), poor parental support and supervision, dropping out of school, and gang involvement (Hunt et al., 2002) tend to co-occur, as do abuse and illicit drugs, risky sexual behavior, impulsivity, low self-esteem, a propensity for general risk-taking (Lejuez, Simmons, Aklin, Daughters, & Dvir, 2004), as well as prior family violence, and violent behaviors (Albus, Weist, & Perez-Smith, 2004). Examination of more specific traits within these literatures demonstrates strong positive relationships among impulsive sensation seeking and alcohol problems, alcohol use, cigarette use, and non-use of condoms (Robbins & Bryan, 2004). There are also strong positive associations among substance use, sexual risk taking, and STDs including HIV (Sharma, Agarwal, & Dubey, 2002), as well as adolescent emotional and behavioral problems, sexual and physical abuse, life stress, impaired family relationships, and school drop-out (Friedrich, Lysne, Sim, & Shamos, 2004; Hubbard & Pratt, 2002). Similarly, delinquency is positively associated with unusually large number of sexual partners and early age of first intercourse (Jessor & Jessor, 1977).

Since Jessor and Jessor's (1977) seminal work in adolescent problem behavior and their subsequent development of Problem Behavior Theory, the field of Developmental Psychology has taken a closer look at the probabilistic occurrence of antagonistic behaviors clustering at the nomothetic and ontogenetic levels. Wachs' characterizes this advance well: "causality is best assigned to a complex of covarying multiple influences" (1996; p.798). Wachs' thinking refreshingly points to consilience.

Problem behavior theory rests on the relations within and between what Jessor and Jessor (1977) describe as the "personality system, the perceived environmental system, and the behavioral system." (p. 19). Interactions among these systems generate a probability of engaging in antagonistic or mutualistic behaviors. Their position is that the personality system is comprised of three components: motivation/instigation, belief, and personal control. Although many elements of these components may be better described by the Big Five (e.g., Costa & McCrae, 1992), some, such as motivation/instigation ("…goals toward which a person strives and with the motivational sources or pressures that instigate particular behaviors" p.19) and personal control (i.e., "control over non-normative behavior" p. 20) overlap quite well with our current representation of self-regulation as an executive function (Lezak, Howieson, & Loring, 2004; see below). Their conceptualization of environment centers on "perceived environment" – one that has meaning for the individual in both distal (e.g., expectations of the individual by parents and friends) and proximal domains (proportion of friends who engage in specific risk behaviors). Finally, their behavior system places the classification of "deviant" behaviors in accordance with idiosyncratic setting (i.e., geographical location), situation (i.e., presence of friends, peers, authority figures), age-graded life-history timing (i.e., truancy and other status offenses) and personal/social perception of specific acts being deviant.

In their longitudinal study spanning 1967 to 1972, Jessor and Jessor (1977) followed middle school and high school students with questionnaires that simultaneously tapped a range of behavioral, personality, and environmental elements. The behavioral items measured self-reported mutualistic behaviors as well as antagonistic behaviors such as excessive drinking, marijuana use, sexual behavior, aggression, theft, and lying. Longitudinal analyses over the four years of data collection revealed a consistent and steady shift in stable developmental change in self-described personality traits, perceived environment, and engagement in antagonistic and mutualistic behaviors for both males and females. Developmental trends in self-stated personality consisted of a decrease in participant's value of academic achievement and decreased intolerance of deviance, with an increased value of independence. Perceived distal environmental shifts consisted of less parental control and greater support from friends, with the proximal social environment shifting to a less disapproving attitude of problem behaviors. Moreover, there was a consistent increase in self-reported marijuana involvement and general deviant behavior, with a sharp self-expressed decrease in church attendance (Jessor & Jessor, 1977).

From an objective biologically-based LH perspective, it is not difficult to imagine ideographic scenarios –particularly those involving fairly normative behaviors such as alcohol use and sexual intercourse, and infrequent respective consequences such as injury or pregnancy - in which behaviors easily slide in and out of the individual's behavioral categories of "problematic" and "conventional". This may be the case particularly when people with genetically driven fast strategies live in environments that are both fast and slow. For example, an adolescent may live with family members and interact with peers who share fast strategies (proximal social environment), yet be in a school system and embedded in a larger social domain that adopts "slow-strategies" and insist upon “mutualistic” behaviors. To the degree that deviant behavior is environmentally caused, it is easy to see how individual differences arise.

In other research, independent factor analyses have demonstrated that externalizing behaviors maintain a distinct factor from internalizing behaviors (Achenbach, 1985; Achenbach, Conners, Quay, Verhulst, & Howell, 1989).

Loeber, Farrington, Stouthamer-Loeber, and Van Kammen (1998) report a strong association among a range of externalizing behaviors such as physical aggression, delinquency, and conduct problems; as well as with internalizing behaviors such as substance abuse.

Loeber and colleagues (1998) propose a deviance hypothesis, in which peers who engage in antagonistic social strategies normalize earlier onset of intercourse specifically because doing so breaks social norms. An extension of this hypothesis posits that many of the negative consequences of early sexual activity stem from the social norm breaking, rather than social perceptions of early sexual behaviors in isolation. Nonetheless, the earlier an individual first engage in coitus, the more likely s/he is to contract STDs, experience early pregnancy (Zabin & Hayward, 1993), have more sexual partners (Durbin et al, 1993), fail to use contraception, and possibly be less responsive to intervention programs (Zabin & Hayward, 1993).

Considerable evidence supports Problem Behavior Theory, particularly regarding externalizing and internalizing behaviors. The data thus far center on white middle-class youth, however, and less is known about other populations. One important implication of the current state of data supporting Problem Behavior Theory is that this research ought to take a multivariate approach, investigating multiple behaviors across categories (e.g., school drop-out, substance use, violent behaviors; Loeber et al., 1998).

Clusters of Antagonistic Behaviors and Adolescent Reproduction. Clustering of antagonistic behaviors is particularly notable as they pertain to sex and reproduction in adolescence. Such clustering may be viewed as LH strategies. Females who become pregnant during adolescence, more than adult females, tend to have had teenage mothers themselves, give birth to more than one child during adolescence, and have children who, in turn, have social problems such as engagement in socially antagonistic behaviors (Zabin & Hayward, 1993). Among older adolescents and younger adults who compete for resources and mates in harsh and unpredictable environments and situations, engaging in criminal and other antagonistic behaviors is strongly related to getting pregnant, or getting someone else pregnant (Bingham & Crockett, 1996; Jessor, Costa, Jessor, & Donavan, 1983). Adolescent fathers, more than non-fathers, are more likely to have had harsh or unpredictable childhoods comprised of low socioeconomic status (SES) and parental antisociality (Fagot, Pears, Capaldi, Cosby, & Leve, 1998) and later involvement in criminal behavior (Stouthamer-Loeber & Wei, 1998).

Childhood aggression in females has been associated with adolescent pregnancy (Serbin, Cooperman, Peters, Lehoux, Stack & Schwartzman, 1998). Antisocial behaviors have been associated with multiple sexual partners in adolescent males (Lalumière & Quinsy (1996), with sexual coercion, aggression, and deception, in particular, being associated with age at first intercourse (Quinsey, Book, & Lalumière, 2001). Adolescent pregnancy literatures describes correlated clusters of antagonistic behaviors that include welfare dependence, intergenerational transmission of poverty (Gueorguieva et al., 2001); males having multiple sex partners, one or more STDs, drug abuse, and unreliable condom use (Guagliardo, Huang, & D'Angelo, 1999). Moreover, being a sexually active teen with multiple sex partners is correlated with sexual intercourse before age 15, non-use of birth control, poor school performance, alcohol and illicit substance use, having friends in gangs, and low SES (Kivisto, 2001).

Further, such pregnancies and births are not necessarily happenstance occurrences that arise within suites of "sensation seeking" behaviors. Indeed, self-report data indicate that teenage parenthood is normative to many adolescents (Loeber et al, 1998). Pregnancy is sometimes an intentional decision made by adolescent females who often live in poor urban communities and recognize the reproductive advantages of reproducing early when their social environments are wrought with poor health outcomes and truncated life-spans (Geronimus, 2003). An estimated 10% of U.S. adolescent births are intentional (Spitz, Velebil, Koonin, Strauss, Goodman, Wingo, Wilson, Morris, James & Marks, 1996) with some speculative U.S. estimates as high as 22% (Coleman & Cater, 2006).

Self-report data suggest that youth tend to assess the costs of later childbearing, and when people in their community have a disproportionate number of life-threatening health problems (e.g., hypertension and diabetes), adolescent girls appear to be aware of the mortality and reproductive risks they, too, may incur (Geronimus, 1996). Further, many girls also report that postponed childbearing carries the risk of the child's father not being alive to help support the child (Geronimus, 1996). Some writers have speculated that reinforcers such as attention from family and peers, access to social support services, and encouragement from prospective fathers may affect many young mothers decisions (Furstenberg, 1992).

Parenting literatures demonstrate comparable clusters. Young fathers as well as fathers who do not support their children or child's mother tend to engage in criminal behavior, substance abuse, drop out of school, and are unemployed and of low SES (Cochran, 1997; Weinman, Smith, & Buzi, 2002). Father absence also tends to co-occur sexual precociousness, early pregnancy and young motherhood, poor parenting, poor academic performance, mood and anxiety disorders, suicide attempts, conduct problems, violent offending, dysfunctional parental relationships and other family life stressors, as well as low SES (Ellis et al., 2003). Similar clusters have been identified and described in the divorce literatures (O'Connor, Thorpe, Dunn, & Golding, 1999; Amato, 1996), as well as literatures of unwed motherhood, welfare dependence, and delinquency (Allen, Philliber, Herrling & Kuperminc, 1997; Voydanoff & Donnelly, 1990; Murphey & Braner, 2000). Delinquency itself appears to also have its own constellation of correlated antagonistic behaviors.

The "d"-Factor

While some researchers describe antagonistic social behaviors as a full range of non-harmful behaviors, others reserved the term *victimful criminality* for more severe acts that include violence and property offenses (L. Ellis, 1988). Rowe and colleagues (Rowe & Flannery, 1994; Rowe, Vazsonyi, & Figueredo, 1997) specifically investigated relations among deceitfulness, rebelliousness, aggression, automobile speeding, lying, theft, trespassing, and vandalism. When Rowe and Flannery (1994) factor analyzed self-report items of their list of behaviors (see above), those behaviors loaded on a single common factor. Factor analyses consistently reveal large general factors in which a substantial range of antagonistic social behaviors converge as a positive manifold of traits.

Rowe and Rodgers (1989) proposed a partially heritable trait disposition toward antagonistic social behaviors in general, which they called "*d*", in parallel to Spearman's "*g*". This "*d*" factor accounts for the genetic covariance between sexual motivation, including adolescent promiscuity and mating effort, and a wide range of delinquent and antisocial behaviors. Moreover, Rowe and Flannery (1994) described a predictive latent variable "delinquency proneness" – comparable to "*d*" – that loaded positively on impulsivity, deceitfulness, rebelliousness, and peer delinquency. L. Ellis (1988) proposed a similar approach in which he employed the r/K concept to describe the emergence of criminal behavior.

Our research group has used LH strategy to explain the occurrence of clustering antagonistic behaviors (Figueredo et al., 2006), with a comparable factor significantly and negatively correlating with the K-Factor (Figueredo et al., 2005, 2006; Tal et al., 2005; Wenner et al., 2005). This single common factor –the AB-Factor- (i.e., *antagonistic attitudes* and *behaviors*) emerges from measures of risk-taking behaviors (e.g., sexual, alcohol, drug, gambling, and automobile behaviors), low-level delinquent behaviors (e.g., fighting, weapon carrying, arson, theft, and truancy), and impulsive behaviors.

Genetic Influences on Socially Antagonistic Strategies. Genetic effects on behavior are caused by a number of factors that point to the ontogenetic *and* phylogenetic effects of our EEA, as described within LH theory. Reiss, Neiderhiser, Hetherington, and Plomin (2000) described three potential sources of gene expression. First, ontogenetically, intrapersonal responses to the environment can influence gene expression. For example, fatigue and stress can cause genes to be "turned on" or "turned off" throughout one's life history. This effect can be influenced by the individual's behavior and environmental stimulation. Second, environments conducive to the expression of specific traits influence gene expression. As the environment shifts, so does the expression of genes. Finally, the slow accumulation of deficits (genetic errors) over phylogenetic time influence gene expression. These small effects build slowly over generations and become obvious only later in life, when the full force of their influence on individual differences can be measured reliably.

Ideographically, genetic influence on behavioral traits often plays a powerful role in influencing behaviors such as aggression and sociability. Nomothetic research, such as that by Reiss et al. (2000, p. 222) found that "genetic factors accounted for 69 percent of the stability of antisocial behavior across the 3 years of adolescent development", pointing to the heritability of stable long-term aggressive behaviors.

Behavioral genetic research is conducted nomothetically either via quantitative family study designs or molecular genetic designs (Rowe, 1994). Family study designs use "natural experiments" that capitalize on variable genetic relatedness and rearing environments of existing families by way of twin and adoption studies designed to estimate the differential genetic and environmental contributions to population-level phenotypic variance. Measured phenotype is the total score of shared environmental influence (e.g., family experiences common to siblings), unshared environmental influence (i.e., differences between family members such as variation in education due to age or mobility), genetic influence (i.e., inherited genetic effects), plus measurement error (Rowe, 1994). Heritability (h^2) is the proportion of phenotypic variance that can be attributed to genotypic variance within a population; it is a quantitative and nomothetic estimate of the extent of genetic influence on behavior (Reiss et al., 2000; Rowe, 1994).

Our research group recently capitalized on available twin data from the MIDUS dataset (Figueredo et al., 2007) and found that our K-Factor accounted for 72% of the reliable variance in the twin data. Moreover, virtually all of the reliable variance within the Covitality Factor and Personality Factor was accounted for. Moreover, we found bivariate correlations among the K-Factor, the Covitality Factor, and the Personality Factor. Comparing data from over 300 DZ twins and over 300 MZ twins, we found that our three genetic-based factors accounted for very large portions of variance within each of their respective component scales. The Genetic K-Factor accounted for 61%; Genetic Covitality Factor accounted for 85%; and the Genetic Personality Factor accounted for 55%. Estimated heritabilities for each of these three factors were also substantial; Genetic K-Factor was .65, Genetic Covitality Factor was .52, and Genetic Personality Factor was .59. The genetic common factor loadings were substantially greater than the phenotypic factor loadings, while the heritability estimates for the genetic common factors were also substantially greater than the individual scales. In concert, these results suggest that the same pleiotropic genes (i.e., genes that have many affects) and perhaps regulatory genes (switches) may be substantially contributing to, coordinating, and controlling these measured LH traits. Consistent with LH theory, though, though heritability estimates reported above provide room for environmental influence, perhaps with conditional gene expression as determined by degree of harshness and unpredictability in childhood development.

In these analyses, the K-Factor consisted of MIDUS items that corresponded to theoretically driven dimensions of LH theory and were acceptably internally consistent; these items measured mother, father, marital, child and close-relationship quality, family and friend support, altruism towards kin and non-kin, communitarian beliefs, religiosity, financial status, health control, agency, advice seeking, foresight/anticipation, insight into past, primary control/persistence, flexible/positive reappraisal, and self-directedness/planning. We constructed the Covitality Factor (Weis, King, & Enns, 2002; comparable to the idea of "comorbidity' in psychopathology literatures) from scales that measure subjective well-being, negative affect, positive affect, general health, and medically relevant physical symptoms. Miller's (2000) Fitness Indicator Theory predicts that such a suite of coordinated positive attributes serve as honest signals of psychological and physical health in mating competition. We constructed the Personality Factor from Costa and McCrae's (1992) Five-Factor Model (i.e., the "Big Five") of personality that consists of openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. Factor analyses of each of these three domains revealed single common factors for each independent domain, as well as a single higher order factor (i.e., the "Super-K" factor) that consisted of all three domains and revealed virtually 100% of the reliable variance among them. This finding, too, supports the hypothesis that a fast LH strategy uses a coordinated suite of sexually selected personality and behavioral traits in the service of trade-offs that favor high somatic effort and parental and nepotistic effort.

In a review of behavioral genetic (BG) studies, Plomin (1990) found that a wide range of behavioral problems, personality disorders, and mood disorders are heritable and related to antagonistic social behaviors. Further, from a national sample of 720 same-sex adolescent siblings, O'Connor, McGuire, Reiss, Hetherington, & Plomin (1998) determined that just under half of the variability in depressive symptoms and antisocial behavior is heritable. Further, IQ, creativity, school achievement, and learning disabilities are also at least partially heritable (Plomin, 1990) as are personality characteristics (Plomin, Reiss, Hetherington, & Howe, 1994) and temperamental factors (Rowe, 1986). For example, hyperactivity, conduct disorder, and ADHD are highly heritable (Silberg, Rutter, Meyer, Maes, Hewitt, Simonoff, Pickles, Loeber & Eaves, 1996). A number of behavioral genetic studies have shown that ADHD is highly heritable, suggesting that the occurrence of this disorder has little environmental influence (Barkley, 1998; Levy, Hay, McStephen, Wood, & Waldman, 1997). Further, Reiss et al. (2000) found that the stability of antagonistic social behavior has a strong genetic influence.

Life History strategies appear to develop conditionally upon variations in environmental contingencies. Nonetheless, it is well-accepted that individual differences in trait dispositions such as general personality (e.g., the Big Five) and antagonistic behaviors are largely genetically inherited, as indicated in countless behavioral genetic studies (Mason & Frick, 1994). For example, abuse in childhood might signal quality of current and future environments (i.e., harsh and unpredictable) which may activate an adjustment in (neurological) development. Consider that molecular genetics points to a genetic polymorphism on the X chromosome that is associated with the monoamine oxidase A, an enzyme that moderates the relations between childhood abuse and aggressive behaviors in adulthood. People abused in childhood with a low expression of the gene are much more aggressive in adulthood than people with a high expression of the gene (Caspi et al., 2002).

Environmental Influences on Socially Antagonistic Strategies. Before proceeding, the following definitions for ecology, environment, local environment, context, and situation are in order. *Ecology*: Full range of possible environments in which a species may survive and reproduce; across evolutionary history (phylogenetically, for the past 200,000 years that people have been "human;" as well as ontogenetically) and space (geographical and social range); think of it from a gene's eye view (i.e., converging lineages). *Environment*: Phylogenetic and ontogenetic geographic and social stimuli and contingencies with which one's converging lineages have had direct interaction. *Local Environment*: Within the environment, immediate (i.e., "the here and now") physical and social stimuli and contingencies. *Context*: The geographic (e.g., physical structures, food, other-species predators) components of the environment and local environment. *Situation*: The within-species (i.e., other people) and between-species (e.g., prey-predator, predator-prey, parasites) components of the environment and local environment

(W. J. Jacobs, personal communication, ~February, 2010; see also Figueredo, Wolf, Gladden, Olderbak, Andrzejczak, & Jacobs, 2010).

One's interaction with the local environment influences the manifestation of antagonistic social behaviors. Behavior varies across person-environment domains in at least three ways. First, person-environment interactions are often *evoked*, for example, by one's personality. Obtuse or demanding infants may elicit anxiety and pressure from parents, which then influences parenting style, which, in its turn produces less support and time caring for the child (Chess & Thomas, 1977).

Second, person-environment interactions are *proactive*. For example, people often "niche-pick" by self-selecting their social niches (Gottfredson & Hirschi, 1990), particularly peer groups (Caspi & Moffitt, 1995), and assortatively mate (i.e., select mates with traits similar to one's self; Rutter & Quinton, 1984). Given the appropriate choices, individuals engineer their own social environment.

Finally, person-environment interactions are *reactive*. There are individual differences in the ways in which individual process social information. People do not interpret events, experiences, and environments in the same way. For example, aggressive people, more than non aggressive people, view aggression and violence as a preferred and effective means to resolve social problems (Boldizar, Perry, & Perry, 1989).

Socially Antagonistic Strategies and Frontal Lobe Function. The frontal lobe is the largest and most distinguishing feature of the human brain as well as the last area of the brain to develop phylogenetically and ontogenetically. It makes up more than 30% of the human brain (Walsh, 2002) and is functionally implicated most in the occurrence of antagonistic social behaviors (Kolb & Whishaw, 2003).

Some theories of criminality (e.g., Buss & Plomin, 1984, Gottfredson & Hirschi, 1990; Wilson & Herrnstein, 1985) emphasize the inability of individuals to engage in efforts to improve their well-being, particularly if the attempts involve long-term exertion and go beyond a “here-and-now” orientation. These authors and others report evidence that cognitive difficulties in assessing potential consequences of behavior, as well as acting on those assessments characterize antisocial behavior (Fishbein, 2001; Newman, Kosson, & Patterson, 1992). These traits are consistent with frontal lobe dysfunction, which cause problem solving difficulties, difficulty focusing on tasks (*attending*), and difficulty planning a sequence of complex actions needed to complete an action (*sequencing*). In addition, these individuals tend to be stubborn and inflexible toward their environment, regardless of the characteristics of the surroundings (Buss & Plomin, 1984; Moffitt, 1993b).

In a quasi-meta analysis Pallone and Hennessy (1998) complied data on more than 2,100 criminal offenders and found that individuals who had committed the most serious and chronic patterns of violent offenses were those who had the greatest degree of anatomic frontal lobe problems (based on EEG, imaging, and neuropsychological test data). Indeed, as Phineas Gage demonstrated well (Harlow, 1848), individuals who have frontal lobe injury frequently experience a change in their personalities, often becoming short-tempered and aggressive (Blumer & Benson, 1975; Volavka, 1999).

General Cognitive Ability, Life History, and Antagonistic Behaviors. Recent literature on the K-Factor, as measured with the ALHB, suggests that slow LH is strongly associated with behavioral preferences (i.e., strategies) but not general cognitive ability. For example, work within our group (Sefcek, Miller & Figueredo, 2005; Sefcek & Figueredo, 2010) found that the K-Factor is not correlated with general cognitive ability, even when cognitive ability is measured with individual tests or in collapsed latent variables of multiple measures (i.e., the APM-18, the Shipley Vocabulary and Abstractions Tests, the Mill-Hill Sets A & B, and Scholastic Aptitude Tests).

There is a long history and general consensus among intelligence researchers that people have a *general cognitive ability* that consists of a wide range of psychosocial and neurological processing abilities. Spearman (1904) explicated and described this factor analytically (i.e., *Spearman's g*).

As predicted by LH theory, intelligence is negatively correlated with morbidity, positively correlated with extended mortality (Gottfredson & Dreary, 2004) and negatively correlated with criminally antagonistic behaviors (Herrnstein & Murray, 1994; Hirschi & Hindelang, 1977; Wilson & Herrnstein, 1985). This latter correlation appears as early as age 8 or 9 (Gibson & West, 1970), holds for juvenile offenders (Wolfgang, Figlio, & Selin, 1972; Yeudall, Fromm-Auch, & Davies, 1982), lifetime criminals (Wolfgang et al, 1972; Moffitt, 1990), and perpetrators of serious crimes (Lynam, Moffitt, & Stouthamer-Loeber, 1993).

Substance Use Disorders as an Illustration of a Socially Antagonistic Life History Strategy

The convergence of antagonistic behaviors and LH traits holds theoretical and practical significance within the behavioral sciences. Multiple literatures on substance use, as a common element of clustering antagonistic behaviors, illustrate this well.

Susceptibility to substance use disorders (SUDs) describes a multifactorial trait that involves genetic components, environmental components, and interactions between the two (Vanyukov, Tarter, Kirisci, Kirillova, Maher, & Clark, 2003). Here, susceptibility to SUDs serves as a general trait, one that encompasses the majority of substances, illicit or otherwise, including tobacco and alcohol. Although SUDs are vastly heterogeneous in terms of symptomatology, description, and the substances, there is mounting evidence for a common SUD susceptibility (Vanyukov et al., 2003), perhaps because the brain evolved to respond to other "natural" rewards, such as food (Wise, 2008) and sex (Ellis, Das & Buker, 2008; Pfaus, 2009). The same chromosomal loci link appears to be involved in SUDs of a wide variety of substances (Bierut, Rice, Goate, Foroud, Edenberg, Crowe, Hesselbrock, Li, Nurnberger, Porjesz, Schuckit, Begleiter & Reich, 2000). Also, the reward systems for different drugs share the same brain structures, including the mesocorticolimbic dopamine (DA) systems, involving DA neurons on the ventral tegmental area (VTA) with DA neuronal projections into the nucleus accumbens (NAc), amygdala, and prefrontal cortex (PFC; Wise, 1985, 2008; Kelly & Berridge, 2002). Although specific drugs enter the mesocorticolimbic system at different points, they share substantial structures including portions of the ventral tegmental area (Koob & Le Moal, 2001).

Nonetheless, a number of individual and environmental risk factors associate with initial substance use and SUDs (Tarter & Vanyukov, 1994; Vanyukov & Tarter, 2000). Some of these risk factors are demographic features such as age and sex; males and people in their late teens and early twenties tend to use various substances and have SUDs more than females and people at other ages. Another substantial risk factor is heritability; behavior genetic data indicate a strong heritable component to SUD susceptibility. Environmental factors such as relationship parameters with peers and family add risk over and above these largely heritable traits.

Susceptibility to SUD. Susceptibility to SUD is a complex phenotypic trait that involves maladaptive patterns of substance use, leading to clinically significant impairment or distress, (American Psychiatric Association, 2000). The Diagnostic and Statistical Manual of the American Psychiatric Association (2000) outlines the diagnosis criteria of substance dependence as the presence of at least three out of nine symptoms that involve compulsive drug seeking and use. As such, 466 unique symptoms combinations may meet substance dependence criteria, not including the possibility of poly-substance use. Among drug users, polydrug use is far more common than single drug use and people with SUDs generally use two or more substances opportunistically and often together (Darke & Hall, 1995). Describing this population, then, as people with a SUD that involves a single substance does not adequately represent their behavior.

Family Variables and Behavior Genetics. Merikangas and colleagues (Merikangas, Stolar, Stevens, Goulet, Preisig, Fenton, Zhang, O'Malley & Rounsaville,1998) found (via self- and/or family report) that people with a first degree relative carrying a SUD diagnosis are eight times more likely to receive a diagnosis of SUD than if they do not have first degree relatives with SUD. Mounting evidence from twin and adoption studies suggest genetic factors play a significant role in risk of SUD. SUD appears polygenic (i.e., multifactorial). Hence, this, and related, disorders vary in the population due to individual genetic differences, environmental factors, and probably interactions between gene clusters and environmental experience. Outcomes of behavior genetic studies indicate that variation in individual genotypes as well as by differences in environmental conditions predicts phenotypic variation in the susceptibility to SUD (Vanyukov & Tarter, 2000). The degree of genotypic differences in the phenotypic variation (i.e., *heritability*), depends on both the existence of trait-relevant genetic polymorphisms and the role of the environment in susceptibility variation.

Heritability. Some studies have reported heritability for SUD as high as 0.8 both in males and females (Kendler & Prescott, 1998a; Kendler, Jacobson, Prescott & Neale, 2003). An adoption study using female adoptees as participants showed a pattern of relationships between biological family background and SUD outcome similar to that in males (Cadoret, Troughton, O'Gorman & Heywood, 1986; Cadoret, Yates, Troughton, Woodworth & Stewart, 1996). Most studies have, however, shown moderate sex differences in the heritability of SUD. For example, twin studies of alcoholism show heritability estimates of .70 in males (McGue, Pickens & Svikis, 1992) and .60 in females (Kendler, Heath, Neale, Kessler & Eaves, 1992).

Other twin studies of SUD indicate lower heritability for males than females. Tsuang, Lyons, Eisen, Goldberg , True, Lin, Meyer, Toomey, Faraone & Eaves, 1996) reported male heritability estimates for cocaine, opiates, and marijuana of .44, .54, and .33, respectively. Kendler & Prescott reported heritability estimates of .79 for both cocaine abuse (1998a) and marijuana-specific SUDs (1998b) in females. The divergent heritability estimates for nicotine are comparable, with males at .53 (Carmeli, Swan, Robinette, & Fabsitz, 1990) and females at .72 (Kendler et al., 1999). Silberg, Rutter, D'Onofrio, and Eaves (2003) found similar results for adolescent substance use (SUDs were not assessed), with environmental factors such as infrequent, inconsistent or harsh family involvement and dysfunction and delinquent and drug-using peers having a stronger mediating effect for males than females. Again, estimates of genetic contributions to substance use explained more of the variance in females than males.

Genetic Susceptibility to Multiple Substances. Considerable evidence indicates a strong genetic association of use across substances; high heritabilities for abuse of a given drug tend to be highly correlated with high heritabilities of other drugs. There are significant genetic correlations between susceptibility to alcohol and drug use disorders (Tsuang, Lyons, Meyer, Doyle, Eisen, Goldberg, True, Lin, Toomey & Eaves, 1998; Newlin, Miles, van den Bree, Gupman & Pickens, 2000), illicit substance use and cigarette smoking (Swan, Carmeli & Cardon, 1996), as well as nicotine and alcohol dependence (True, Xian, Madden, Bucholz, Heath, Eisen, Lyons, Goldberg & Tsuang, 1999). Moreover, susceptibility for different categories of drugs (e.g., marijuana, stimulants, sedatives, opiates, psychedelics) share as much as 50–85% of their variance in males (Tsuang et. al., 1998).

Antagonistic Behavior and Crime. In human males, some childhood disorders, such as conduct disorder (CD) or, in adulthood, antisocial personality disorder (ASPD), appear to predict criminal behavior and SUD (Moffitt, Caspi, Dickson, Silva, & Stanton, 1996). The temporal parameters, at least, are right for this interpretation; those first displaying antisocial problems in childhood rather than late adolescence demonstrate increased rates of SUD and other delinquent and criminal behaviors at age 26 (Moffitt, Caspi, Harrington, & Milne, 2002). Longitudinal data reported by Capaldi and Stoolmiller (1999) from the Oregon Youth Study support this hypothesis. They followed youth from age 10 to 18-20 that lived in a high crime area and found that early CD strongly predicts young adult substance use even more than early adolescent substance use.

Hence, these early onset behavior disorders are predictors of SUD. Moreover, the covariation between hyperactivity and oppositional/conduct problems in both younger and older boys and girls is almost entirely heritable (Silberg, et al., 1996), suggesting substantial commonality between the genes that contribute to variation in childhood disruptive behavior and liability to SUD. The relationship between parental SUD and an offspring's risk for early onset substance use problems and SUD is in part mediated by sensation/novelty seeking (Kirillova, Vanyukov, Gavaler, Pajer & Tarter, 2001), a factor well known as a risk factor predicting SUD (Masse & Tremblay, 1997).

Moreover, phenotypic variation in ASPD has a considerable genetic component (Bohman, Bock & Goode, 1996). In the same vein, children of antisocial biological parents, even those adopted out, have an increased frequency of ASPD as adults (Cadoret, 1978). In a twin adoption study Cadoret (1992) reported that in males, ASPD explained much of the variance of transitioning from drug use to SUDs. Also, men with ASPD are five times as likely to abuse drugs as those without this disorder, whereas the risk of drug abuse for women is about 12 times higher in the presence of ASPD than in its absence (Robins & Price, 1991).

Substance use and abuse may well be an adaptation to environmental situations, such as common association with delinquent youth and gang membership, in which substance use is normative. Supporting this hypothesis, prior conduct disorder predicts gang entry (Lahey, Gordon, Loeber, Stouthamer-Loeber & Farrington, 1999). Such environmental conditions promote and are normative for elevated thrill and novelty seeking, as well as high aggression, disinhibition and general antisociality. Inasmuch as these traits are risk factors for substance abuse, antagonistic behaviors may translate into an adaptive *advantages* for individuals having high liability to SUD and thus, paradoxically, into higher Darwinian fitness — fitness in deviant/antagonistic social groups. Such in-group association allows the individual to benefit from in-group protection, thereby increasing reproductive fitness. When in an unstable and dangerous environment, in which one perceives high mortality rates (e.g., family and/or community), it behooves an individual to use the most proximate adaptive strategies available that (generally without awareness) focus on immediate reproductive behaviors. Associating with delinquent peers and engaging in illicit drug use may function as a tactic that helps accomplish these goals.

Simultaneously, potentially socially disabling (e.g., resulting in imprisonment) criminal behaviors and personality characteristics are consistent with Zahavi's handicap principle (Zahavi, 1975). The handicap principle posits that people, typically males, increase potential reproductive benefit by adopting a phenotypic feature that appears to, and may actually, decrease survival and fitness probability. If an individual has or adopts traits such as high risk-taking behaviors (including SUDs) and continues to survive and flourish, this 'handicap' serves as a fitness indicator –signaling a substantial degree of phenotypic robustness. Under these conditions, some people, generally young males, may use substance use as a mechanism to attract mates by conveying a high level of fitness. In such cases, labeling the behavior as a Substance Abuse *Disorder* may not be entirely fitting.

Brain Function

Neuropsychology

Within the cortex, the frontal lobes serve to solve both proximate and ultimate problems. Within the midbrain the hippocampus and amygdala are the primary contributors to the interface between the environment the individual and responding to immediate environmental stimuli and allowing for proximate problem solving (Kolb & Whishaw, 2003).

Frontal Cortex. The functions of the frontal cortex, sometimes specified as prefrontal functioning, are implicated in both short- and long-term adaptive problem solving. These cortices are centrally responsible impulse control, delay of gratification, and organizing behaviors across time and space (Davison, Neale, & Kring, 2004) – abilities commonly referred to as the executive functions (Lezak et al, 2004).

Self-regulation as an Executive Function. Executive functions allow for apparent behavioral volition, planning, purposive action, self-regulation, and effective performance (Lezak et al, 2004). In short, executive functions are those that enable us to consider, start, regulate, and successfully complete large integrated sets of behaviors, or behavioral chains, which evolved to solve adaptive problems (Barkley, 2001) and are highly heritable (Friedman, Miyake, Young, DeFries, Corley, & Hewitt, 2008).

Recently, Miyake and colleagues (Miyake, Friedman, Emerson, Witzski, Howerter, & Wager, 2000) identified three distinguishable classes of executive function specific to self-regulation: shifting, updating, and inhibition. *Shifting* involves alternating behaviors between multiple tasks, operations, or mental sets. *Updating* requires one to actively monitor, manipulate and update relevant information with newer, more relevant information in working memory, such as when planning. *Inhibition* involves intentional and controlled inhibition of dominant, automatic, or prepotent responses necessary for successfully completing a given task (Miyake, et al., 2000).

While descriptions of these three components of self-regulation are clear, distinctions in the literature between self-regulation and other similar functions are less clear. Self-regulation has been described as the ability to efficiently, flexibly, and productively engage in specific tasks (Lezak, Howieson & Loring, 2004), such as those put forth within the neuropsychological testing literatures described later in this document. Clearly, solving real-life adaptive problems (e.g., those that require control risk-taking, aggressive, and sexual behaviors) also require self-regulatory abilities (Figueredo & Jacobs, 2010), however, distinctions between behavioral self-regulation (described above) and other related constructs such as emotional self-regulation, self-control, behavioral inhibition (Beaver, Wright & Delisi, 2007; Reisberg, 2002), and impulse control (Milner & Petredes, 1984) are vague at best.

Nonetheless, these higher-level "controlling" functions operate *top-down* to modulate lower-level automatic processes, particularly impulsivity. While impulsive behaviors are sometimes adaptive (e.g., avoiding a sudden violent conflict) ability to self-regulate impulses allows us to respond flexibly and adaptively to novel situations and environments, such as those that present trade-off decisions (e.g., by using alternative behavioral strategies; Barkley, 2001; Figueredo & Jacobs, 2010).

Self-regulation is a central concept within our conceptualization of the K-Factor as a paramount function that distinguishes fast and slow strategists. Because self-regulation is essential for decisions based on weighted risk/reward trade offs, much antagonistic adolescent behavior is likely anchored by an immature frontal cortex substrate (Blakemore & Choudhury, 2006; Spear, 2000). Such immature behaviors appear to map on well to impulse control problems (Geidd, 2004).

Research on impulse control converges on a set of primary features: engaging in behavior too quickly, too little deliberation before action, and failure to consider the consequences of the action (Patton, Stanford, & Barratt, 1995). Doing so, in essence, suggests great difficulty in conducting “functional analyses” with identification of antecedents, target behaviors, and consequences (Baum, 2004). Moreover these are behaviors that reflect failed inhibitory control to adaptively navigate given situations and contexts, and maladaptive decision making, sensation seeking, and risk-taking (i.e., “as potentially producing harm to self in certain environments”; Figueredo & Jacobs, 2010, pg. 1). Impulsivity and associated behaviors are seen substantially more frequently during adolescence than during adulthood, and appear to be a by-product of the anatomical and physiological developmental level achieved during these years of critical brain growth (Patton, Stanford, & Barratt, 1995).

Criminal offenders who are prone to re-offending, for example, have been shown to display a cluster of behaviors that reflect difficulty with impulse control that include poor inhibitory control, difficulty maintaining a given task, boredom proneness, and sensation seeking (Craig, Browne, Beech, & Stringer, 2004). Blair and Frith (2000) found that criminal offenders are highly prone to deficits in prefrontal and orbito-frontal cortex-based executive functioning as well as limbic system-based emotional processing. Moreover, non-human animal models have shown experimentally that surgically induced damage to the frontal cortex and hippocampus have resulted in emotional and behavioral effects common in people with poor executive functions (Metcalfe & Jacobs, 1998; Metcalfe & Mischel, 1999; Metcalfe & Jacobs, 2000).

Although we do not conceptualize fast strategists as "disordered," many current descriptions of psychological disorders include poor self-regulation as a prominent feature (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001), particularly for children and adolescents with attention-deficit disorders, oppositional defiant disorder, and conduct disorder (American Psychiatric Association, 2000).

Hippocampus. The hippocampi, in coordination with the basal ganglia, are also responsible for another form of discriminated behavioral strategies. The hippocampus specializes in the specific domain of cognitive mapping – that is, spatiotemporal mapping of landscapes, structures, social relationships, and episodic memories of events relevant to the organism (O'Keefe & Nadel, 1978). This "contextual mapping" allows us to differentiate complex sets of discriminative stimuli – that is, adaptive problems – on the basis of *relations among* specific stimuli (Duvernoy, Cattin, Naidich, Raybaud, Risold, Salvolini, et al., 2005). Recognition of, and distinguishing between, settings as a means for selecting appropriate behavioral strategies is a critical skill to posses – that is, if one is inclined to remain alive and engage in social relationships.

Amygdala. The amygdala also plays a role in establishing and maintaining social relations. The functions of the amygdala are, however, more specific to emotion-laden discriminative stimuli, often stimuli that signal adaptive problems. These often involve "mind-reading" other people by virtue of cues such as their affective, postural, and facial movements. This biologically based ability is particularly important in socially sexual, threatening, and even benign interactions (LeDoux, 1998, 2000).

The Adolescent Brain

Evolutionary developmental psychologists have amassed considerable data indicating that an extended juvenile period in humans developed phylogenetically as an avenue for substantial brain development. Functional explanations for this extended juvenile period during which our brains undergo massive change are found within evolutionary developmental psychology. Phylogenetic neoteny, that is, the slowed growth and delayed maturation relative to prior generations which leads to persistence of juvenile characteristics into adulthood (Brune, 2000), may be the result of selective pressures over the EEA. Neurologically plastic and large brains may have allowing us to solve novel adaptive problems (Figueredo, Hammond, & McKiernan, 2005; Geary, 2004) nested within complex situations (Bjorklund, & Rosenberg, 2005; Geary, 2004) and complex burgeoning societies (Dunbar, 1998; Geary, 2004).

The transition from childhood to adulthood involves intensive and immense neural change particularly in the frontal cortex, as well as other areas such as the hippocampus (Giedd, Blumenthal, Jeffries, Castellanos, Zijdenbos, Paus, Evans, & Rapoport, 1999; Sisk & Foster, 2004; Spear 2000). For example, the frontal cortex of the adolescent primate brain loses, by some estimates, as many as 30,000 synapses per second; this loss may be partially accountable for a sustained decrease in the human frontal cortex volume during adolescence (Rakic, Bourgeois, & Goldman-Rakic, 1994). Further, neural processing speed does not peak until the early to late 20s, when myelination is complete (Blakemore & Choudhury, 2006), which, in the frontal cortex, occurs late in adolescence and well into adulthood. Indeed, the frontal cortex is the last area of the brain to complete myelination (Spear, 2000).

These data suggest that complete development of the frontal cortex, with it’s associated executive functions, may occur later in life than the traditionally endorsed “teen” years suggest. Individual differences in onset and duration of adolescent brain development may be quite pronounced. Although this range has traditionally been thought to span the ages of 12 to 18, neuropsychological data have led some researchers to suggest the upper bounds more closely approximate the early to late 20s (Baumrind, 1987; Jacobs & Nadel, 1999; Peterson, Silbereisen, & Sorenson, 1996).

Individual differences in neurological development have been described in the biological literature as heterochrony, that is, the varying rates of ontogenetic development (McKinney &McNamara, 1991). Heterochrony has been used to describe the adaptive nature of neotenous features (Brune, 2000) and other important features of interindividual variability in adolescent brain development (Rice, 1997).

Indeed, Geidd et al., (1999) provide magnetic resonance imaging (MRI) data indicating tremendous individual differences in the age at which the brain reaches full development, sometimes occurring in the mid-20’s. Longitudinally obtained MRI images suggest the brain continues to grow significantly until at least age 25. Although the brain is genetically set to have a specific phenotype, there are vast individual differences with subtle changes occurring in the gray matter structure based on environmental differences and experience. The last part of the adolescent brain to develop is the dorsolateral prefrontal cortex (DLPC) and the superior temporal gyrus. The DLPC, according to Geidd (2004), is “linked to the ability to inhibit impulses, weigh consequences of decisions, prioritize, and strategize” (p.83).

One implication from these studies is that morphological and structural brain changes during adolescence should correlate with observable changes in behaviors. Raine and his colleagues (Raine, Meloy, Bihrle, Stoddard, LaCasse & Buchsbaum, 1998) described behaviorally indicated structural differences in the prefrontal cortex, as measured by MRI such as significantly less (11%) gray matter in the prefrontal area of antisocial individuals than controls, but no differences in the white matter (Raine, Lencz, Bihrle, LaCasse, & Colletti, 2000).

Beyond the structural aspects, there are also significant differences in the way in which the prefrontal cortex of socially deviant people functions. Volkow and Tancredi (1987), using positron emission tomography (PET), showed that, in violent individuals, glucose utilization and blood flow measurements in the prefrontal cortex were decreased relative to controls and that these abnormalities tended to be in the left portion of the cortex. Furthermore, several studies by Raine and colleagues (Raine, et al., 1998; Raine, Phil, Stoddard, Bihrle, & Buchsbaum, 1998) demonstrate lower mean glucose metabolism in the prefrontal cortex of murderers relative to controls. Further, in a twin study that used three-dimensional MRI images, Thompsen et al. (2001) found that the distribution of grey matter across the frontal cortex is substantially heritable. While there is a substantial heritable component to overall brain volume (Tramo, Loftus, Stukel, Green, Weaver, & Gazzaniga, 1998; Thompson, Cannon Narr, van Erp, Poutanen, & Huttunen, 2001) concluded that his results revealed “a strong relationship between genes, brain structure, and behavior, suggesting that highly heritable aspects of brain structure may be fundamental in determining individual differences in cognition” (p.1).

Adolescent Decision-Making. Despite incomplete brain development during adolescence, most adolescents have decision-making abilities comparable to that of adults. Immediate contextual and situational variables, however, appear to impact efficiency and precision of decision-making (Steinberg, 2004). According to Steinberg (2004), adolescents aged 15 and older report *comprehension* of behavioral risks comparable to that of adults. Also, although they can estimate risk accurately, adolescents simultaneously overestimate reward (Reyna, 2004) and disregard costs (Steinberg, 2004). However, differences between adolescents and adults appear in instrumental *behavior* specific to impulse inhibition, particularly in the presence of peers. For example, in a driving simulator study, Gardner and Steinberg (2005) found that adolescents and adults performed about equally well. When friends of the participant watched or interacted with the participant during the simulated driving, however, risky driving increased substantially among the adolescents, but not the adults.

Consilience

An ultimate view of development sees natural and sexual selective pressures craft genes over phylogenetic time. Genes' function is to grow, maintain and control bodies and brains that maximize fitness via genetic lineages. A proximate view of development sees an individual body and brain grow and change in concert with its external environment (e.g., food, family, peers) and internal environment (e.g., gonadal hormones). Brain structures that control bodies that solve adaptive problems via LH strategies have varying levels of reproductive and inclusive fitness that, if successful, continue the cycle. This sketch is designed to address Tinbergen's (1963) four questions of evolution, survival value, mechanistic causation, and ontogeny to present a comprehensive causal understanding of LH process.

A phylogenetically driven genetic basis for human LH traits and associated markers such as skeletal growth, puberty and menarche is well established (see Bogin, 1999; Towne, Blangero, Parks, Brown, Roche, Siervogel, 2002). The genetics for the timing of other markers such as weaning and age at first reproduction, is not yet well established in humans but likely exists because there is a genetic basis for these types of traits in other species (Stearns, 1992). Genes lay the foundation for other LH traits as well, such as executive functions (Friedman et al., 2008; see also review by Barkley, 2001). Genes influence these behaviors by way of structure and structural changes in the form of brain development and resulting function.

The study of brain development and function ought to view this organ as plastic and incessantly changing as it grows in line with both its genetic structure and responses to environmental contingencies (Kolb & Whishaw, 2003). Such growth manifests as successful or failed solutions to adaptive problems we encounter throughout our life histories. As such, the brain develops and maintains schemas about the self and the world and behavioral traits that are unique to the individual's interwoven genetic design and life experience. Such development results in idiosyncratic patterns of clustered cognitive, affective, and behavioral characteristics. Self-regulation (i.e., impulsivity and impulse control) as a central feature of a coordinated suite of proximate brain mechanism serves as a driving function for solving ultimate adaptive problems.

In line with LH theory, we expect to see heterochrony at work, with individual differences in rate of brain development. We expect to see development of the frontal cortex and hippocampus beginning at an earlier age, proceeding faster, and completing development at an older age in slow strategists than in fast strategists (i.e., *peramorphic* heterochrony). Thus, the process is far more extended in faster strategists. In turn, we expect to see an inverse pattern of development in the amygdala. Although the Amygdala is well-developed at birth, developmental completion and final HPA circuitry integration will occur at an older age, proceeding slower, and completing formation at a younger age for slow strategists than fast strategists (i.e., *paedomorphic* heterochrony; MacNamara, 1997).

Fast LH strategies allow for maximum use of time and bioenergetic resources for reproduction. These trait clusters include early sexual maturity, relatively indiscriminate mating choices, multiple offspring, and low parental investment. On the other hand, slow strategists typically have reproductive traits that include later sexual maturity, relatively discriminate mating choices, few offspring, and high parental investment.

At the behavioral level and within this culture, we expect fast strategists to have higher rates of antagonistic social behaviors because (1) of their over-all slower or limited brain development, (2) such behaviors are adaptive in some life stages (i.e., adolescence) and in some environmental niches (e.g., unpredictable environments), (3) these adaptations increase reproductive and inclusive fitness by serving as “handicaps” for attracting mates, and are used in LH trade-offs specific to mating effort, mate competition, and are used as alternative strategies for provision for mates and offspring. Such antagonistic behaviors may be identified in late adolescence/early adulthood (i.e., ages 18-24) as temporally truncated and (1) relatively normative age-based behaviors, (2) adolescent-limited “criminological” behaviors, (3) or as temporally expanded life-course persistent “criminological” strategies.

Proximately, whether antagonistic or not, ideographic behavioral strategies form our ontogenic life histories (Draper & Harpending, 1982) which influence our reproductive and inclusive fitness (i.e., by increasing the probability of pushing our genes into future generations via offspring and other genetically related kin such as siblings, nieces, and nephews; Stearns, 1992; see also Dawkins, 1976), our reproductive success (i.e., quantity and quality of gene-level offspring; Stearns, 1992), and hence have an ultimate genetic influence on our descendants’ phylogenetic life history (Belsky et al, 1991; Ellis, 2004; Figueredo et al., 2006; Rowe, 2000). In an unbroken generational cause and effect chain, our ancestors and our own experiences influence our life history;

in turn, our life history has a direct influence on our descendants (see also Ellis, Figueredo, Brumbach & Schlomer, 2009 for an extensive review and description).

Empirical Objectives of the Current Study

Within the current research, my group examined relations among brain function, LH strategy, and socially antagonistic attitudes and behaviors. We built upon our prior research that indicates that the K-Factor is negatively correlated with (suggesting that slow LH strategy may have a causal inhibitory effect on) sexual coercion, intersexual competition, negative androcentrism, negative ethnocentrism, intimate partner violence and antagonistic attitudes and behaviors over-all. This negative correlation and possible inhibitory effect appears to be mediated by executive functions which may be the proximate mechanisms allowing individuals the control to inhibit their inclinations to have antagonistic attitudes and engage in antagonistic behaviors. The slow LH strategies may be incompatible with antagonistic social strategies because the latter has an adverse effect on long-term mating strategies, parental investment in offspring, and social cohesion and reciprocal altruism among kin and non-kin.

We conducted the current research iteratively in two studies; the first study, a pilot, used samples of students from a local federally-funded agency that provides educational and job training for young people from low SES. The second study used a sample from the same agency as well as a sample from the undergraduate population at the University of Arizona. Measuring behavioral phenotypes such as LH traits, antagonistic behaviors, and brain function in humans can be complex and time extensive, relying on multiple indirect measures (i.e., self-report questionnaires) as well as direct behavioral measures (i.e., neuropsychological tests).

Measuring Behavioral Phenotypes. Directly measuring human LH traits and antagonistic behaviors is problematic. For ethical, generational, and practical reasons, measures of LH traits and antagonistic behaviors were obtained via self-report questionnaires.

Measuring Brain Function. Measures of brain function were obtained through self-report questionnaire and direct neuropsychological examination.

Self-Report. Personality and neuropsychological researchers often use self-reports of traits such as self-regulation and impulsivity. We used validated self-report measures of psychopathy, mating effort, and risk-taking instruments to measure antagonistic attitudes and validated delinquency, risk-taking, and substance abuse instruments to measure antagonistic behaviors.

Neuropsychological Testing. Well-validated neuropsychological tests are believed to provide exceptional direct behavioral indices of brain function (Lezak et al, 2004; Strauss, Sherman & Spreen, 2006). We measured self-regulation using a battery of validated neuropsychological tests and self-report instruments. Further, described here are data-based predictions of self-report socially antagonistic attitudes and behaviors. We propose that ecologically valid neuropsychological tests will provide proxy data of proximate and mechanistic dimensions of LH theory.

Research Predictions

Study I Predictions

The primary hypotheses within this research program focuses on correlates of LH strategies, which are represented in our initial model (See Figure 2). This model indicates a flow of causal influences beginning with LH genes (not measured here), which provide the raw genetic architecture for brain function (e.g., Frontal, Amygdalar, and Hippocampal function), which is, in essence, the neuroarchitecture underlying behaviors that act in concert as one's LH strategy. And, finally, these LH strategies predict the presence, or lack thereof, of socially antagonistic attitudes and behaviors.

The first hypothesis is that brain function will predict the K-Factor (i.e., LH strategy). Fast strategists have slower and later development of the frontal cortex which is associated with reduced abilities in self-regulation, impulse control, attention, working memory, rule governance, delay of gratification, and decision making. Hence, we expect to see faster strategists engaged in more sexuality, more intersexual and intrasexual competition (e.g., risk-taking behaviors), and greater range of emotionality.

Further, due to later and slower hippocampal development, we expect to also find fast strategists exhibiting less behavioral flexibility and less ability to discriminate among physical and social contexts and situations.

Also, due to slower amygdalar development, we expect to see fast strategists have more difficulty with "mind-reading" ability, that is, the ability to detect others' emotional state and intentions; difficulty differentiating the costs and benefits of one's behaviors; and more difficulty experiencing appropriate emotional responses to social situations.

Prediction 1. We predict a feedback loop with interactions between each of the three domains of brain function (i.e., Frontal Function, Hippocampal Function, & Amygdala Function; See Figure 1 for conceptual path model).

Prediction 2. The three neuropsychological phenotypic composites will correlate positively with the LH phenotypic composite (i.e., "K-Factor"). Although simplified for coherence, the interactions between the functions of the three measured brain regions and LH traits illustrate associations that my group has identified as important to this first step of identifying proximate and ultimate domains of LH strategy (See Figure 2 for conceptual path model). Slow LH strategy should have a positive association with functions of the frontal cortex and hippocampus, and a negative association with the amygdala.

Because of age-based heterochrony within the age-range of our sample, we expect to find slower LH traits to be associated with increased neurological development in the frontal cortex and hippocampus but decreased development in the amygdala.

Prediction 3. Finally, we predict that slow LH strategy will be negatively associated with socially antagonistic attitudes and behaviors, as antagonistic attitudes and behaviors are believed to be less adaptive for slow strategists.

Study II Predictions

Prediction 1.1. Our self-report instruments of self-regulation will cohere within the following three lower-order factors: Shifting, Updating, and Inhibition.

Prediction 1.2. The Shifting, Updating, and Inhibition factors will load on a single higher-order factor.

Prediction 2.1. Our neuropsychological tests of self-regulation will cohere within the same three lower-order factors as our self-report measures: Shifting, Updating, and Inhibition.

Prediction 2.2. The Shifting, Updating, and Inhibition neuropsychological factors will load on a single higher-order factor.

Prediction 2.3. The higher-order self-report self-regulation factor will be highly and positively correlated with the higher order self-regulation factor based on neuropsychological test scores.

The results of Study I led to our work on Study II, which continued our focus on LH strategy as a mid-level theory that integrates behavior and brain function. Within socially antagonistic behaviors, we parsed out attitudes from behaviors. Our pilot results on brain function led us to train our neuropsychological focus on the three theoretically specified sub-components of self-regulation (shifting, updating, and inhibition). We continued our investigation of the relations among LH strategy, socially antagonistic attitudes and behaviors, self-regulation, and general cognitive ability with the following predictions:

Prediction 3.1. In the structural model, slow LH strategy will be positively associated with self-regulation abilities. Slow LH strategy, when measured with the K-Factor, has shown strong heritability estimates in recent studies. Figueredo and colleagues found heritability estimates of .65, (Figueredo et al., 2004; Figueredo & Rushton, 2009). Because of the specific associations described above between LH theory and neurological (e.g., frontal lobe) and pubertal (i.e., age-based heterochrony) development, we expect slower LH traits to be associated with faster and greater neurological development of the frontal cortex.

Prediction 3.2. Slow LH strategy will be negatively associated with socially antagonistic attitudes *and* behaviors. That is, we will see people who represent the slower end of LH strategies expressing fewer antagonistic attitudes and engaging in fewer antagonistic behaviors than people who represent the faster end of LH strategies. According to LH theory, slower LH strategists' genetic programs (as they interact with more predictable and less harsh nomothetic environments) typically drive more prosocial attitudes and behaviors and fewer antagonistic attitudes and behaviors.

Prediction 3.3. Self-regulation will mediate the relations between Slow LH strategy and socially antagonistic attitudes and behaviors. According to LH theory, slower LH strategists' posses increased frontal ability to self-regulate their temptations to maintain antagonistic attitudes and engage in antagonistic behaviors.

Prediction 3.4. Socially antagonistic attitudes will be positively but moderately associated with antagonistic behavior. Although these attitudinal and behavioral constructs are theoretically distinguishable and factor analysis in Study I distinguishes the two constructs, the former ought to lead to the latter.

Prediction 3.5. General cognitive ability (*g*) and Slow LH strategy will not correlate. *g* is primarily included for discriminant validation purposes: to parse out at least this one other function (general cognitive ability) from LH strategy and self-regulation. We intend to demonstrate that the K-Factor and self-regulation do not simply correlate with everything. That is, the presence of *g* to lend support for true correlations rather than "crud factor" correlations (Meehl, 1990).

To be sure, many researchers argue *g* is a primary component of life history. While this appears to be so at species and population levels among humans (see Rushton, 1985, 2000, 2004) this relation does not hold at the level of individual differences. Amassing data from my research group, suggests *g* is not correlated with LH strategy (Brumbach, Figueredo & Ellis, 2009; Gladden, Figueredo & Jacobs, 2009; Sefcek, 2010) and sometimes correlates *negatively* with LH strategy (Figueredo et. al., 2005; Gladden, Sisco & Figueredo, 2009).

Prediction 3.6. General cognitive ability (*g*) and socially antagonistic attitudes or behaviors will not correlate. As described above, many researchers argue *g* positively correlates with socially antagonistic attitudes and behaviors (e.g., Herrnstein & Murray, 1994). However, amassing data from my research group, as described above, suggests *g* is not correlated with socially antagonistic attitudes and behaviors (Gladden, Figueredo & Jacobs, 2009; Sefcek, 2010).

Current Research

Building upon the extant literature in these domains, the current research program addressed these hypothesized associations in two populations, a community sample and a university sample aged 18-24. This is important because we sampled people in our two populations who, because of their age, likely represent a substantial range of LH strategists with a range of unpredictability and harshness (and lack thereof) in their phylogenetic and ontogenetic environments. In concert, we anticipate our participants also have a wide range of socially antagonistic attitudes and behaviors, posses a range neurological development, and a significant range of intelligence. The current studies' aims are to investigate the relations between LH strategies, socially antagonistic behaviors (with a focus on self-regulation in Study II), and brain function, including *g* (for discriminant validation purposes).

Our research program's primary aim, within Study I (i.e., the pilot), was to test our predictions on a sample of community youth. We tested our hypotheses that LH strategies, brain function, and socially antagonistic attitudes and behaviors would be correlated. We also tested our hypotheses that neurological functions of the frontal cortex would be positively correlated with hippocampal functions, and negatively with amygdalar functions. We also tested the hypotheses that neuropsychological test scores would correlate with self-reported LH traits and self-reported socially antagonistic attitudes and behaviors. Our pilot results led us to converge on the self-regulation functions of the frontal cortex, their relations to LH strategy and socially antagonistic behaviors.

Our secondary aims within the pilot study were exploratory and iterative in terms of hypotheses modification (e.g., inclusion of a measure of general cognitive ability), data collection and general methodology, and research design.

The aims of Study II are similar to those of the pilot, although the pilot analyses strongly suggested that self-regulation as exerted by the frontal cortex is the primary neuropsychological function associated with LH strategy and antagonistic behaviors.

Our aim within Sample II of Study II was to integrate a university sample with our data set. Doing so allowed us to expand the variability in relevant LH variables, such as predictability and harshness in childhood environment, socioeconomic status, intelligence, and range of antagonistic behaviors.

In addition to testing the above hypotheses, within the current study we examine the relation between our self-report measures of brain function and our neuropsychological behavior measures. We hope tests and self-report measures will correlate highly, permitting future work in this area to depend solely on the relatively inexpensive and convenient self-report measures.

A neuropsychological profile based on self-report and behavioral tests, ought to roughly mirror one’s unique suite of brain function and psychological repertoire. Targeting one’s executive functions, particularly self-regulation, will provide information on one’s ability to adapt to changing nuances within one’s immediate environment. A properly implemented set of neuropsychological tests ought to provide valuable information on the neurologic-based proximate mechanisms that implement and control one’s LH strategy.

Overview of Hypothesized Models

Theoretical Models

Study I Models. The first theoretical model presented here includes four phenotypic constructs: (1) Frontal Function, (2) Amygdala Function, (3) Hippocampal Function, and (4) Life History Indicators are comprised of cognitive and behavioral indicators of the K-Factor and include individual, familial, and social behaviors related to LH strategy.

Brain function is theoretically assumed to be based on genetic structure, or "K-Factor genes" that drive current ontogenetic function via phylogenetically obtained genetic structure. These neurological functions are measured via neuropsychological tests and questionnaires of executive functions (i.e., Frontal Function), spatial cognition and long-term memory (i.e., Hippocampal Function), and emotionality (i.e., Amygdala Function; see Lezak et al, 2004 for a comprehensive list and description of available tests). We selected the three brain areas for our hypothesized model because they interact densely and reciprocally and are critical for normal social functions (Darby & Walsh, 2005) that are probabilistically critical for successful execution of LH strategies.

Study II Model. The second refined theoretical model is largely based on the results of Study I. This model includes four phenotypic constructs: (1) Life-History Strategy, (2) Socially Antagonistic Attitudes, (3) Socially Antagonistic Behaviors, (4) Self-Regulation, and (5) General Cognitive Ability (See Figure 3).

METHOD

Overview

The Profiling Approaches to Life and Employment (PALE) research program was conducted in collaboration with a community branch of a Federally-funded social service agency in southern Arizona. The youths and directive at this community-based agency spawned our initial interest in collaboration: both their youths and directive bear close resemblance to those found in university settings. They both provide educational and employment training for older adolescents and younger adults. We believe, however, that this agency serves a substantially different population - people for whom traditional programs such as high-school and college are not suitable or a good fit generally use this resource as an alternative route to gainful employment. Our research program also incorporated an age-similar sample drawn from introductory psychology courses at the University of Arizona.

The PALE research program was designed to be exploratory and iterative in terms of specific hypotheses, data collection methods, research design, and general methodology.

Study I provided exploratory data from our community population. We based Study II on the exploratory analytic results and experiential discoveries from Study I. Study II consists of two samples: Sample I is from our community agency, and Sample II is from our university population. We initially incorporated Sample II to address our relatively low acquired sample size from Sample I (e.g., Structural Equations Modeling is possible only with a substantially sample size). Secondarily, we incorporated Sample II to address range restriction concerns with Sample I; many of our predictions are testable only with a more diverse (combined) sample (i.e., a more full range of fast *and* slow strategists). Both Study I and Study II of PALE were conducted under full approval of the Human Subjects Protection Program (BSC#04-24) at the University of Arizona.

Study I

Study I Overview

Study I data collection occurred between January 2005 and February 2006. We intended to characterize the community sample with descriptive data, run a preliminary test of the hypothesized model, determine the best instruments to use in our later confirmatory studies, and establish and refine our recruiting and assessment procedures. We focused on identifying correlations among LH strategy (i.e., the K-Factor), socially antagonistic behaviors, a range of theoretically specified brain functions, and general cognitive ability.

Within Study I we investigated relations among a number of theoretically bound multivariate composites. The first composite was LH strategy as measured by the K-Factor. The second and third were factor composites of antagonistic social attitudes and behaviors. We explored a number of composites of neuropsychological tests and subtests of frontal lobe, amygdalar, and hippocampal function – as well as general functions of parietal and temporal lobes. The design did not permit us to compute a full SEM, thus we used simple Pearson correlations and Exploratory Factor Analyses (EFA) for our primary analyses.

Three months into data collection in Study I a number of complications brought us to modify our procedures. I describe these changes in this section. Stage I of Study I refers to the initial data collection period, while Study II refers to the latter, updated, part of the study.

Participants

Eighty-two agency youths consented to participate in Study I. During Stage I of Study I, we recruited 46 participants; during Stage II of the Pilot, we recruited 32 participants. We obtained complete data sets on N = 54 participants (27 female, 27 male).

Procedure

Recruitment. Agency youths were invited to participate via brief in-class presentations given by our research personnel. Those who responded to the recruitment presentations were directed to the designated recruitment location. Attendees at our presentation were provided opportunities to ask questions, read and sign consent forms, or leave the presentation to return to their usual agency routine. There were no recruitment differences between Stage I and Stage II.

Testing and Compensation. Trained research personnel conducted neuropsychological assessments and administered questionnaires in individual and group sessions in designated, private rooms at the agency's facility. Each participant received up to four hours of neuropsychological testing in two two-hour individual testing sessions. Two two-hour group sessions for paper-and-pencil questionnaire administration generally followed. Each session was conducted according to the participant's inclination and schedule: Some were held back-to-back while others occurred on different days, or even weeks. Although we attempted to hold each of the four sessions in order, we changed the order for participants when doing so was substantially more efficient or convenient for the participant. In this design, maximizing data collection takes precedent over data continuity. In total, each participant completed between 6 and 8 hours of testing.

During Stage I of the Study I, all four scheduled testing sessions using a Delay of Gratification (DOG) protocol. Our DOG protocol was adapted from those used by Petry and colleagues (Petry, 2001; Petry & Casarella, 1999) and tailored for this specific study. This procedure had two purposes. The first was to schedule the participant's next testing session. The second was to provide a real-life, ecologically valid measure of ability to delay gratification of reward (i.e., the telephone calling cards which, according to agency administrators, were highly coveted). At the beginning of the first individual assessment session, the participants were reminded that they had the opportunity to earn one $5.00 telephone card at the end of that session. Then at the end of the session, we notified each participant of the following option: "You may have your one $5.00 phone card right now, or wait until the upcoming individual assessment session and receive three $5.00 phone cards. If you choose to accept your single phone card now, you will also receive one phone card during the upcoming individual session. It is your decision to make." Thus, participants had the potential to earn 4 to 7 calling cards, each worth $5.00.

Although potentially informative, we abandoned this protocol. The only way to make the "delay" a consistent and accurate measure was to schedule successive sessions. Participant's fixed schedules and personal preferences varied, however, often without notice to them or us – and often resulting in "no-show" testing sessions. Further, tracking participant's decisions and maintaining confidentiality via their individualized pass codes proved, at best, to be a Herculean task.

During Stage II of Study I, we abandoned the DOG and initiated a Reward After Testing (RAT) scheduling and participant compensation protocol. The RAT protocol eliminated the problems described above. Instead of scheduling testing sessions with participants, who sometimes experienced a change of plans or heart, we initiated extemporaneous testing sessions. Here, we arrived at the agency according to our and agency schedules, contacted the participant via telephone, and immediately met with participants who were available, willing, and had permission from agency staff. The RAT protocol included participant compensation of six $5 Wal-Mart gift cards, rather than telephone calling cards. Immediately following each of the first three sessions, participants received one Wal-Mart gift card. Following the final (i.e., fourth session), each participant received three cards.

Research Personnel. Graduate and undergraduate-level university students conducted all recruiting, neuropsychological tests and questionnaire assessments. Each psychometrician was trained and supervised by one doctoral and one masters-level clinician. Training centered on neuropsychological testing and also focused on professional conduct (i.e., proper social conduct with research participants, agency staff and administrators), ethics (e.g., maintaining participant confidentiality and anonymity), and maintaining the integrity and documentation of testing materials and data.

Psychometrician Adherence. For quality control during all of our work at the agency, particularly during testing, at least two research personnel worked together at all times. During neuropsychological testing, two research personnel who met pre-specified neuropsychological testing standards worked together with each participant. One psychometrician served as the assessor; the second psychometrician served as the observer. The assessor was responsible for the actual testing and noting testing error and environmental obstructions; the observer was responsible for quality control, that is, to closely monitor and notate the assessor's performance.

During Stage I of Study I, there were 11 research personnel (age range of 18-31; 2 male; 9 female), all of whom served as psychometricians (not including the two supervisors; the masters level supervisor also served as psychometrician). Each psychometrician received between 43 and 61 hours of training before attaining psychometrician status. Their training included demonstration of flawless proficiency with general conduct, documentation, questionnaire administration, administration of individual neuropsychological tests, and performance mock sessions of each of the complete neuropsychological testing sessions. Each person's proficiency test(s) was directly assessed and approved by at least one of the supervisors. Further, when possible, the master-level supervisor served as observer during each psychometrician's initial testing sessions with study participants. Finally, throughout the entire data collection period, weekly supervision meetings permitted ongoing training. Assessor and observer notes and reports that indicated flawed testing procedures provided topics for further neuropsychological and general conduct training.

Following the testing session, and before test scoring and data entry, at least one of the supervisors read, discussed, and evaluated all notes for evidence of invalid test scores (e.g., as a result of psychometrician error or external interruption during testing). Occurrences of questionable events during testing were discussed among the supervisor(s), administrating psychometricians, and generally all study psychometricians during weekly supervision meetings, and suspect data were identified as “invalid” and denied entry to the database.

During Stage II of Study I, 17 people served as research personnel (age range of 20-32; 5 male, 12 female). Of these, 14 performed as psychometricians (age range 20-32; 4 male, 10 female) of whom 4 were continuing psychometricians from Study I; eleven of the psychometricians were advanced undergraduate students and 3 were first-year graduate students. Training and supervision was comparable to that of Study I, with number of training hours ranging from 43 to 59.

Psychometrician Error. Throughout Study I (both Stage I and Stage II), two of the 21 psychometricians (10%) were identified as having difficulty maintaining testing precision and one psychometrician did not maintain professionalism in the field. As soon as these problems were recognized as patterned and impervious to additional focused training, these personnel were removed from the field site and relegated to administrative work. Of the two psychometricians with questionable testing adherence, one psychometrician did not test any participants (i.e., serve as assessor) but observed the testing of eight participants (i.e., served as an observer); the other psychometrician tested eight participants and observed the testing of four participants.

The specific tests that these and other psychometricians invalidated due to psychometrician error were removed from analysis. However, some test scores were removed from analysis due to other sources of invalidation, such as external interruption of the testing room and questionable participant cooperation. Our records do not distinguish the source of test invalidation.

Nonetheless, eighteen tests from sixteen participants were invalid and their scores were not included in our analyses (within N = 82): Rey-O (n = 3), the Eyes Test (n = 0), the Rivermead (n = 6), Arizona Map Test (n = 0), the US Map Test (n = 0); Logical Memory (n = 2), Trails A (n = 0), Trails B (n = 2), MMSE (n = 3), Digit Span (n = 1), the Modified Stroop (n = 1), and the Shipley (n = 0).

Confidentiality. We insured individual confidentiality using the following methods. Each student devised a personal code (determined by that individual) and provided that code to our recruiting personnel. We asked participants to memorize and provide that pass code for the duration of the study. Because that pass code is the only identifier linking individual data, participants were informed that inability to provide the pass code at the beginning of each successive session would result in their permanent removal from the study. There were no differences in our confidentiality procedures between Stage I and Stage II.

Scales and Measures

We selected our instruments according to *a priori* predictions based on LH theory, developmental theory, personality theory, neuropsychological theory, and my group’s prior research. Neuropsychological tests were selected to provide a wide range of functional indicators of strengths and weaknesses believed to depend upon the functional level of the frontal lobes, amygdala, hippocampus, as well as the parietal and temporal lobes (Kolb & Whishaw, 2003). The hypothesized domains were 1) LH strategy, 2) socially antagonistic attitudes, 3) socially antagonistic attitudes and behaviors, 4) neuropsychological function, and 5) general cognitive ability.

Life History Strategy

We used several paper-and-pencil self-report questionnaires that measured life history strategy and perform well psychometrically.

Mini-K Life History Strategy Short Form. We used the 20-item *Mini-K Life History Strategy Short Form* (*Mini-K*; Figueredo et al., 2004, 2006), which is a measure of slow life history strategy based on the 199-item *Arizona Life History Battery* (*ALHB*; Figueredo, 2007). Respondents were asked to “indicate how strongly you agree or disagree with the following statements” with a scale that ranges from -3 (Disagree Strongly) to +3 (Agree Strongly) and includes items such as “I have to be closely attached to someone before I am comfortable having sex with them,” and “While growing up, I had a close and warm relationship with my biological mother.”

The *Mini-K* correlates approximately r = 0.70 with the *ALHB* (Figueredo, Wolf, Gladden & Olderbak, 2010; Figueredo, et al., 2006) and has been validated on many samples (Brumbach, Figueredo, & MacDonald, 2005; Vásquez, Sefcek, Douglas, & Figueredo, 2005; Wenner et al., 2005; Wolf, Vásquez, Frías-Armenta, Corral-Verdugo, & Figueredo, 2005).

Multidimensional Measure of Work Ethic. We used the 65-item *Multidimensional Work Ethic Profile* (*MWEP*; Miller, Woehr, & Hudspeth, 2002), which is a general measure of work ethic and contains several subscales, including a scale that measures delay of gratification. Respondents are asked to indicate how strongly they agree or disagree with a number of statements. The response scale ranges from -2 (strongly disagree) to +2 (strongly agree). Sample items include "It is important to stay busy at work and not waste time," and "Any problem can be overcome with hard work."

Mate Value Inventory. As a measure of mate value, which is a composite of self-perceived attributes commonly desired in social or sexual partners, we included the 17-item *Mate Value Inventory* (*MVI*; Kirsner, Figueredo, & Jacobs, 2003). The inventory asks participants to "Please indicate how people who know you well would rate you on each of the following characteristics." The response scale ranges from -3 (Extremely low on this characteristic) to +3 (Extremely high on this characteristic) and includes traits such as "ambitiousness" and "having an attractive face."

Hopkins Symptom Checklist. Also, as a brief assessment of anxiety and depression, we used the 25-item *Hopkins Symptom Checklist* (*HSCL*) which is a shortened version of the original 90-item *HSCL* (Derogatis, Lipman, Rickels, & Cori, 1974). The inventory asks participants to identify "symptoms of strain that people sometimes have." The response scale ranges from 0 (Not at all) to 3 (Extremely) and includes 10 symptoms of anxiety such as "feeling fearful" and 15 items of depression such as "feeling blue."

Impulse Control and Impulsive Behaviors Questionnaires. Questionnaires identifiable and available in the literature appeared to not distinguish between *attitudes* and *behaviors*. As such, our group developed our own 29-item *Impulse Control Questionnaire* (*ICQ*) and the 15-item *Impulsive Behavior Questionnaire* (*IBQ*) that are designed to measure attitudes regarding impulse control as well as a predilection to engage in impulsive behaviors, respectively (described also in Figueredo et al, 2006).

We sorted items from the *Impulsive Behavior Scale* (Rosenbaum, 1980), the *Self-Control Questionnaire* (Rehm, 1988), and the *Barratt Impulsivity Scale* (Barratt, 1983) to create separate composite lists of impulsive attitudes and behaviors. Sample items from the *ICQ* include “I am a careful thinker,” and “I concentrate easily.” Respondents are asked “how strongly you agree or disagree with the following statements” with a scale that ranges a scale that ranges from -3 (Disagree Strongly) to +3 (Agree Strongly). We predict that the *ICQ* will load on the K-Factor, while the *IBQ* will load on a factor of antagonistic social behavior.

Socially Antagonistic Behaviors

Based on the empirical data that demonstrate a clustering of antagonistic social behaviors, we used a number of instruments that measure a comprehensive range of mild to moderate antagonistic behaviors.

Impulsive Behavior Questionnaire. We included the 15-item *IBQ*, as described above. Respondents are asked “how strongly you agree or disagree with the following statements” with a scale that ranges from -3 (Disagree Strongly) to +3 (Agree Strongly). Sample items from the *IBQ* include “I act ‘on impulse’,” and “I say inappropriate things.”

Jake’s Temptation’s Questionnaire. We included the 42-item *Jake’s Temptations Questionnaire* (*Jake’s Temptations*), an instrument developed by our group based loosely on the venial and capital Seven Deadly Sins (Schumacher, 2005). This instrument measures a wide range of antagonistic behaviors that people typically control, or consider controlling, and upon which they may or may not have actually acted. Respondents were asked to “Indicate just how often you have experienced the following in the past two weeks. It doesn't matter if you succumbed to temptation or not, we want to know how often you were tempted by it." These *temptations* were all behaviors with short-term gains but long-term costs. Item examples include "the frequency with which you were tempted to 'break laws,'" and "act without considering the consequences."

Delinquency Short Form. As a pure measure of mild to moderate antagonistic behaviors, we included the 20-item *Delinquency Short Form* (*D-20*; Charles & Egan, 2004). Respondents are asked "how many of these things you have ever done" on a scale that ranges from 0 (Never) to 3 (Very Often). Item examples include "fighting in the street or another place," and "purposely damaging property that belongs to someone else."

Life Experiences Questionnaire-Revised. We also included the 27-item *Life Experiences Questionnaire -Revised* (*LEQ-R*), which is an adaptation of the original *LEQ-R* (Zuckerman & Kuhlman, 2000) that my group modified for use in diverse non-student populations. The *LEQ-R* includes items that measure risky sexual activity, drinking, smoking, drug-taking, reckless driving, and gambling. The *LEQ-R* uses a variety of categorical response options. For example, the item that reads "During the past 12 months, how often have you used marijuana or hashish?" has a scale that ranges from "Never" to "Nearly Every Day;" while the item that reads "If you are driving on a straight, un-crowded highway with a 55 mile per hour speed limit, at what speed do you usually drive?" has response options that range from "I never drive," to "75mph or faster."

Drug Abuse Screening Test. As a pure measure of substance abuse, we included the

10-item *Drug Abuse Screening Test* (*DAST*; Skinner, 1982). This instrument has forced-choice yes/no response options for questions such as “Do you abuse more than one drug at a time?” and “Have you engaged in illegal activities in order to obtain drugs?”

Mating Effort Scale. As a measure of effort invested in procuring and maintaining sexual partners, we used the 10-item *Mating Effort Scale* (*MES*; Rowe, Vazsonyi, & Figueredo, 1997). Respondents are asked to “circle the response that best fits you” on a scale that ranges from -2 (Strongly Disagree) to +2 (Strongly Agree). Each item has parallel questions, one written for heterosexual females and one written for heterosexual males. Item examples include “I like boys more for their good looks than for their companionship” and “I would start a relationship with another girl before ending one with my current girlfriend.”

Psychopathic Personality Inventory. We also used the 187-item *Psychopathic Personality Inventory* (*PPI*; Lilienfeld & Andrews, 1996) which assesses psychopathy in non-incarcerated populations, although it also serves well for convicted criminals. This questionnaire measures personality traits rather than antisocial behaviors. Respondents are asked to respond to items that indicate different personality styles and to “decide to what extent [each item] is false or true as applied to you” on a 1 to 4 scale (i.e., False, Mostly False, Mostly True, True).

The sum of the scale endorsements produce a total *PPI* score or one of eight subscale-scores: (1) Machiavellian Egocentricity (manipulativeness), (2) Social Potency (charm and influence), (3) Coldheartedness (callousness and guiltlessness), (4) Carefree Nonplanfulness (lack of forethought), (5) Fearlessness (risk taking), (6) Blame

Externalization (blaming others for mistakes), (7) Impulsive Nonconformity (a disregard for social norms), and (8) Stress Immunity (lack of anxiety). The *PPI* has sound psychometric properties when used with male adult and male adolescent inmate populations, as well as undergraduate students (Lilienfeld & Andrews, 1996). It also demonstrates strong internal consistency with Cronbach's alphas ranging from .64 to .93 for the total score as well as the subscales (Chapman, Gremore, & Farmer, 2003; Lilienfeld & Andrews, 1996).

Self-Monitoring Scale. As a measure of ability to observe and self-regulate one's own situationally specific self-presentation we used the *Self-Monitoring Scale* (Snyder & Gangestad, 1986), an 18-item true-false instrument that indicates the probability that an individual is a high or low self-monitor. Sample items include "In different situations and with different people, I often act like very different persons" and "I am not always the person I appear to be".

Neuropsychological Tests

We conducted the following neuropsychological assessments that primarily measure frontal lobe, amygdalar, and hippocampal functions:

Frontal Lobe Functions

Mini-Mental Status Examination. We administered the *Mini-Mental Status Examination* (*MMSE*; Folstein, Folstein, & McHugh, 1975) as an initial and brief assessment of general cognitive function. The *MMSE* has 4 sections that measure orientation to space and time, immediate recall, attention and calculation, and a range of language abilities. *MMSE* scores range from 0-30, higher scores indicate higher cognitive function. Our intent with the *MMSE* was to confirm that individuals in the study were not cognitively impaired beyond established normative cut-offs.

Rey-Osterrieth Complex Figure Test. We also used the *Rey-Osterrieth Complex Figure Test* (*Rey-O*; Osterrieth, 1944; see also Myers & Myers, 1995) as a measure of working memory, long-term memory, and an executive function –specifically shifting-ability. A maximum score of 36 represents a summed performance-based score of 18 components required to recreate a drawing of a complex figure. This maximum score indicates superb shifting performance. This drawing is re-created three times for three independent sub-test scores: 1) *Rey-O Copy* is conducted with the original figure in plain view of the participant, 2) *Rey-O 3-Minute* is conducted after engaging in other tasks for 3-minutes with the original figure out of view, 3) *Rey-O 30-Minute* is conducted after engaging in other tasks for 30-minutes, again, with the original figure out of view (Osterrieth, 1944).

Trail-Making Tests A and B. We administered the *Trail-Making Tests A and B* (*Trails A & B*; Army Individual Test Battery, 1944). *Trails A* provided a measure of attention (i.e., drawing a dot-to-dot line), while *Trails B* provided a measure of shifting (i.e., drawing a dot-to-dot line but shifting between numbers and letters). This is a timed test, with scores reflecting number of seconds taken to complete the test; higher scores indicate slowed ability.

Rivermead Behavioral Memory Test –Extended Version. As a test of multiple memory functions, we used the *Rivermead Behavioral Memory Test –Extended Version* (*RBMT-E*; Wilson, Forester, Bryant & Cockburn, 1990). The *RBMT-E* is comprised of thirteen subtests and was selected because it was developed with ecological validity in mind. It is intended to predict everyday memory problems and comprises tasks analogous to situations found in daily living. Tasks include short- and long-term memory tasks such as remembering novel people's names, the presence and location of objects, a scheduled but fabricated "appointment," details of a story, and walking a pre-specified route around the testing room.

Digit Span. We also used the *Digit Span* forward and backward subtests of the *Wechsler Memory Scale III* (*WMS-III*; Wechsler, 1997b) which involves verbally repeating number strings in a memorized order and in reverse order. The *Digit Span* subtest provided measures of working and short-term memory (Wechsler, 1997a).

Logical Memory I, II, & Recognition. We also used the *Logical Memory I, II, and Recognition* subtests of the *WMS-III* (Wechsler, 1997b) which provided measures of long-term memory (Wechsler, 1997a). These tests involve recall and recognition of components and details from two novel standardized stories.

Amygdalar Function

*Reading the Mind in the Eyes Tes*t. We included the *Reading the Mind in the Eyes Test* to provide measures of Amygdalar function (*The Eyes Test*; Baron-Cohen, Wheelwright & Hill, 2001). This is a test of "mind-reading ability", also described as "theory of mind." With this test, participants demonstrate ability to discern a range of emotions of other people by viewing black-and-white photographs of human faces. In this test, however, they include only a horizontal rectangular portion of the face –that is, the eyes and bridge of the nose.

Hippocampal Function

The US Map Test. The *US Map Test* (Borod, Goodglass, & Kaplan, 1980) provided measures of spatial ability, specifically by identifying 14 well-known landmarks within and surrounding a United States map.

Arizona Map Test. Similarly, the *Arizona Map Test* was used as an adjunct to the *US Map Test* for Arizona residents to test for spatial ability with 10 landmarks within and surrounding the US state of Arizona. Our research team is in process of validating the *Arizona Map Test*, which it developed based on the *US Map Test.*

General Cognitive Ability

Shipley Institute of Living Scale. Finally, we used the *Shipley Institute of Living Scale* (*The Shipley*; Zachary, 1986), a paper-and-pencil test of general cognitive ability. *The Shipley* is a 60-item measure of intelligence validated and normalized on 322 Army recruits (Zachary, 1986). The manual reports appropriate use for motivated test-takers who are English speaking and aged 14 and up. *The Shipley* is composed of two subtests: A vocabulary intelligence subtest (*Shipley-Vocabulary*) is comprised of 40 items with a split-half reliability of .87 and an abstraction subtest (*Shipley-Abstraction*) is comprised of 20 items with a split-half reliability of .89. The split-half reliability of the total score (vocabulary and abstraction subtests combined) is .92 (Zachary, 1986).

Measurement Additions in Pilot Study II

Executive Interview. In the Pilot II, we added 17 of the 25 standard tasks within the *Executive Interview* (*Exit-25*; Royall, Mahurin, & Gray, 1992), an interactive behavior-based neuropsychological battery that tests for shifting, inhibition, and updating abilities.

We included the following *Exit-25* tasks. Number-letter task (shifting), word fluency task (updating), design fluency task (updating and inhibition), anomalous sentence repletion (inhibition), thematic perception (inhibition and updating), memory/distraction task (shifting), interference task (inhibition), go-no-go task (inhibition and updating), two echopraxia tasks (inhibition), two Luria hand-sequence tasks (shifting, inhibition, and updating), a complex command task (shifting and updating), a serial order reversal task (inhibition and updating), two counting tasks (inhibition), and a utilization behavior task (inhibition).

We excluded eight *Exit-25 tasks* because we *a priori* believed them to be too simplistic or socially inappropriate for the community population because they involved touching the participants. The excluded tests were two automatic behavior tasks (inhibition), a grasp reflex (inhibition), social habit (inhibition), motor impersistence (inhibition), snout reflex (inhibition), finger-nose-finger task (inhibition and updating), and a grip task (inhibition).

We discontinued use of all *Exit-25* tasks because it is designed for people with cognitive impairment and we observed *posteriori* a substantial ceiling effect with our community sample.

The Modified Stroop Task. We used a modified version of the *Stroop Task* (Stroop, 1935; see also Schmidt & Cheesman, 2005), a classic test of self-regulation. Developed by our Mexican colleague, Pablo Valdez (2005), this *Modified Stroop* is composed of the original two tasks and two modified tasks. The rule of the first task is to read 48 words of colors that are printed in ink of other colors, while the rule of the second task is to say the name of the color the same 48 words are printed in, while inhibiting the prepotent response to read the word. However, the *Modified Stroop* also has two extra tasks, both of which demand that the participant repeatedly switch between the first two rules within the same task. Thus, the *Modified Stroop* tests for inhibition *and* shifting.

Five-Point Test. We assessed updating abilities primarily with the *Five-Point Test* (*Five-Point*; Regard, Strauss, & Knapp, 1982), a paper-and-pencil test that involves the drawing of a maximum number of designs without repeating previously drawn designs.

Administering Study I of the Pilot

Study I of the Pilot included the following measures, in order of administration:

Session one (individual neuropsychological testing): *Mini-Mental Status Examination*, *Rey-O Copy*, Demographics, *Rey-O 3-Minute, Rivermead Behavioral Memory Test-E*, and the *Rey-O 30-Minute*.

Session two (individual neuropsychological testing): *Logical Memory I, Digit Span, Trails A & B, The Shipley, Logical Memory II, Logical Memory –Recognition, The Eyes Test*, *Arizona Map Test*, and the *US Map Test*.

Session three (group questionnaire administration)**:** *Life Experiences Questionnaire-R, Drug Abuse Screening Test, Mini-K, Multidimensional Work Ethic Profile*, *Mating Effort Scale, Mate Value Inventory, Impulse Control Questionnaire, Impulsive Behaviors Questionnaire,* and *Jake's Temptations Questionnaire*.

Session Four (group questionnaire administration): *Delinquency Short Form, Psychopathic Personality Inventory*, *Self-Monitoring Questionnaire*, and the *Hopkins Symptom Checklist*.

Additions to Study II of the Pilot

Study II of the Pilot included the addition of the *Exit-25* to the end of Session 1; the *Modified Stroop Task* and the *Five-Point Test* were added to the beginning of Session 2.

Data Analytic Strategies

We will use correlational analyses with our directly measured manifest indicators to estimate the relationships among the hypothetical constructs representing the multivariate "phenotypic" composites of LH strategy (the K-Factor), socially antagonistic attitudes and behaviors, multivariate composites of neurological function, as well as general cognitive ability.

Unless specified otherwise, all statistical analyses will be conducted with SAS version 8.2 (SAS Institute, 1999) for Windows. Cronbach's alphas and bivariate correlations used PROC CORR, while exploratory factor analyses (EFAs) used PROC FACTOR. We will select the retained factors based on eigenvalue coefficients, scree tests, and proportions of variance accounted for. Confirmatory factor analyses (CFAs) and structural equation modeling, although originally intended, will not be possible with the Pilot data because of the design.

All scale scores will be computed by taking the average of all answered questions. I will use mean substitution for any missing data point, which means that a participant's mean score for the variable with the missing data point was substituted for that missing data point. Factor scores will be computed by taking the mean of all relevant scales, with the scales first standardized (PROC STANDARD).

RESULTS

Sample

Recruitment and Attrition. Of the four-hundred and eight youths who we invited to attend our recruitment presentation, 160 signed up for the presentation. Ninety-six of the youths who signed up for the presentation attended. Eighty-five percent of the youths (N = 82) who attended the presentation consented to participate in the study. Finally, we obtained partial data sets on N = 66 participants and complete data sets (i.e., all four testing sessions) on N = 54 participants. The 28 consented participants who did not supply full data sets either dropped-out of the agency, were asked to leave the agency, relocated for off-site community training, decided to not continue with our research, or supplied data that were of suspect validity (e.g., due to literacy or “playful” responses). Unfortunately, no data are available that distinguish the causes of attrition.

Demographics. Eighty-six percent of the sex-balanced sample was age 18-21, their mean age was 19.94 (SD = 2.09). Thirty seven percent had graduated from high school, and 26% had obtained the equivalent in the form of a General Education Degree (GED). Thirty percent of the sample self-identified as Caucasian, 28% Hispanic, 20% Native American, and 22% African American, Pacific Islander, or responded as “Other.”

Scale Reliabilities

Internal consistency estimates were calculated for each self-report scale through the use of the Cronbach’s alpha coefficient. The cut-off for reasonable internal consistency reliability is a minimum of .70 (Nunnaly, 1978). See Table 1 for a complete list of scale reliabilities with sample size comparisons. As can be seen, all alphas met the .70 cutoff, with the exception of the Self Monitoring Questionnaire (α = .68).

Descriptive Statistics

Because one objective of Study I was to describe our community sample relative to normed data on relevant measures, a few comments and supporting descriptive statistics relating to the general strengths and weakness of this sample are warranted. Normative data for comparison with our community population are provided below on the instruments and tests for which normative data are available. Sample size, means, and standard deviations are provided, and when available, age, sex, and other demographics of the comparison population(s) are provided. Because raw data from our comparison samples are not available for analyses, *t*-test coefficients were calculated via an Internet-based calculator for Independent Groups *t*-test for Means (Dimension Research, Inc., 2005). This calculator allows the user to establish *t*-score coefficients with pre-specified alpha significance by inputting sample size, means and standard deviations for each group. These data are also provided in Table 2 which presents *t*-test scores and probabilities of the community sample data and the comparison normed data that were available to us.

Unavailable Comparison Data. Comparison data were not available for the following instruments and tests: The *Life Experiences Questionnaire-R,* the *Impulse Control Questionnaire*, the *Impulsive Behaviors Questionnaire*, *Jake's Temptations Questionnaire*, the *Self-Monitoring Questionnaire,* the *Psychopathic Personality Inventory*, *Rey-O Copy*, *Rey-O 3-Minute,* the *Rivermead Behavioral Memory Test-E*, *Trails A, Logical Memory I, II,* and *Recognition, Digit Span,* the *Arizona Map Test, and* the *US Map Test*.

Available Comparison Data. Comparison data were available for the following instruments and tests: The *Mini-K,* the *Multidimensional Work Ethic Profile,* the *Delay of Gratification* subscale from the *Multidimensional Work Ethic Profile,* the *Mate Value Inventory,* the *Hopkins Symptom Checklist,* the *Mating Effort Scale*, the *Delinquency Short Form,* the *Drug Abuse Screening Test*, the *Mini Mental Status Exam,* the *Reading the Mind in the Eyes Test*, *Trails B, Rey-O 30-Minute,* and the *Shipley.*

Mini-K. Mini-K data from Sample I (M = 1.19, SD = 0.73, N = 54) are comparable to that of normative scores from a comparison sample (M = 1.03, SD = 0.63, N = 207; t (259) = 1.61, p > .05) that was comprised of a community sample (Figueredo & Wolf, 2009). A *Mini-K* maximum score of 3.0 is indicative of a very slow strategist, while a minimum score of -3.0 is indicative of a very fast strategist; scores are obtained by summing response options that range from +3.0 to -3.0. Our Pilot sample demonstrated a similar over-all LH strategy as the normative sample.

Multidimensional Work Ethic Profile. MWEP data from Sample I (M = 249.7, SD = 26.5, N = 54) are significantly higher than that of normative scores from a comparison sample of undergraduates from a large Southwestern University (M = 169.31, SD 25.4, N = 598; t (650) = 22.19, p < .01; Miller, Woehr & Hudspeth, 2002). They are also significantly higher than that of normative scores from a sample of US Air Force enlisted personnel ages 18-35 (M^{age} = 18.76; M = 142.11, SD = 24.7, N = 741; t (793) = 30.75, p < .01; Miller, Woehr & Hudspeth, 2002). An *MWEP* maximum summed score of 325 is indicative of a self-report rating of very high work ethic, while a minimum score of 0 is indicative of absent work ethic. Our Pilot sample is reporting stronger work-ethic than did the normative comparative samples.

Delay of Gratification (MWEP Subscale). Data from the Delay of Gratification subscale of the *MWEP* from Study I (M = 24.10, SD = 4.07, N = 54) did not statistically differ from a comparison sample of undergraduates from a large Southwestern University, ages 17-27(M^{age} is 19.2; M = 24.29, SD 6.43, N = 598; t (650) = 0.21, p > .05; Miller, Woehr & Hudspeth, 2002).

Our sample's Delay of Gratification scores, however, were significantly greater than that of normative scores from a sample of US Air Force enlisted personnel ages 18-35 (M^{age} = 18.76; M = 19.42, SD = 5.76, N = 741; t (793) = 5.86, p < .01; Miller, Woehr & Hudspeth, 2002). A Delay of Gratification maximum summed score of 30 is indicative of a self-report rating of very high ability to delay gratification, while a minimum score of 0 is indicative of no ability to delay gratification. Our Pilot sample is reporting stronger ability to delay gratification than the comparative US Air Force personnel but not the comparative University sample.

Mate Value Inventory. *MVI* data from Sample I (M = 1.67, SD = 0.69, N = 54) and normative scores from a community based comparison sample were comparable (M = 1.73, SD = 0.65, N = 206; t (258) = 0.60, p > .05; Figueredo & Wolf, 2009). An *MVI* maximum score of 3 is indicative of a self-report rating of exceptionally high mate value (attributes commonly desired in social or sexual partners), while a minimum score of -3 is indicative of self-perceived mate value. Our Pilot sample demonstrated an over-all similar self-perceived mate value as the normative sample.

Hopkins Symptom Checklist. HSCL data from Sample I (*M* = 0.93, *SD* = 0.63, *N* = 54) indicate scores significantly lower than that of normative scores from a comparison sample (*M* = 1.15, *SD* = 0.45, *N*= 735; *t* (787) = 3.36, *p* < .01) that was comprised of a community sample of adults (49% male; Derogatis, Lipman, Rickels, Uhlenhuth and Covi, 1974). Here, a mean score of zero indicates very good self-reported health, while a maximum score of 3 indicates very poor health. Our Pilot sample is reporting less physical and psychological symptomatology than did the normative comparative sample.

Mating Effort Scale. MES data from Sample I (*M* = 25.80, *SD* = 8.85, *N* = 54) are comparable to that of normative scores from a comparison sample (*M* = 24.70, *SD* = 5.60, *N* = 232; *t* (284) = 1.15, *p* > .05) that was comprised of a community sample of 60 brother and 56 sister sibling pairs, primarily middle class, ages 13-20 (M^{age} = 16.8; Rowe et al. 1997). An *MES* maximum score of 50 is obtained by summing responses ranging on a scale of 1= strongly disagree to 5 = strongly agree and are indicative of self-reported exceptionally high effort put forth to attract and keep short-term mates (Rowe et al. 1997). Overall, our Pilot sample and the normative sample demonstrated efforts in attracting and keeping short-term mates.

Delinquency Short Form. D-20 data from Sample I (*M* = 0.58, *SD* = 0.61, *N* = 54) are significantly lower than that of normative scores from a comparison sample (*M* = 0.88, *SD* 0.61, *N* = 207; *t* (259) = 3.22, *p* < .01) that was comprised of a community sample (Figueredo & Wolf, 2009). A mean *D-20* maximum score of 3 is indicative of a self-report rating of exceptionally delinquent behavior, while a minimum score of 0 is indicative of absent self-self-reported delinquent behaviors. Our Pilot sample reported fewer life-time incidences of delinquent behaviors.

Drug Abuse Screening Test. DAST (Skinner, 1982) data from Sample I (*M* = 0.22, *SD* = 0.24, *N* = 54) are significantly lower than that of normative scores from a comparison sample (*M* = 0.55, *SD* 0.48, *N* = 207; *t* (259) = 4.89, $p < .01$) that was comprised of a community sample (Figueredo & Wolf, 2009). A mean *DAST* maximum score of 1 is indicative of a self-report rating of very high drug abuse, while a minimum score of 0 is indicative of absent self-self-reported drug abuse behaviors. Our Pilot sample reported fewer symptoms of drug abuse than the normative comparative sample.

Mini-Mental State Examination. MMSE data from Sample I (*M* = 27.51, *SD* = 2.2, *N* = 54) indicate scores significantly lower than that of normative scores from a comparison sample (*M* = 29.00, *SD* = 2.23, *N* = 1,326; *t* (1378) = 4.91, $p < .01$) that was comprised of a community sample of adults ages 18-24 (Crum, Anthony, Bassett & Folstein, 1993). An *MMSE* score in the range of 27-30 is indicative of normal cognitive function (Folstein, Folstein & McHugh, 1975). Although our Pilot sample demonstrated general cognitive ability that was statistically lower than the normative sample, our participant's over-all cognitive abilities were not in the impaired range.

Reading the Mind in the Eyes Test. The *Eyes Test* data from Sample I (*M* = 21.11, *SD* = 4.76, *N* = 54) indicate scores significantly lower than that of normative scores from a comparison sample (*M* = 26.23, *SD* = 3.61, *N* = 122; *t* (174) = 7.82, $p < .01$) that was comprised of a community sample of adults (55% male; Baron-Cohen, Wheelwright &

Hill, 2001). A maximum score of 30 is indicative of exceptional ability to “read one’s mind” based on facial expression (Baron-Cohen, Wheelwright & Hill, 2001).

Trail-Making Test-B. Trails B data from Study I (*M* = 73.62, *SD* = 36.00, *N* = 54) indicate significantly lower performance scores than that of normative scores from a comparison sample of ages 15-19 (*M* = 49.80, *SD* = 15.23, *N* = 83; *t* (135) = 5.34, *p* < .01) and ages 20-29 (*M* = 58.71, *SD* = 15.92, *N* = 35; *t* (87) = 2.30, *p* < .05) that was comprised of a normal sample (Yeudall, Reddon, Gill, & Stefanyk, 1987). This is a timed test, with scores reflecting number of seconds taken to complete the test; higher scores indicate slowed ability to shift between numbers and letters.

Rey-Osterrieth 30-Minute. Rey-O 30-Minute data from Study I (*M* = 13.07, *SD* = 4.65, *N* = 54) indicate scores significantly lower than that of normative scores from a comparison sample (*M* = 19.28, *SD* = 7.29, *N* = 48; *t* (100) = 5.19, *p* < .01) that was comprised of a community sample of adults ages 30-50 (46% male; Fastenau, Denburg & Hufford, 1999). A maximum score of 36 represents a summed performance-based score of 18 components required to recreate a drawing of a complex figure after engaging in other tasks for 30 minutes. This maximum score indicates superb shifting performance (Osterrieth, 1944).

Shipley Institute of Living Scale. Shipley data (combined *Vocabulary* and *Abstraction* scores combined to create an intelligence quotient) from Study I (*M* = 94.82, *SD* = 12.50, *Range* = 80-117, N = 54) indicate mean IQ scores significantly lower than that of normative scores from a comparison sample (*M* = 112.00, *SD* = 5.60, *N* = 64; *t*

(116) = 9.90, $p < .01$) that was comprised of a sample of paid volunteer adults ages 20-29 (Harnish, Beatty, Nixon, & Parsons, 1994).

Overview of Comparison Data. Over-all, the comparison data indicate that our community sample and the normative samples did not statistically differ in over-all LH strategy, as measured by the *Mini-K* and *MVI*. Also, our community sample reported some trait qualities that are suggestive of slower strategists. Compared to the normed data, the sample reported fewer symptoms of depression and anxiety (as measured by the *HSCL*), and greater work ethic scores than the community or Air Force samples (as measured by the *MWEP*). Further, the sample reported several comparable socially antagonistic attitudes, such as mating effort, and *fewer* indicators of delinquent and drug-using behaviors than the comparison samples. Finally, their neuropsychological test scores were uniformly lower than scores from our normative samples. This pattern was consistent across domains of over-all cognitive ability (i.e., the *MMSE*), frontal function (i.e., *Trails B* and *Rey-O 30-Minute*), amygdalar function (i.e., *The Eyes Test*), and general cognitive ability (i.e., the *Shipley*).

Common Factor Models.

Previous K-Factor research used theoretically derived regression coefficients to define factors (see Figueredo et al., 2006, for review). These factors were determined by constructing each factor based on the correlation of each scale to a theoretically defined factor model. In the present research, bivariate correlations among the higher-order factors of interest were calculated by the PROC CORR procedure and are displayed in Table 3, which presents a correlation matrix of K-Factor scales and illustrates strong correlations among most of the K-Factor scales. The factors based on these latent constructs were used in all subsequent analyses.

In addition, we used exploratory factor analyses (EFAs) for each of the hypothesized higher-order neuropsychological factors to determine how these data fit the theoretical models. The theoretically specified factors were comprised of the mean of the standardized variables of interest, which created a new coefficient representing that factor. Each of the standardized means representing the variables of interest were correlated with their respective common factor.

K-Factor. In Study I, the theoretically specified K-Factor scales were the *Mini-K, Impulse Control Questionnaire, Mate Value Inventory, Multidimensional Work Ethic Profile*, and the *Hopkins Symptom Checklist*. Bivariate Pearson correlations among these scales can be seen in Table 3. The Mini-K correlated with each of these scales, with the exception of the Impulse Control Questionnaire, which only approached significance at $r = .23$ ($p = .063$). Further, the mean standardized score of each of these scales correlated significantly with the anticipated factor; correlations ranged from $r = .58$ to .76 ($p < .001$), as can be seen in Table 4 which illustrates the correlations of each variable's standardized mean score with the K-Factor. Because each of the included scales measured traits that are theoretically specified to measure LH strategy, the factor warrants the name K-Factor.

Self-Regulation Factors. Our neuropsychological tests measured self regulation. Subtests that measure each self-regulation domain were identified *a priori* based on the primary abilities required by participants to successfully complete each task (as described above). These factors were identified based on expert consensus (W. Jake Jacobs and Christopher J. Wenner) rather than via EFA.

The *Rey-O 30-Minute* score, *Trails B* score, and the *Route, Delayed* raw score from the *Rivermead Behavioral Memory Test-E* measured Shifting abilities. The *Concentration/Working Memory* subtest from *Mini-Mental State Exam* and the *Route, Immediate* raw score from the *Rivermead Behavioral Memory Test-E* measured Updating abilities. None of our instruments or their sub-tests directly measured Inhibition. The Shifting-Factor and Updating-Factor correlated (r = .42, p < .001; see Table 5 which illustrates this correlation). Because each scale measured theoretically specified Shifting and Updating functions, the two factors warrant the names Shifting-Factor and Updating-Factor, respectively. The Shifting-Factor and Updating-Factor correlated with the higher-order Self-Regulation Factor (r = .84 and .85, p < .001, respectively; see Table 6 presents the correlations of the Shifting and Updating factor's standardized mean scores with the SR-Factor). Because each of the scales measured traits theoretically specified as measure executive functions, this factor warrants the name SR-Factor.

AB-Factor. The *Mating Effort Scale, Self Monitoring Questionnaire, Psychopathic Personality Inventory*, *Impulsive Behaviors Questionnaire*, *Life Experiences Questionnaire-R*, *Delinquency Short Form*, and the *Drug Abuse Screening Test* scales measured socially antagonistic attitudes *and* behaviors. Each scale correlated significantly with the anticipated factor, ranging from r = .44 to .74, p < .001 (see Table 7). Table 7 is presented because it illustrates the correlations of antagonistic attitude and behavior scales with AB-, A-, and B-Factors. Because each scale measured traits theoretically specified as socially antagonistic attitudes and behaviors, the factor warrants the name AB-Factor.

A-Factor. The *Mating Effort Scale, Self Monitoring Questionnaire,* and the *Psychopathic Personality Inventory* scales measured socially antagonistic attitudes. Each of these three scales correlated significantly with the A-Factor; ranging from r = .76 to .81, p <. 001 (see Table 7). Although two of these three scales also correlated significantly with the B-Factor, these correlations were substantially lower than with the A-Factor. Therefore, we designated these three scales to the A-Factor. Because these scales measures traits theoretically specified primarily as socially antagonistic attitudes, the factor warrants the name A-Factor.

B-Factor. The *Impulsive Behaviors Questionnaire*, *Life Experiences Questionnaire-R, Delinquency Short Form,* and the *Drug Abuse Screening Test* measured socially antagonistic behaviors. Each scale correlated significantly with the anticipated factor, ranging from r = .65 to .83, p < .001 (see Table 7). Although two of these four scales also correlated significantly with the A-Factor, these correlations were substantially lower than with the B-Factor. Therefore, we designated these four scales to the B-Factor. Because each of these scales measured traits theoretically specified to measure socially antagonistic behaviors, the factor warrants the name B-Factor. Further, the AB-Factor correlated with the A-Factor (r = .78, p < .001) and the B-Factor (r = .88, p < .001); the A-Factor and B-Factor correlated (r = .40, p < .001) indicating discriminant validity between the factors (see Table 8 which illustrates well the correlations among the AB-, A-, and B-Factors).

g-Factor. The *Shipley's Vocabulary* and *Abstraction* subtests were theoretically specified as measures of general cognitive ability. These two measures correlated significantly with each other (r = .36, p < .01) and with the *g*-Factor (r = .83 and .83, p < .001). Because these scales measures traits theoretically specified as measures of general cognitive ability, the factor warrants the name *g*-Factor.

Correlations Among Factors

Exploratory correlation analyses among factors revealed lack of statistical correlation to be the typical rule. In our initial correlational matrix, the K-Factor, AB-Factor, and *g*-Factor were all not statistically correlated.

Exploratory Correlations Among Factors

In a telling correlational matrix, we examined the K-Factor, AB-Factor, A-Factor, B-Factor, and *g*-Factor by the SR-Factor, Shifting-Factor and Updating-Factor. Here, with the following exceptions, a lack of statistical correlation was the rule –only five of the fifteen correlations were statistically significant: The AB-Factor and Shifting-Factor correlated (r = -.28, p < .05); the A-Factor correlated with the SR-Factor *and* the Shifting-Factor (r = -.36 and -.44, p < .01, respectively); and finally the *g*-Factor correlated with the SR-Factor and the Shifting-Factor (r = .26 and .30, p < .01, respectively). The lack of meaningful pattern among these few correlations is noteworthy, along with the fact that two-thirds of the correlations were nonsignificant. However, the occurrence of five statistically significant correlations out of fifteen analyses may be due to Type I error (see Table 9 for the complete matrix which illustrates the correlations of the higher order factors with the SR-Factor, Shifting-Factor, and

Updating-Factor). Nonetheless, this matrix suggests that the date do not fit our initial model.

Exploratory Factor Analyses of Neuropsychological Tests

We computed theoretically specified factors, incorporating each of the neuropsychological sub-tests. As before, each factor was comprised of the mean of the standardized variables of interest, which created a new coefficient representing that factor. The factors based on these latent constructs were used in all subsequent analyses.

Brain Region. Our initial factorial differentiation was based on brain region, with *a priori* designation of 28 test and subtest scores devoted to factors we labeled as Frontal (Lobes), Amygdala, Hippocampus, Temporal (Lobes), and Parietal (Lobes). Test scores were designated to each factor based on expert consensus (W. Jake Jacobs and Christopher J. Wenner) of the brain locale primarily associated with the requisite abilities to perform each test well. Each of the factors are comprised of the mean scores of the tests and subtests that make-up each factor. See Table 10 for the bivariate correlation of each measure with each factor. The factors are as follows:

Frontal Factor. The *MMSE, Digit Span Forward, Digit Span Backward, Rey-O Copy, Rey-O 3 Min, Rey-O 30 Min, Trails-A, Trails-B, Shipley Vocabulary, Shipley Abstraction*, and from the *Rivermead*, the *Route Immediate* and the *Route Delayed* subtest scores.

Amygdala. The *Eyes Test.*

Hippocampus. Rey-O Copy, Rey-O 3 Min, Rey-O 30 Min, Trails-A, Trails-B, Logical Memory I Recall, Logical Memory II Recall, Recognition, AZ Map Test, US Map

Test, and from *The Rivermead*, the *First Name, Last Name, Belongings, Appointments, Story Immediate, Story Delayed, Route Immediate, Route Delayed*, and *Messages Immediate* subtest scores.

Temporal. *Rey-O Copy, Rey-O 3 Min, Rey-O 30 Min, Logical Memory I Recall, Logical Memory II Recall, Recognition,* and from the *Rivermead*, the *Belongings Appointments, Story Immediate, Story Delayed,* and *Messages Immediate* subtest scores.

Parietal. Rey-O Copy, Rey-O 3 Min, Rey-O 30 Min, the *Eyes Test, AZ Map Test, US Map Test,* and from the *Rivermead*, the *Picture Recognition, Face Recognition, Route Immediate, Route Delayed, Messages Immediate,* and *Orientation & Date* subtest scores.

We conducted the correlational analysis using PROC CORR. Theoretically, the specified neuropsychological subtests comprising each of the five factors ought to correlate well within factors (convergent validity) but correlate less well between factors (discriminant validity). Again, correlational analyses showed a consistent pattern of correlations between each test score (with the exceptions of the Rivermead test scores, which were inconsistent) and each of the lower-order factors, suggesting poor convergent validity within brain region (see Table 10). Table 10 is presented because it illustrates the general proclivity of most of our test scores to correlate with each of the factors, with the exception of *Amygdala* (which has relatively few correlates). Further, the second correlation matrix indicated strong and consistent correlations between lower-order factors, suggesting poor discriminant validity (see Table 11 which is presented because it illustrates this pattern well).

Moreover, each of the five theoretically specified lower-order factors ought to remain distinct, rather than converge as a single higher-order factor. This pattern would support the hypotheses that our neuropsychological subtests do indeed differentiate neuropsychological ability as pre-specified by brain region. To examine this prediction, we first conducted a principal factors procedure using PROC FACTOR. We identified a single eigenvalue (3.15), based on Kaiser's (1960) rule of selecting eigenvalues above 1.0. This single factor accounted for the largest proportion of variance (96.3%). Further, Cattell's (1966) subjective scree test indicated that a single factor solution best fit these data. Based on these three criteria, I accepted this single factor as a disconfirmation of our hypothesis that these neuropsychological subtests differentiate cognitive ability as pre-specified by brain region. The factor loadings for this single-factor solution were all in the high range (.70 to .95) with the exception of Amygdala, which was low (.37).

Brain Function I. Our second factorial differentiation was based on brain function, with *a priori* designation of the same 28 subtests devoted to factors we labeled Attention-1, Short-Term Memory, Long-Term Memory, Verbal Ability, Spatial-1, and Social Performance Ability. Test scores were designated to each factor based on expert consensus (W. Jake Jacobs and Christopher J. Wenner) of the brain function primarily associated with the requisite abilities to perform each test well. Each of the factors are comprised of the mean scores of the tests and subtests that make-up each factor. See Table 12 for the bivariate correlation of each measure with each factor. Table 12 is presented because it illustrates the general proclivity of most of our test scores to correlate with each of the factors, with the exception of *Social*, which has relatively few correlates. The factors are as follows:

Attention-1. The *Digit Span Backward, Rey-O Copy, Trails-A, Trails-B, Shipley Abstraction, Logical Memory I Recall, Logical Memory II Recall, The Eyes Test,* and from the *Rivermead*, the *Story Immediate, Route Immediate*, and *Messages Immediate* subtest scores.

Short-term Memory (STM). The *Digit Span Forward, Digit Span Backward, Rey-O 3 Min, Trails-B, Logical Memory I Recall,* and from the *Rivermead*, the *Picture Recognition, the Story Immediate, Route Immediate,* and *Messages Immediate* subtest scores.

Long-term Memory (LTM). The *Rey-O 30 Min, Logical Memory II Recall, Recognition*, the *Eyes Test, AZ Map Test, US Map Test,* and from the *Rivermead, the First Name, Last Name, Belongings, Appointments, Picture Recognition, Story Delayed, Route Delayed,* and *Orientation & Date* subtest scores.

Verbal. The *Shipley Vocabulary, Logical Memory I Recall, Logical Memory II Recall, Recognition*, the *Eyes Test*, and from the *Rivermead*, the *Story Immediate, Story Delayed* subtest scores.

Spatial-1. The *Rey-O Copy, Rey-O 3 Min , Rey-O 30 Min, Shipley Abstraction, Logical Memory I Recall, Logical Memory II Recall, Recognition, AZ Map Test, US Map Test*, and from the *Rivermead*, the *First Name, Last Name, Belongings, Appointments, Story Immediate, Story Delayed, Route Immediate, Route Delayed, Messages Immediate,* and *Orientation & Date* subtest scores.

Social. The *Eyes Test*, and from the *Rivermead*, the *First Name, Last Name, Belongings, Appointments, Story Immediate, Story Delayed, Face Recognition, Route Immediate, Route Delayed, Messages Immediate,* and *Orientation & Date* subtest scores.

Analyses and procedures were identical to those of Brain Region, above, with identical predictions identifying convergent and discriminant validity. Again, correlational analyses showed a consistent pattern of correlations between each test score (with the exceptions of the Rivermead test scores) and each lower-order factors, (with the exception of Social; see Table 12 which illustrates this well), and consistent and strong correlations between lower-order factors, suggesting neither convergent nor discriminant validity (see Table 13, which illustrates this well).

Also, as before, each of the six theoretically specified lower-order factors ought to differentiate neuropsychological ability as pre-specified by brain function. We identified a single eigenvalue (4.42) that accounted for 90.3% of the variance. Further, a subjective scree test indicated that a single factor solution best fit these data. I accepted this single factor as a disconfirmation of our hypothesis that these neuropsychological subtests differentiate cognitive ability as pre-specified by brain function. Factor loadings were all in the high range (.85 to .96.) with the exception of Social Performance Ability, which was moderate (.55).

Brain Function II. Given the previous failures to identify regional or function distinctions in our battery of neuropsychological tests, we developed a third factorial differentiation based on brain function. Again, we designated *a priori* 28 different subtests, many of which were included in *Brain Region* and *Brain Function I,* above, and were devoted to factors labeled Recall, Spatial-II, Attention-II, and Executive Functions. Again, test scores were designated to each factor based on expert consensus (W. Jake Jacobs and Christopher J. Wenner) of the brain function primarily associated with the requisite abilities to perform each test well. Each of the factors are comprised of the mean scores of the tests and subtests that make-up each factor. See Table 14 for the bivariate correlation of each measure with each factor. Table 14 is presented because it illustrates the general proclivity of most of our test scores to correlate with each of the factors, with the exception of *Executive Functions*, which has relatively few correlates). The factors are as follows:

Recall. The *Rey-O 30 Min,* and *Recognition*, and from the *Rivermead*, the *Story Delayed* subtest score.

Spatial-II. The *Rey-O Copy, AZ Map Test, US Map Test,* and from the *Rivermead,* the *Route Immediate* and *Route Delayed* subtest scores.

Attention-II. The *MMSE, Digit Span Forward, Digit Span Backward, Trails-B, Logical Memory I Recall, Logical Memory II,* and from the *Rivermead*, the *First Name, Last Name, Belongings, Appointments, Picture Recognition, Story Immediate, Face Recognition, Messages Immediate,* and *Orientation & Date* subtest scores.

Executive Factor. *Shifting* and *Updating* factors as described above.

Analyses and procedures were identical to those described above, with identical predictions identifying convergent and discriminant validity, which, yet again, shows an inconsistent pattern of correlations between each test score and the lower-order factors (see Table 14 which illustrates this well) and consistent and strong correlations between lower-order factors, suggesting neither convergent nor discriminant validity (see Table 15, which illustrates this well).

Finally, each of the four theoretically specified lower-order factors ought to differentiate neuropsychological ability as pre-specified by brain function. I identified a single eigenvalue (1.82), and this single factor accounted for 83.8% of the variance. A subjective scree test indicated that a single factor solution best fit these data. I accepted this single factor as a disconfirmation of our hypothesis that these neuropsychological subtests differentiate cognitive ability as pre-specified by brain function. Factor loadings for Spatial Ability and Executive Functions were in the mid to high range (.83 & .76, respectively) with the exception of Recall and Attention, which were moderate (.55 & .51, respectively).

Exploratory Factor Analysis of the Model

Given the previous failures to identify regional or function distinctions in our battery of neuropsychological tests, as well as our model predictions of the relationship between the Mini-K, the K-Factor, the AB-Factor, General Brain Function Factor, and the *g*-Factor, we developed a fourth factorial differentiation based on this model with *a priori* designation of neuropsychological subtests devoted to each of those domains. Each of the factors are comprised of the mean scores of the tests and subtests that make-up each factor. The factors are as follows:

Mini-K. Consists solely of the *Mini-K*.

K-Factor. The *Mini-K, Impulse Control Questionnaire, Mate Value Inventory, Multidimensional Work Ethic Profile*, and the *Hopkins Symptom Checklist*.

AB-Factor. The *Mating Effort Scale, Self Monitoring Questionnaire, Psychopathic Personality Inventory, Impulsive Behaviors Questionnaire, Life Experiences Questionnaire-R, Delinquency Short Form*, and the *Drug Abuse Screening Test*

General Brain Function. The *MMSE, Digit Span Forward, Digit Span Backward, Rey-O Copy, Rey-O 3 Min, Rey-O 30 Min, Trails-A, Trails-B, Shipley Vocabulary, Shipley Abstraction*, the *Eyes Test AZ Map Test, US Map Test*, and from the *Rivermead*, the *First Name, Last Name, Belongings, Appointments, Picture Recognition, Story Immediate, Story Delayed, Route Delayed, Face Recognition, Route Immediate, Messages Immediate*, and *Orientation & Date* subtest scores.

Analyses, procedures, and validity predictions were identical to those described above which revealed fairly consistent patterns of correlations among the neuropsychological subtests with the General Brain Function-Factor as well as with the *g*-Factor (statistically significant correlations ranged from $r = .29$, $p < .05$ to $r = .83$, $p < .001$; see Table 16). These patterns are suggestive of poor discriminant validity between General Brain Function-Factor and the *g*-Factor, consistent with the proposal that *g* is an indicator of general cognitive ability (Spearman, 1904).

There was, however, a general lack of correlation among the neuropsychological subtests and the Mini-K, K-Factor, and AB-Factor. These patterns indicate that even individual neuropsychological subtests bear no consistent theoretically specified statistical relationship with LH measures or socially antagonistic behaviors. See Table 16 for the bivariate correlation of each measure with each factor. Table 16 is presented because it illustrates the general proclivity of most of our test scores to correlate with the General Brain Function Factor and *g*-Factors, but not the Mini-K, K-Factor, nor the AB-Factor.

We next ran correlations between all of the pre-specified lower-order neuropsychological factors and the Mini-K, K-Factor, AB-Factor, General Brain Function-Factor, and the *g*-Factor, which again revealed a consistent patterns of correlations between *all* of the pre-specified lower-order neuropsychological subtest factors and both the General Brain Function-Factor and the *g*-Factor (correlations ranged from $r = .25$, $p < .05$ to $r = .96$, $p < .001$; see Table 17). Further, virtually all of these neuropsychological factors showed non-significant correlations with the Mini-K, K-Factor, and AB-Factor. The exception to this pattern is that the Amygdala factor correlated significantly and negatively with the Mini-K and K-Factor ($r = -.27$, $p < .001$; $r = -.28$, $p < .001$; respectively). Table 17 is presented because it illustrates well that all of our neuropsychological factors correlate with the General Brain Function Factor and *g*-Factors, but typically do not correlate with the Mini-K, K-Factor, nor AB-Factor. Although these correlations support the LH notion that slower strategists in our sample's age bracket have poorer amygdalar function than fast strategists, these results may again be the result alpha slippage.

Summary of Exploratory Factor Analyses. Although our *a priori* specified factors that measure LH strategy (K-Factor), combined and differentiated socially antagonistic attitudes and behaviors (AB-, A-, and B-Factors), self-regulatory abilities (Shifting- and Updating-Factors) and general cognitive ability (*g*-Factor) held together well, their relations with each other were typically not statistically correlated, and when significantly correlated, they were theoretically inconsistent and possibly driven by alpha slippage.

Further, the exploratory factors constructed with the neuropsychological subtests were inconsistent within factors (i.e., the standardized subtest scores inconsistently correlated with the lower-order factor coefficients), which demonstrated poor convergent validity. Moreover, the correlation matrices and EFA results showed very consistent relationships between factors, indicating poor discriminant validity. Hence, our theoretically specified factors based on brain region and brain function were typically measuring one thing, over-all neurological ability.

Summary of Pilot Results

Study I was designed to inform our research program on future proceedings in the domains of 1) research methodology, 2) new instrument validation, 3) characterization of our community population, and 4) initial testing of our theoretical model. Study I and Study II of the Pilot informed us in these domains.

Methodology. Over-all, the design worked well, despite a heavy response burden on participants. Our experience with the Delay of Gratification protocol illustrated the necessity for flexibility with this population; participants frequently did not maintain scheduled assessment appointments or return for further assessment. Even though consistency in the order of assessment sessions across participants is ideal, this often is not feasible given time constraints, participant availability within time slots, participant characteristics, and space availability.

Instrument Validation. Our newly developed instruments typically showed acceptable internal consistency estimates (see Table 1 for Cronbach's alpha coefficients of each of our instruments, including our newly developed Jake's Temptations Questionnaire, Impulse Control Questionnaire, and Impulsive Behaviors Questionnaire).

Population Characterization. Participant recruitment must contend with low recruitment rates, the possibility that the acquired sample is self-selecting, and that the obtained sample may be comprised of more inquisitive and conscientious community members. Also, drop-out rates in this population were substantial, possibly due to the response burden of our study as well as extraneous factors such as participant discontinuation from the training program. As such, our final sample with useable data, again, may be comprised of participants with traits more characteristic of slow strategists (e.g., predictably consistent behavior and "stick-to-it-ness").

Anecdotal evidence from research personnel suggest that some of our participants had difficulty reading our questionnaires. Future participant recruitment ought to establish literacy at the 8th grade reading-level an inclusion criterion.

Finally, comparison of our sample with normed data indicate that, in many ways (i.e., those specific to LH characteristics), this sample compares favorably to other community samples. Further, although, over-all averaged performance on neuropsychological tests was statistically lower than the comparison samples, our community sample reported higher work ethic and delay of gratification scores, as well as lower rates of delinquent behaviors, including drug abuse. These reports may very well be accurate, particularly given possible biases in our self-selected sample and circumstances surrounding attrition. As a precaution against self-reported “socially desirable” responses, however, subsequent data analyses ought to account for this possibility.

Theoretical Model. Our correlational analyses indicate that our multiple theoretically specified scale composites are typically not statistically correlated: the K-Factor was not associated with socially antagonistic attitudes or behaviors. We did, however, find that one component of executive functions – shifting – is associated with the AB-Factor and *g*-Factor. Also, consistent with our group’s previous research on LH and general cognitive ability, the pilot data presented here suggest that *g* is not statistically correlated to the K-Factor.

Further, data presented here indicate that neither K-Factor nor *g* predict socially deviant attitudes or behaviors. Rather, self-regulation correlates, along with K, peoples’ socially deviant attitudes and behaviors. That is, measures of self-regulation correlate negatively to self-reported deviant attitudes, and acts based on those attitudes (Valdez, 2005).

Finally, our correlational analyses EFAs indicate that our multiple theoretically specified brain function composites did not differentiate brain regions or brain functions; they all appear to be measuring general cognitive function. As indicated above, the exceptions are the correlations between shifting both the AB-Factor and the *g*-Factor.

DISCUSSION

Analyses of these data produced surprising, but not alarming, results. For example, the three brain function composites do not correlate with each other, with the K-Factor, or with the socially antagonistic attitudes/behaviors factor. Further, the K-Factor does not correlate with the socially antagonistic attitudes/behaviors factor. We did, however, find that one component of executive functions –set shifting- is associated with socially antagonistic attitudes/behaviors and general cognitive ability. Because executive functions (i.e., self-regulation abilities) appear to be related to socially antagonistic attitudes and behaviors – and theoretically ought to have a strong relationship with LH strategies - we set aside amygdalar and hippocampal functions and proceeded to focus on frontal lobe functions exclusively.

Although these exploratory results appear to disconfirm our initial hypotheses, we continued with Study II. First, although it is possible the lack of relationship found between the K-Factor, the AB- factor, and brain function will re-appear in Study II, we suspected this to be unlikely with a larger sample size and with data that are void of concerns of socially desirable responding and reading ability.

Study II

Procedural Adjustments to Study II

In collaboration with agency personnel, we demonstrated the success of running a large-scale research study in a way that was consistent with and complements the ongoing operations of the community-based training program. Nonetheless, adjustments to our research procedures were necessary to acquire a large sample (i.e., one suitable for data analyses such as structural equations modeling), as well as controlling possible response bias (i.e., social desirability) and ability to accurately read and respond to our instruments.

Increasing Sample Size. The small sample in Study I is largely a result of difficulty recruiting and retaining participants. In part, this was due to intricate personnel, recruitment and data collection procedures that are common in field studies. Largely, though, this was the result of the population and local environment being “spontaneous” with priorities, plans, and schedules often changing abruptly and without notice. This made follow-through of scheduled assessment difficult. We refined these procedures.

First, we adapted our assessment procedures to their system; we worked with participants when they were immediately available, rather than schedule in advance. Second, we also discontinued the DOG procedure. Third, we worked more closely with agency personnel who began taking a more directive approach in their role in recruiting appropriate youths for the study. Fourth, our research team took a number of steps towards better integrating with the community agency “system”, which greatly improved our ability to locate and work with consented participants.

Also, the lack of correlations among our neuropsychological measures led to a de-emphasis on neuropsychological testing. More research personnel hours were directed towards mass-testing. In Study II, we recruited participants and collect data with more efficiency and at a much more substantial pace than in Study I.

Social Desirability. Our data indicate that the community sample is well within the average range on some measures, and above average on others. They are a normal, non-impaired population. Nonetheless reporting rates of deviant behaviors, including substance abuse that *were*, surprisingly, lower than our normed data. The participants also demonstrated trait scores that were statistically greater than that of our normed data (such as work ethic and ability to delay gratification). To account for the possibility that some of the community participants responded to our instruments in a socially desirable direction (e.g., due to concern that they would be removed from the program for reporting illicit activity) we decided to control for social desirability on each of our instruments with the *Marlowe-Crowne Social Desirability Scale* (Strahan & Gerbasi, 1972).

Reading Ability. Anecdotal evidence from research personnel suggest that some of our participants had difficulty reading our questionnaires. Future recruit guidelines ought to establish literacy at the 8th grade reading-level an inclusion criterion.

Sample I

Sample I Overview

Following up on the pilot results, Study II was designed as a confirmatory study to test the predictions outlined in the introduction. We collected Sample I data within Study II from the community agency from May 2006 through December 2007.

Inclusion Criteria. Two inclusion criteria were employed: consenting participants were required to be aged 18 or over and able to read at the eighth-grade level or higher. Participant's reading level, based on the *Tests of Adult Basic Education-Reading Form* (*TABE*; 1987), was verified from pre-existing agency files of *TABE* scores following the consenting process.

Recruitment. Two-hundred and twenty-two students responded to agency invitations and flyers about our study and signed up for our information and consenting session; of these, 23 registered invitees did not show up for the scheduled session. One-hundred ninety-nine students attended our sessions, and of these, 183 students consented to participate in our study; however 18 students did not qualify for the study because their *TABE* scores indicated that they did not meet our literacy inclusion criterion of 8th grade reading proficiency.

One-hundred and sixty-five participants began the study, of these, 5 participants gave indication of problems reading our questionnaires – they discontinued the study and their data were excluded from the analyses. We also removed date from participants who consented and began the study but provided no useable data. Our final *N* for analyses = 155.

Attrition. Seventy-five (45.5%) of the Sample I participants in Study II completed all five testing sessions. Among the participants who did not complete the study (*N* = 90, 55.5%), 24 (27.7%) did not continue because they were “no longer at the agency” (as reported by agency staff, with no further explanation), 19 (21.1%) self-reported to our personnel that they chose not to continue, 17 (18.8%) did not continue for undocumented reasons, 17 (18.8%) because their agency responsibilities prohibited them from participating, 8 (8.8%) because they forgot their necessary password, and 5 (5.5%) because the youths expressed difficulty reading our questionnaires, despite having adequate *TABE* scores. Nonetheless, we acquired useable data from partial data sets from *N* = 121 participants.

Method

Participants

One-hundred fifty-five (70 female, 85 male) agency youths comprised Sample I of Study II and provided complete or partial and useable data sets. Our participants' ages ranged from 18 to 25 (M = 19.58, SD = 1.60), and their *TABE* reading scores were all above 550 (M = 579.35, SD = 90.01, *range* = 550-690). Thus, their *TABE* scores correspond to school-grade reading levels ranging from 8.0 to 13.0, with an average of 9.6. Further, among our participants who reported educational achievement (n = 108), nearly two-thirds graduated from high-school, received a *General Educational Development* (*GED*) certificate, or had some college experience (n = 62.9%). The remaining 37% of participants completed the 7th grade (1.9%), 8th grade (2.8%), 9th grade (8.3%), 10th grade (13%), or the 11th grade (11.1%).

Ethnic variation in our sample consisted of participants who self-identified as Hispanic (43%), Native American (19.3%), Caucasian (19.3%), Black (8.8%), Pacific Islander (3.5%), Asian (.9%), and Other (5.3%).

Procedure

Recruiting. We used two recruiting approaches at the community agency. With the first approach, youths new to the program were invited by agency staff to participate on an optional "research presentation session". This took place on a weekly basis, with recruitment success ranging from 3 to 21 new participants. In the second recruitment procedure, youths who had not yet participated in the recruitment session were identified by agency staff and invited to participate in the research presentation. After being invited by agency personnel to hear a voluntary recruitment speech administered by our research personnel, consenting youths began the two primary components of the study.

Testing. The first testing component involved scheduled group-testing, in which participants completed three packets of questionnaires, taking up to 65-minutes per packet. Up to twenty-one participants were in each testing group, with precautions taken to ensure that participants were not discussing the material or viewed each others' responses.

The second component involved two neuropsychological testing sessions. These sessions were conducted spontaneously to avoid complications of missed appointments; our psychometricians would simply arrive at the agency and test participants who were readily available and willing to volunteer their time. The psychometricians worked with one participant at a time in a private room. Each neuropsychological testing session took up to 65-minutes. Thus, each participant received about five hours of testing.

Participant Compensation. Participants were compensated with fifty ($50.00) U.S. dollars worth of Wal-Mart gift cards (http://www.walmart.com). Participants received one five-dollar gift card for completing each of the first four sessions, and thirty-dollars for completing the fifth and final session.

Research Personnel. Graduate and undergraduate-level university students conducted all recruiting, neuropsychological tests and questionnaire assessments. They were trained and supervised by one doctoral and one masters-level clinician; the former possessing extensive neuropsychological experience and expertise; the latter possessing training and experience typical of advanced doctoral-level students. Training centered on neuropsychological testing and also targeted on professional conduct (i.e., proper social conduct with research participants, agency staff and administrators), ethics (e.g., maintaining participant confidentiality and anonymity), and data and testing documentation.

Psychometrician Adherence. For quality control during all of our work at the agency –and particularly during testing- at least two research personnel worked together at all times. During the neuropsychological testing, two research personnel who met pre-specified neuropsychological testing standards (i.e., “psychometricians”) worked together with each participant. One psychometrician performed as the “assessor,” while the second psychometrician served as the “observer.” While the assessor was responsible for the actual testing and noting testing error and environmental obstructions, the observer’s responsibility was that of quality control: to closely monitor and notate the assessor’s performance.

During Sample I of Study II, 21 advanced undergraduate students (5 male, 16 female) and 1 female first-year graduate student served as psychometricians (age range from 19 to 27). Two of the undergraduate students were previously trained during the Study I and received further training on new procedures and neuropsychological tests. In total, each psychometrician received between 40 and 67 hours of group and individual training prior to attaining psychometrician status. Their training included demonstration of flawless proficiency with general conduct, documentation, questionnaire administration, administration of individual neuropsychological tests, and mock performance sessions that included each of the complete neuropsychological testing sessions. Each person’s proficiency was directly assessed and approved by at least one of the supervisors. Further, when possible, the master-level supervisor served as observer during each psychometrician’s maiden testing sessions with study participants. Further, throughout the entire data collection period, weekly supervision meetings allowed for ongoing training. Assessor and observer notes and reports that indicated flawed testing ability provided focal topics for further neuropsychological and general conduct training.

Following the testing session, and prior to test scoring and data entry, at least one of the supervisors read, discussed, and evaluated all notes for evidence of invalid test scores (e.g., as a result of psychometrician error or external interruption during testing). Occurrences of questionable events during testing were discussed among the supervisor(s), administrating psychometricians, and all psychometricians during weekly supervision meetings. Suspect data were identified as “invalid” and denied entry to our database.

Psychometrician Error. Throughout neuropsychological testing in Sample I of Study II, three of our research personnel did not demonstrate testing competency and never served as psychometricians. Of the remaining 22 psychometricians, none were identified as having difficulty maintaining testing precision. However, two of our 22 psychometricians (9%) did not maintain professionalism in the field and were removed from the field site and relegated to administrative work (although their testing skills were proficient).

The specific tests that our psychometricians invalidated due to psychometrician error were removed from analysis as were tests that were invalidated due to other causes.

Our records do not distinguish the source of test invalidation. Nonetheless, twenty-one tests and twenty-three subtests (within the Modified Stroop and Rey-Osterreith tests) were invalid and their scores were not included in our analyses (within N = 76): the Five-Point Test (n = 3), the Shipley (n = 8), Trails A (n = 4), Trails B (n = 6), the Modified Stroop (n = 12 subtests), and the Rey-Osterreith (n = 11 subtests).

Measures

Modifications Following Study I. The following tests were removed from our study following the Pilot because they demonstrated poor correlations with our theoretically derived factors or proved insufficient or inappropriate for the community population: *Self Monitoring Questionnaire, The Eyes Test, Arizona Map Test, U.S. Map Test*, *Logical Memory* subtest from the *Wechsler Memory Scale, Digit Span* subtest from the *Wechsler Memory Scale, Mini-Mental Status Exam, Rivermead Behavioral Memory Test-E, The Executive Interview*, and the *Mating Effort Scale*.

Life History Strategy

Life history theory predicts that individual differences in many behavioral and cognitive indicators of LH strategy will be explained by a single factor, the K-Factor. These indicators should include variance in relationship quality an individual has with their parents, romantic/sexual partner, and children; the amount of support given and received to kin and non-kin; religiosity; socioeconomic status; and a range of attitudes that reflect an individual's perception and response to their environment. Although the *Mini-K, Multidimensional Work Ethic Profile, Mate Value Inventory*, and the *Hopkins*

Symptom Checklist all loaded well on the K-Factor in Study I, we decided to use a more purified set of scales, the *Arizona Life History Battery*, in Study II.

Arizona Life History Battery. We measured LH strategy with the *Arizona Life History Battery* (*ALHB*; see Figueredo, 2007; Figueredo et al., 2006). This 199-item inventory measures the attitudinal and behavioral manifestations of life history strategy that includes the *Mini-K* short form measure of LH strategy (20-items), *Insight, Planning and Control* (20-items), *Parental Investment* (26-items), *Family Support* (15-items), *Friends Support* (15-items), *Altruism Towards Own Children and Kin* (15-items), *Altruism Towards Friends* (14-items), *Altruism Towards Community* (21-items; because of high inter-item correlations, the 50 altruism items are typically collapsed into a single lower-order factor "*General Altruism*"), *Religiosity* (17-items), *Partner Attachment* (36-items). This battery has thus far demonstrated strong convergent and discriminant validity, as well as internal consistency within scales (see Table 18 for Cronbach's alphas in the current study).

Socially Antagonistic Attitudes and Behaviors

Our Pilot data indicate that our community population self reports as neither extremely socially deviant nor drug using, and it is unlikely that our university sample will do so either. Although some of their attitudes appear to be socially antagonistic, the literature indicates that presuming corresponding behaviors would be erroneous (Wicker, 1969). As such, we *a priori* clustered our instruments into Socially Antagonistic Attitudes and Socially Antagonistic Behaviors.

Socially Antagonistic Attitudes

Impulsive Behaviors Questionnaire. Although we had predicted that the *IBQ* would load on the B-Factor because it has strong face validity as a measure of antagonistic behaviors, this instrument consistently loads on the A-Factor and thus has been added to the A-Factor.

Psychopathic Personality Inventory- Short Form. As a measure of socially antagonistic attitudes we used the 56-item Psychopathic Personality Inventory Short Form (PPI-SF; Lilienfeld & Andrews, 1996) which was developed as a shortened version of the Lilienfeld and Andrews' (1996) 187-item self-report questionnaire. We switched from the PPI to the PPI-SF to reduce respondent burden.

Risk-Taking Questionnaire. We used the 22-item *Risk-Taking Questionnaire* (RTQ; (adapted from Eadington, 1976; Kidd & Holton, 1993), which is a general measure of risk taking and attitudes towards risk-taking (e.g., gambling. Respondents are asked to indicate how strongly they agree or disagree with a number of statements. The response scale ranges from -3 (strongly disagree) to +3 (strongly agree). Sample items include "A little recklessness is good for people," and "There is a certain excitement in breaking someone else's rules." The original scale was 20-items and our research group constructed and added two additional items which were: ''I would not date someone too attractive for fear of losing them'' and ''I would approach someone very attractive even if it were a long shot''(Cronbach's alpha = 0.84).

Socially Antagonistic Behaviors

As in Study I, we used the *Life Experiences Questionnaire-Revised* version (*LEQ-R*; Zuckerman & Kuhlman, 2000), the *Delinquency Short Form* (D-20; Charles & Egan, 2004) and the *Drug Abuse Screening Test* (*DAST*; Skinner, 1982).

We *a priori* removed the *Jake's Temptations Questionnaire* from this factor because its exceptionally low correlations with the A-Factor in Study I. Also, we did not include the *Mating Effort Scale* (*MES*; Rowe, Vazsonyi, & Figueredo, 1997) because of protocol error.

Self-Regulation

Our concentration on self-regulation in Study II was based on discussions with our Mexican colleagues (V. Corral-Verdugo, M. Frías-Armenta & P. Valdez, personal communications, ~February-April 2006) who encouraged us to focus on the relationship of executive functions with social deviancy. Also, we discovered Miyake and colleagues' (2000) identification of three components of self-regulation following their confirmatory factor analysis of numerous frontal functions specific to executive performance –shifting, updating, and inhibition. Shifting (otherwise known as set- or task-shifting) is the ability to disengage from one task or operation, actively engage in a second task or operation, then move back again (Lezak et al, 2004). While related to the notion of working memory, updating is the ability to work with current information while updating and integrating new and relevant information to a specific task (Lezak et al, 2004). Inhibition has been described as the ability to intentionally inhibit and control the suppression of automatic or prepotent responses (Lezak et al, 2004).

In Study II, we included the following instruments as measures of self-regulation:

Dysexecutive Questionnaire. Our self-report measures of executive functions included the 22-item Dysexecutive Questionnaire (*DEX*; Wilson, Alderman, Burgess, Emslie, & Evans, 1996). The *DEX* is intended to measure a wide range of behaviors that result from strong executive functions. Respondents are asked to "Please indicate how often you personally experience the following statements". The response scale ranges from 0 (never) to 4 (very often). Sample items include "I act without thinking, doing the first thing that comes to mind," and "I have trouble making decisions, or deciding what I want to do."

Behavioral Rating Inventory of Executive Function- Adult Version. Second, we used the self-report Behavioral Rating Inventory of Executive Function (*BRIEF-A*; Gioia & Isquith, 2002), which is a 75-item measure of global executive functioning. Respondents are asked "…if you have had problems with the [list of] behaviors over the past month". The response scale ranges from 1 (never) to 3 (often). Sample items include "I have trouble prioritizing activities," and "I don't plan ahead for tasks."

Executive Function Questionnaire. The third questionnaire we included is the 36-item Executive Function Questionnaire (*EFQ*) which our group developed (Wenner, Jacobs, & Nagaran, 2007) with Miyake's (Miyake et al., 2000) three self-regulatory factors in mind. The *EFQ* has items that measure Shifting (11 items), Updating (12 items), and Inhibition (13 items). Respondents are asked to "please indicate how strongly you agree or disagree with the following statements". The response scale ranges from -3 (disagree strongly) to +3 (agree strongly). A sample of the Shifting items is "I find it easy to do two things at once"; a sample of the Updating items is "It is easy for me to find new and useful information in most situations"; and a sample of the Inhibition items is "I consider myself careful and cautious."

Neuropsychological Tests of Self-Regulation

Self-regulation was assessed using a number of neuropsychological tests. As in the Study I, we used the *Rey-Osterrieth Complex Figure Test* (Rey-O; Osterrieth, 1944) and the Trail-Making Test B (Trails B; Army Individual Test Battery, 1944) as a measure of shifting ability. Also, we added the following two tests.

Five-Point Test. We assessed updating abilities primarily with the Five-point Test (Regard, Strauss, & Knapp, 1982), a paper-and-pencil test that involves the drawing of designs without repeating previously drawn designs.

Modified Stroop Task. To test for updating and inhibition, we used a modified version of the Stroop Task (Stroop, 1935; see also Schmidt & Cheesman, 2005), a classic and well-founded test of inhibition. Developed by Valdez (2005), this Modified Stroop Task is composed of the original two tasks and two modified tasks. The rule of the first task is to read words of colors that are printed in ink of other colors, while the rule of the second task is to say the name of the color the word is printed in, while inhibiting the prepotent response to read the word. However, the Modified Stroop Task also has two extra tasks, both of which demand that the participant repeatedly switch between the first two rules within the same task. Thus, the Modified Stroop Task tests for inhibition and shifting.

General Cognitive Ability

We retained the *Shipley Institute of Living Scale* (Zachary, 1986) from Study I as our measure of general cognitive ability.

Social Desirability

Marlowe-Crowne Social Desirability Scale. We added the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960), which is the most widely used scale of social desirability bias (van de Mortel, 2008). To control for participants inclined to respond to sensitive items in a socially desirable manner, we used the 10-item version (Strahan & Gerbasi, 1972) of the original 33-item scale. This truncated version has high internal consistency ($\alpha = .88$) and is highly correlated with the original 33-item scale ($r = .91$; Fischer & Fick, 1993). Respondents are asked to "Read each item and decide whether the statement is *True* or *False* as it pertains to you personally" (italics theirs). Item examples include "I have never intensely disliked anyone" and "I can remember 'playing sick' to get out of something".

Five Assessment Sessions

We held five assessment sessions per participant. The first three sessions were in group format and were for the self-report questionnaires. The final two sessions were individual sessions for the neuropsychological tests. Session and instrument administration occurred in the order outlined below.

The reader will notice additional measures in the list below. These are instruments and neuropsychological tests that were administered but are beyond the scope of the current document. These measures are the *Multidimensional Work Ethic Profile*, *Hopkins*

Symptom Checklist, Rand-SF-36, Mate Value Inventory, Mating Effort Scale, Impulse Control Questionnaire, Jake's Temptations, ADHD screener, NEO Personality Inventory-Revised, Rey-O Copy, Rey-O 3-Minute, and the *Trails-A.*

Session 1. Demographics, *Arizona Life History Battery*.

Session 2. *Multidimensional Work Ethic Profile , Hopkins Symptom Checklist, RAND SF-36, Mate Value Inventory, Impulse Control Questionnaire, Impulsive Behaviors Questionnaire, Behavioral Rating Inventory of Executive Function-A, Dysexecutive Questionnaire, Jake's Temptations, ADHD Screener*, and the *Psychopathic Personality Inventory-SF*.

Session 3. *Marlowe-Crowne Social Desirability Scale, Risk Taking Questionnaire, Life Experiences Questionnaire-R, Delinquency Short Form, Drug Abuse Screening Test,* and the *NEO Personality Inventory-R.*

Session 4. The *Rey-O Copy, Rey-O 3-Minute*, and the *Rey-O 30-Minute* subtests.

Session 5. The *Five Point Test,* the *Modified Stroop Task,* the *Shipley Vocabulary and Abstraction* subtests, and *Trails A* & *B.*

Additions to Our Battery

Approximately half-way through data collection (February 2007) of Sample I of Study II, we revised our study by adding the *Executive Function Questionnaire* (*EFQ*) and the *Family Tree* questionnaire to the beginning of Session 1; we also added the *Behavioral Assessment of the Dysexecutive Syndrome* (*BADS*) neuropsychological test battery to the end of Session 4. The Family Tree and BADS were not included in the current analyses and thus will not be reported on here. The Family Tree was not included because it is beyond the scope of current analyses and this document; the BADS was not included because insufficient sample size with this battery limited our analytic abilities

At this point, participants who were previously consented and enrolled in the study were invited to complete a supplementary session that included these three measures. Nine participants completed this supplementary session and were compensated with $10-dollars worth of Wal-Mart gift cards. In total, these revisions allowed us to successfully acquire data on the *Executive Functions Questionnaire* (n = 72), the *Family Tree* (n = 72) and the *BADS* (n = 48).

Prior to revising our study, we had recruited 74 (44.8% of our total) participants. Of this 74, 39 (52.7%) of them completed all five sessions of the study. Following the revision, we recruited 91 (55.2% of total) participants; of these, 36 (39.6%) of them completed all five sessions of the study. Although a higher percentage of participants completed the entire five sessions of the study prior to our revisions, chi square analysis indicates that this difference only approaches statistical significance (X^2 (1) = 3.14, p = .08).

Sample II

Participants

From February 2008 through April 2008, we collected Sample II data from undergraduate students at the University of Arizona. One-hundred and twenty-one (79 female, 43 male) university students participated in Sample II and provided full, useable data sets. Sex ratios between the two samples were statistically different, with more males (54.5%) being represented in Sample I than in Sample II (34.7%; X^2 (1) = 10.74, $p < .001$). To maintain age-similar samples, we only included data from students aged 18 to 25 (*M* = 18.89, *SD* = 1.60, *range* = 18-24, *n* = 122) in Sample II. I removed 3 cases because these participant's ages were beyond the age range of our community sample and beyond our theoretically specified "older adolescent/young adult" age range. These three participants were female, ages 26, 27, and 33.

Despite out attempt to age-match our samples, the mean age of the university sample was statistically lower than the community sample (*M* = 19.58, *SD* = 1.60; t (260.2) = 3.61, $p < .001$). Participant ethnicities in this sample were notably different than those in our community sample, with most participants self-identifying as Caucasian (45.7%), followed by Hispanic (17.5%), Native American (10.7%), Asian (5%), and Black (4.2%). Chi Square analysis indicates that ethnic frequencies in this sample are, indeed, different from the community sample (X^2 (6) = 77.89, $p < .001$).

Procedure

Consenting was initially conducted online and conducted again in person, following a description of our study. We administered the majority of our questionnaires using a web-based format, rather than paper and pencil. Along with the web-based consenting process, this took about 90-minutes for participants to complete.

Instrument Selection

We selected our instruments according to *a priori* predictions based on LH theory, developmental theory, personality theory, neuropsychological theory, my group's prior research, and results from Study I. We selected neuropsychological tests with apparent ecological validity (Spooner & Pachana, 2006) to ensure the testing tasks closely approximated those found in the natural environment. Also, because of our concerns about reading ability in our community sample, we selected neuropsychological tests and questionnaires that have minimal dependence on participant's reading and writing ability. We assessed our questionnaires for reading level in Microsoft Word using Flesch-Kincaid grade level scores (Kincaid, Fishburne, Rogers, & Chissom, 1975). All of our self-report instruments are written at or below the 8th grade reading level.

Measures

The instruments administered online were as follows: Demographics, *Arizona Life History Battery*, *Multidimensional Work Ethic Profile, Hopkins Symptom Checklist, RAND SF-36*, *Mate Value Inventory, Impulse Control Questionnaire, Impulsive Behaviors Questionnaire, Behavioral Rating Inventory of Executive Function-A*, *Dysexecutive Questionnaire*, *Jake's Temptations, ADHD Screener*, the *Psychopathic Personality Inventory-SF*, *Marlowe-Crowne Social Desirability Scale, Risk Taking Questionnaire, Life Experiences Questionnaire-R, Delinquency Short Form,* and the *Drug Abuse Screening Test.*

We administered the Shipley Institute of Living Scale, *Behavioral Rating Inventory of Executive Function-A*, *Executive Functions Questionnaire, Jake's Temptations*, *and the Family Tree* using paper and pencil during our in-person group-testing session. The group-testing sessions took approximately 30-minutes in a designated quiet room at the university. Each participant had the opportunity to speak privately with research personnel during the debriefing process.

Research Personnel

Research personnel characteristics, training and supervision was comparable to that of preparation for Sample I, Study II. Eight advanced female undergraduate students served as psychometricians (age range from 20 to 25), all of whom were previously trained during Sample I, and received further training on new procedures. Although no new training was required, weekly supervision meetings continued, as described in the Sample I section, above.

Combined Sample I & Sample II Data

Data Analytic Strategies

Unless specified otherwise, all statistical analyses were conducted using SAS version 9.1.3 (SAS Institute, 2007). As in the Pilot, all scale scores were computed by taking the average of all answered questions. I used mean substitution for missing data points; participant's mean scores for the variables with the missing data points were substituted for those missing data points. Factor scores were computed by taking the mean of all relevant scales, with the scales first standardized (PROC STANDARD).

Cronbach's alphas and bivariate correlations were used PROC CORR, while exploratory factor analyses (EFAs) used PROC FACTOR. We selected the retained factors based on eigenvalue coefficients, scree tests, and proportions of variance accounted for. Confirmatory factor analyses (CFAs) and structural equation modeling used PROC CALIS. In the CFA, all cases with missing scales were removed entirely from the analysis. Analyses presented here followed these methods.

Controlling for Social Desirability

I controlled for social desirability on each of our instruments because of concerns during the Pilot study that some participants may have been responding to our instruments in a socially desirable direction. I did so on our combined data sets (Sample I & Sample II) using the *Marlowe-Crowne Social Desirability Scale* (Strahan & Gerbasi, 1972), using PROC GLM.

This procedure involved entering the social desirability total score as a predictor of each of our variables of interest (e.g., *Mini-K*) in separate GLMs, retaining the residuals as our new measure of our variable of interest. R^2 coefficients report the percentage of variance accounted for by our social desirability measure. Parameter estimates based on slope coefficients are indicators of social desirability accounting for statistically significant percentages of variance on the variable of interest.

Multivariate Analyses

Latent Variable Modeling. Latent constructs such as LH strategies are not directly measured but rather are *theorized* to cause observed behaviors, which we call manifest indicators. Manifest indicators *are* measured directly, for example by self-report questionnaire or neuropsychological test. Multiple manifest indicators are used (i.e., “multivariate”), with the correlations of each of these indicators to each other specifying the latent construct (Campbell & Fiske, 1959). Constructs are thus operationalized based on the statistical association of multiple theoretically specified measures rather than subjective definitions of single measures (Gorsuch, 1983). This is accomplished via factor analytic structural equation modeling, which is broadly comprised of (1) a measurement model, and (2) a structural model.

Measurement Model. Hypothetical constructs provide the theoretical foundation for measures of multiple manifest indicators which form the basis of measurement models (Campbell & Fiske, 1959). Typically these constructs are initially established via exploratory factor analysis (EFA). EFAs produce latent constructs (i.e., “factors”) via empirically derived relationships between manifest variables (Gorsuch, 1983). Secondarily, confirmatory factor analyses (CFA) then use the pre-established factorial relationships derived from the EFAs to *a priori* specify the relationships between manifest variables and the factors they comprise (Loehlin, 2004).

Structural Model. The structural model statistically tests the specified pathways between the factors (i.e., latent constructs) established via EFA and CFA. The pathway coefficients between the latent constructs specify how well the data fit the theoretically specified model.

First, an inclusive model is constructed where all plausible theoretical pathways between the latent constructs will be specified and this model was tested on a random sample of Sample I and Sample II combined data. Second, for model development, a restricted model was constructed in which all of the nonsignificant pathways were removed. Third, the restricted model was cross-validated; that is, it was tested against a second independent subsample. This cross-validation was implemented to test for Type I errors in the initial analyses; any pathways with Type I errors in the cross-validation was identified as nonsignificant. I will report on the cross-validated model in the results.

Results

Scale Reliabilities

Internal consistency estimates were calculated for each scale through the use of the Cronbach's alpha coefficient (standardized). The cut-off for reasonable internal consistency reliability is a minimum of .70 (Nunnaly, 1978). See Table 18 for sample size and a list of scale reliabilities from both samples, combined.

Controlling for Social Desirability

We partialled-out social desirability from each of the variables of interest in our predicted factorial domains via a series of general linear models (GLMs). As described above, we used the *Marlowe-Crowne Social Desirability Scale* (Strahan & Gerbasi, 1972). The R^2 coefficients and parameter estimates are illustrated in Table 19, showing statistically significant slope estimates for most of our variables of interest. The variables of interest are as follows:

Life History Strategy Factor. Each domain of the *Arizona Life History Battery*, including the *Mini-K, Insight, Planning and Control, Parental Investment, Family Support, Friends Support, Partner Attachment, General Altruism* (i.e., *Altruism Towards Own Children & Kin*; *Altruism Towards Friends*; and *Altruism Towards Community*), and *Religion*.

Socially Antagonistic Attitudes Factor. Psychopathic Personality Inventory-SF, *Risk-taking Questionnaire*, and the *Impulsive Behaviors Questionnaire*.

Socially Antagonistic Behaviors Factor. Life-Experiences Questionnaire –R, Delinquency Short-Form, and the *Drug Abuse Screening Test*.

Self-Regulation Factor. Behavioral Rating Inventory of Executive Function-A, the *Executive Functions Questionnaire*, and the *Dysexecutive Questionnaire*.

General Cognitive Ability Factor. The *Shipley Institute of Living Scale,* vocabulary and abstraction subtest scores. R^2 coefficients report the percentage of variance accounted for by our social desirability measure. Parameter estimates based on slope coefficients are indicators of social desirability accounting for statistically significant percentages of variance on the variable of interest. The variables with statistically significant slope estimates are *Mini-K, Insight Planning and Control, Partner Attachment, General Altruism,* the *Risk Taking Questionnaire, Delinquency Short Form,* the *Impulse Control Questionnaire,* the *Impulsive Behaviors Questionnaire, Behavioral Rating Inventory of Executive Function-A*, the *Dysexecutive Questionnaire*, the *Executive Functions Questionnaire*, and the *Shipley* Vocabulary and Abstraction subtests. The variables with non-significant slope estimates are *Parental Investment, Family Support, Friends Support, Religiosity,* the *Psychopathic Personality Inventory,* the *Life Experiences Questionnaire-R,* and the *Drug Abuse Screening Test*.

These results indicate that many of our participants were prone to self-report information in a socially desirable fashion, enough to significantly influence their responses on over two-thirds of our measures. All subsequent analyses were conducted on residualized scales.

Common Factor Models

Previous research utilizing the K-Factor used theoretically derived regression coefficients to define factors (see Figueredo et al., 2006, for review). These factors were determined by constructing each factor based on the correlation of each scale to a theoretically defined factor model. To determine how these data fit the theoretical models, exploratory factor analyses (EFAs) were conducted for each of the hypothesized higher-order factors (i.e., K-Factor, A-Factor, B-Factor, SR-Factor, and *g*-Factor).

Exploratory K-Factor, A-Factor, and B-Factor Loadings

We conducted EFA's as initial exploratory analyses on fourteen theoretically specified instruments that measure LH strategy, socially antagonistic attitudes and socially antagonistic behaviors. These instruments include each the eight measures within the *ALHB*, the *Psychopathic Personality Inventory-SF*, the *Risk-taking Questionnaire*, the *Impulsive Behaviors Questionnaire*, the *Life-Experiences Questionnaire –R,* the *Delinquency Short-Form*, and the *Drug Abuse Screening Test*. We expect these fourteen instruments to load on three higher-order factors.

First, we conducted a principal factors procedure using PROC FACTOR. Based on Kaiser's (1960) rule of selecting eigenvalues above 1.0, we identified three eigenvalues (2.64, 1.92, 1.02), suggesting a three factor solution. The initial factor pattern suggests these three factors accounted for 85.8% of the common variance. Further, Cattell's (1966) subjective scree test also indicated that a three factor solution best fit these data. Based on these three criteria, I retained these three factors (Table 20 shows the factor loadings for this three-factor solution, as also described below).

Factor 1 accounted for 40.6% of the common variance and contains the "slow strategist" scales that our group has previously identified as the K-Factor, as measured by the *ALHB* (i.e., the *Mini-K, Insight, Planning and Control, Parental Investment, Family*

Support, Friends Support, Partner Attachment, General Altruism, and *Religion*). Factor 1 warrants the name K-Factor.

Factor 2, accounting for 29.5% of the common variance, contains all of the socially antagonistic attitude scales (i.e., *Psychopathic Personality Inventory-SF*, the *Risk-taking Questionnaire*, and the *Impulsive Behaviors Questionnaire*). Factor 2 warrants the name A-Factor, (i.e., antagonistic attitudes).

Factor 3, accounting for 15.7% of the common variance, contains all of the socially antagonistic behavior scales (i.e., the *Life-Experiences Questionnaire –R*, the *Delinquency Short-Form*, and the *Drug Abuse Screening Test*). Factor 3 warrants the name B-Factor (i.e., antagonistic behaviors).

We obtained further support for the existence of these three factors via Varimax rotation (Pedhazur & Schmelkin, 1991) and Promax rotation, both of which retained the same scales on each of the same factors. Orthogonal and oblique rotations further indicate a good fit for these data.

The results of these analyses led us to retain the *Mini-K, Insight, Planning and Control, Parental Investment, Family Support, Friends Support, Partner Attachment, General Altruism,* and *Religion* as indicators of the K-Factor; *Psychopathic Personality Inventory-SF*, the *Risk-taking Questionnaire,* and the *Impulsive Behaviors Questionnaire* as indicators of antagonistic attitudes (A-Factor); and the *Life-Experiences Questionnaire –R*, the *Delinquency Short-Form*, and the *Drug Abuse Screening Test* as indicators of antagonistic behaviors (B-Factor). All further analyses maintained these distinctions (Gorsuch, 1983).

Exploratory EFQ-Factor Loadings

We conducted an exploratory factor analysis (EFA) as an initial exploratory analysis on the three theoretically specified subscales of the *Executive Functions Questionnaire* (EFQ): shifting (EFQS), inhibition (EFQI), and updating (EFQU). These three subscales ought to load independently, yet hold together as a single higher-order factor.

First, we conducted a principal factors procedure using PROC MAX. We identified a single eigenvalue (1.07), and this single factor accounted for 84.6% of the variance. A subjective scree test indicated that a single factor solution best fit these data. Based on these three criteria, I retained this single factor. The factor loadings for this single factor solution are illustrated in Table 21 and range from .51 to .71. Because this factor is comprised of all three theoretically associated executive function subscales with the executive function questionnaire, this factor has been named the EFQ-Factor (Gorsuch, 1983).

Exploratory SR-Factor Loadings

Next, we conducted an EFA as an initial exploratory analysis on our three theoretically specified instruments that measure self-regulation. These instruments are the *Behavioral Rating Inventory of Executive Function-A*, the *Executive Functions Questionnaire*, and the *Dysexecutive Questionnaire*. These three instruments ought to hold together as a single higher-order factor.

First, we conducted a principal factors procedure using PROC MAX. We identified a single eigenvalue (1.69), and this single factor accounted for the largest proportion of variance (88.9%). A subjective scree test indicated that a single factor solution best fit these data. Based on these three criteria, I retained this single factor (Table 22 illustrates the factor loadings for this single-factor solution which range from -.48 to .84).

Because this factor is comprised of all three theoretically specified measures of self-regulation, this factor has been named the SR-Factor.

Exploratory g-Factor Correlations

Next, we conducted correlation analysis on the Abstraction and Vocabulary subtests of the *Shipley*, a theoretically specified instrument that measures general cognitive ability. These two subtests ought to correlate well as a single higher-order factor. We conducted the correlational analysis using PROC CORR. We identified a single factor, identified by bivariate correlations in which the Abstraction subtest held a strong positive correlation with the factor (r = .78, p < .001), as did the Vocabulary subtest (r = .90, p < .001). Because this factor is comprised of both theoretically specified measures of general cognitive ability, this factor has been named the *g*-Factor.

Unit-weighted Higher Order Factors

Confirmatory factor analyses (CFAs) were conducted following the results of the EFAs. Because of a relatively small sample size, the five new factors were computed outside of the structural equations model (SEM). The five factors (i.e., K-Factor, A-Factor, B-Factor, SR-Factor, and *g*-Factor) were comprised of the mean of the standardized variables of interest, which created a new coefficient representing that factor. Each of the standardized means representing the variables of interest were highly correlated with their respective common factor. Table 23 is presented because it illustrates the factor loadings (reported as Pearson correlation coefficients) for each of the variables comprising the latent constructs. The factors based on these latent constructs were used in all subsequent analyses.

Bivariate correlations among the higher-order factors of interest were also calculated by the PROC CORR procedure and are displayed as a correlation matrix in Table 24. As can be seen in Table 24, significant relationships emerge between both the K-Factor and *g*-Factor with the SR-Factor (r = .33, p < .001; r = .27, p < .001; respectively). The SR-Factor has a negative correlation with the A-Factor Factor (r = -.27, p < .001); and the A-Factor has a positive correlation with the B-Factor Factor (r = .30, p < .001). Further, the SR-Factor and *g*-Factor both have negative correlations with the B-Factor (r = -.26, p < .001; r = -.26, p < .001; respectively). There was no significant correlation between the K-Factor and the B-Factor or the *g*-Factor.

Goodness of Fit of Factor Analytic Structural Equation Model

The structural model is shown in Figure 4. The standardized coefficients are represented as path coefficients, which are all statistically significant. The causal model suggests that the model explains 25.5% of the variance in the higher-order SR factor. The model also explains 9% of the variance in the A-Factor and 17% of the variance in the B-Factor. This suggests that the Self-Regulation predictors account for a substantial portion of the variance in the A- and B-Factors. No correlation between the slow LH factor and *g* was specified nor required by the model; consistent with our other recent findings (e.g., Wenner, Figueredo, Rushton, & Jacobs, 2007), there indeed was no significant correlation between slow LH strategy and general cognitive ability.

Interpretation of the Fit Indices

The model appears to be a good fit to the data as indicated by the chi-square fit index, which suggests that this model and the saturated model do not differ statistically ($X^2(3) = 6.063^{ns}$). The RMSEA fit index of 0.077 is good, meeting the criterion suggested by Steiger (1989). In addition, the GFI fit index of 0.99 and the CFI fit index of 0.967 suggest a good fit (the latter meets the .90 criterion of good fit; Bentler & Bonett, 1980). Further, all of the pathways are statistically significant ($p < .05$; see Figure 4). All in all, these fit indices strongly suggest a good fit of the model to the data.

Measurement Model

Life History Traits

In accordance with LH theory, social cohesion is an important LH trait. Intimately tied to social cohesion are multiple components of social relationships. There were eight manifest variables that served as indicators of social cohesion, as well as related cognitive abilities. These indicators are the *Mini-K*, *Insight, Planning and Control, Parental Investment, Family Support, Friends Support, Partner Attachment, General Altruism,* and *Religion*. The factor loadings were moderate to high, with the exception of *Religiosity*, which was low ($r = .34$, $p < .001$). These factor loadings are reported on Table 23.

Socially Antagonistic Attitudes

Socially antagonistic attitudes are comprised of three manifest indicators that include the *Psychopathic Personality Inventory-SF*, the *Risk-taking Questionnaire*, and the *Impulsive Behaviors Questionnaire*. The factor loadings were all in the high range and are reported in Table 23.

In prior analyses with the combined data sets, the *Impulse Control Questionnaire* (*ICQ*) correlated with the A-Factor correlates ($r = -.17$, $p < .01$) but was not statistically correlated with the B-Factor. Because of this low correlation and lack of statistically significant correlation with the respective factors, I excluded it from our theoretically specified A- and B-Factors. Also, the *Impulsive Behaviors Questionnaire* correlates with the A-Factor ($r = .43$, $p < .001$), and with the B-Factor ($r = .25$, $p < .001$). The substantially higher correlation with the A-Factor led me to add this scale to the A-Factor despite its face validity as a measure of behavior.

Socially Antagonistic Behaviors

Socially antagonistic behaviors are comprised of three manifest indicators that include the *Life-Experiences Questionnaire –R*, the *Delinquency Short-Form*, and the *Drug Abuse Screening Test*. The factor loadings were all in the high range and are reported on Table 23.

Self-Regulatory Abilities

One's ability to self-regulate their behaviors are comprised of three manifest indicators that include *Behavioral Rating Inventory of Executive Function-A*, the *Executive Functions Questionnaire*, and the *Dysexecutive Questionnaire*. The factor loadings were all in the high range and are reported on Table 23.

General Cognitive Ability

General cognitive ability, as measured with the *Shipley*, is comprised of two indicators that consist of the Vocabulary and Abstraction subtest scores. Both factor loadings were in the high range and are reported on Table 23.

Structural Model

The structural equations model can be seen in Figure 4. Each path coefficient is a standardized regression (β) weight and is statistically significant ($p < 0.05$). The model displays one predictor of LH strategy, the *ALHB*, which is primarily a measure of multiple domains of social cohesion and self-reported cognitive abilities. The model also has one predictor of self-reported self-regulatory abilities, which measures how well people can control their impulses in specified contexts and situations. There is also one predictor of socially antagonistic attitudes, which measures what people say they prefer, think, and feel about themselves in relation to specific contexts and situations. Also, there is one predictor of socially antagonistic behaviors, which measures what people say they *do* in specific contexts and situations. Finally, the model has one predictor of *g*, which measures general cognitive ability.

As hypothesized, the model indicates a positive independent correlation between Slow LH Strategy and Self-Regulation. Life history strategy is positively correlated with self-regulation ($\beta = .40$). Further, as predicted, self-regulation appears to serve as a mediator between slow LH strategy and both antagonistic attitudes and antagonistic behaviors. Moreover, as predicted, there was no relationship between LH strategy and *g*.

Self-regulation is negatively correlated with antagonistic attitudes ($\beta = -.30$) as well as antagonistic behaviors ($\beta = -.15$), indicating that older adolescents with stronger shifting, updating, and inhibition abilities are simultaneously less inclined to possess “deviant” beliefs and are less inclined to engage in “deviant” acts. Moreover, antagonistic attitudes are positively correlated with antagonistic behaviors ($\beta = .27$).

As predicted, there was no relationship between *g* and LH strategy. Moreover, although no prediction was specified, *g* was also positively correlated with self-regulation (β = .31), indicating that general cognitive ability, along with slow LH strategy, is associated with heightened self-regulatory abilities. Finally, *g* and antagonistic attitudes are mediated by self-regulation while *g* is negatively correlated with antagonistic behaviors (β = -.17).

Summary

The final structural equations model generally supported the predictions made in the introduction. The model presents both slow LH strategy and *g* ultimately correlating positively with the more specific psychological abilities (self-regulation) and behavioral preferences (socially antagonistic attitudes) that are positively correlated with actual behaviors (socially antagonistic behaviors).

Exploratory Analyses of Sex and Sample

Because the respective literatures on LH strategies, antagonistic social behaviors, self-regulation, and *g* indicate substantial sex differences, I decided to explore sex differences within our variables of interest. I expect males, more than females, to have faster LH strategies, more antagonistic attitudes and behaviors, poorer self-regulation, and higher *g*.

Also, I expect significant differences between our community sample and the university sample in our measures. I expect our community sample, more than our university sample, to have faster LH strategies, more antagonistic attitudes and behaviors, poorer self-regulation, and lower *g*.

Because of restrictions due to sample size, it was not possible to compare SEM differences between Sex or Sample. Instead, we ran a series of general linear models GLMs (ANOVAs) on sex (i.e., male vs. female), our samples (i.e., our community sample vs. our university sample, and interactions between sex and sample. All *F* statistics and effect sizes for sex, Sample, and Sex X Sample are illustrated in Table 26.

There were main effects for Sex, indicating that males scored higher than females on the following scales: *Psychopathic Personality Inventory-SF*, $F(1,237) = 25.87$, $p < 0.001$); *Risk Taking Questionnaire*, $F(1,236) = 41.60$, $p < 0.001$); *Life Experiences Questionnaire-R*, $F(1,239) = 13.24$, $p < 0.001$); and the *Delinquency Short Form*, $F(1,239) = 16.00$, $p < 0.001$).

There were no main effects for Sex, indicating that females scored higher than males. Further, there were no main effects in either direction for *Insight, Planning and Control*, *Parental Investment*, *Family Support*, *Friends Support*, *Partner Attachment*, *General Altruism*, and *Religion*; the *Drug Abuse Screening Test*, the *Impulsive Behaviors Questionnaire*, the *Behavioral Rating Inventory of Executive Function*, the *Dysexecutive Questionnaire*, the *Executive Functions Questionnaire*, and the *Shipley's* Vocabulary and Abstraction subtests.

There were main effects for Sample, indicating that our community sample scored higher than our university sample on the following variables: *General Altruism*, $F(1,238) = 17.23$, $p < 0.001$); *Religion*, $F(1,232) = 8.89$, $p < 0.01$); *Psychopathic Personality Inventory-SF*, $F(1,237) = 21.06$, $p < 0.001$); *Life Experiences Questionnaire-R*, $F(1,239) = 14.75$, $p < 0.001$); *Delinquency Short Form*, $F(1,239) = 12.05$, $p < 0.001$); *Drug Abuse Screening Test*, $F(1,237) = 14.19$, $p < 0.001$); *Behavioral Rating Inventory of Executive Function*, $F(1,235) = 5.02$, $p < 0.05$); and the *Dysexecutive Questionnaire*, $F(1,232) = 11.81$, $p < 0.001$).

There were also main effects for Sample, indicating that our university sample scored higher than our community sample on the following variables: *Parental*

Investment, $F(1,235) = 20.66$, $p < 0.001$); *Shipley Vocabulary*, $F(1,174) = 47.60$, $p < 0.001$); and *Shipley Abstraction*, $F(1,176) = 36.98$, $p < 0.001$). There were no statistically significant main effects for *Mini-K*, *Insight*, *Planning and Control*, *Family Support*, *Partner Attachment*, the *Risk Taking Questionnaire*, *Impulsive Behaviors Questionnaire* and the *Executive Functions Questionnaire* and there were no statistically significant ($p < 0.05$) interactions between Sex and Sample.

Exploratory NSR-Factor Loadings

We conducted an EFA as an initial exploratory analysis on all of our theoretically specified neuropsychological subtest measures of self-regulation. We initially expected the subtests to load on lower-order factors that represented shifting, updating, and inhibition. The *Behavioral Assessment of the Dysexecutive Syndrome* subtests were excluded because of the low number of participants who were administered these tests and successfully completed them (subtest cases ranged from n = 34 to n = 45).

First, we conducted a principal factors procedure using PROC MAX. Based on Kaiser's (1960) rule of selecting eigenvalues above 1.0, we identified three eigenvalues (3.37, 1.45, 1.14), suggesting a three factor solution. However, Cattell's (1966) subjective scree test indicated that a single-factor solution best fit these data because the first factor looked substantially steeper than the second two. Based on the scree criteria, I retained only the first factor which accounted for 51% of the variance.

Moreover, of the original eighteen subtests within our neuropsychological battery, only eight subtests significantly contributed to the single factor solution. These eight subtests consisted of one from the *Five Point Test*, five from the *Modified Stroop Test*, the *Trails A* and the *Trails B*. Because this single higher-order factor describes general self-regulatory abilities measured via neuropsychological testing rather than more specific abilities such as shifting and inhibition, it warrants the name NSR-Factor.

The standardized means representing each of these variables and hence the NSR-Factor were subsequently used in a correlation matrix designed to identify the relationship between the NSR-Factor and our other factors. As Table 25 illustrates, the NSR-Factor significantly correlates only with the B-Factor (r = -.36, p < .05). This indicates that, based on our neuropsychological tests, high self-regulation abilities in our community sample are associated with decreased rates of self-reported antagonistic behaviors.

Moreover, the NSR-Factor is not statistically significantly related to the K-Factor, A-Factor, *g*-Factor *nor* the SR-Factor. In our community sample, there is no statistically significant relationship between the neuropsychological tests of self-regulation and our self-reported self-regulation instruments. In fact, as can be seen in Table 25, the associations between these factors are virtually orthogonal.

Exploratory Structural Equations Model

I constructed a second exploratory structural equations model with the Study II data to test a *post hoc* hypothesis that, along with our original specified paths in the model described above, there is a also a direct path between slow LH strategy (i.e., the K-Factor) and antagonistic attitudes (i.e., the A-Factor). This is conceivable following the results reported by Gladden, et al., (2008; 2009) that described a direct negative correlation between a LH factor (a factor comparable to the K-Factor, as measured with the ALHB) and factor comprised of sexually coercive attitudes and behaviors, as well as a negative androcentrism factor that is based primarily on negative *attitudes* against women. I investigated this *post hoc* hypothesis in an exploratory SEM that included all the specified paths in Figure 4, as well as a direct path between K-Factor and A-Factor.

Goodness of Fit of Factor Analytic Structural Equation Model

The structural model is shown in Figure 5. As in Figure 4, the standardized coefficients are represented as path coefficients, which are all statistically significant -with the exception of the path between K-Factor and A-Factor. As in the previous model, this model suggests that the model explains 25.5% of the variance in the higher-order SR factor. The model also explains only 9% of the variance in the A-Factor and 17% of the variance in the B-Factor. This suggests that the Self-Regulation predictors continue to account for a substantial portion of the variance in the A- and B-Factors. As in the original model, there was no significant correlation between slow LH strategy and general cognitive ability.

Interpretation of the Fit Indices

The exploratory model appears to be a good fit to the data as indicated by the chi-square fit index, which suggests that this model and the saturated model do not differ statistically ($X^2(3) = 5.754^{ns}$). The RMSEA fit index of 0.104 is good, meeting the criterion suggested by Steiger (1989). In addition, the GFI fit index of 0.94 and the CFI fit index of 0.960 suggest a good fit (the latter meets the .90 criterion of good fit; Bentler & Bonett, 1980). Further, all of the pathways are statistically significant ($p < .05$; see Figure 5) with the exception of the path between KFactor and AFactor. Each path coefficient is presented as a standardized regression (β) weight. All in all, these fit indices strongly suggest a good fit of the model to the data.

Structural Model

The exploratory structural equations model can be seen in Figure 5. Contrary to the exploratory post-hoc hypothesis, slow LH and antagonistic attitudes did not correlate significantly (β = .04). All other path coefficients remained statistically significant and each of the paths are virtually identical with the exception of the negative correlation between self-regulation and antagonistic attitudes which dropped from (β = -.30) to (β = -.29). This *post hoc* exploratory structural equations model did not support the prediction that slow LH strategy is substantially and negatively correlated with antagonistic attitudes.

Exploratory Cascade of General Linear Models

Because self-regulatory executive functions are largely responsible for regulating the transfer of attitudes to adaptive behaviors (Barkley, 2001) I explored a *post hoc* hypothesis that self-regulation (i.e., SR-Factor) is a moderator between antagonistic attitudes and antagonistic behaviors (i.e., the A-Factor and the B-Factor). I ran a cascade of general linear models (GLMs; via multiple regression). In the current cascade of GLMs, B-Factor serves as the dependent variable with each of the other higher order factors serving as the independent variables, starting with the K-Factor and G-Factor. Two of our higher-order latent variable predictors were analyzed, then in each successive GLM another predictor was added in front of the prior predictors. Overall, the model was significant, accounting for 23.3% of the variance. However, none of the interactions were statistically significant at $p < .05$ (including the interaction between the A-Factor and the SR-Factor, $F = .22$), as is illustrated in Table 27.

DISCUSSION

Overview

The current research affords extensions of our previous work on life history strategy, by way of consilience (Wilson, 1998), to integrate literatures from a number of fields in the behavioral sciences. Integrating evolutionary, developmental, criminological, and clinical neuropsychological approaches to understanding human LH theory permitted the current research to (at least briefly) address the four domains of inquiry proposed by Tinbergen (1963). Investigating LH strategy, self-regulatory brain function, socially antagonistic attitudes and behaviors, and general cognitive ability permitted us to develop a personality model of these interrelated domains of behavior and function.

Earlier research by our group demonstrates that social relations and individual traits such as insight and planning cohere into a single higher-order factor, the K-Factor (e.g., Figueredo et al., 2005, 2007). Our previous research also demonstrates relations among the K-Factor and a range of antagonistic social attitudes and behaviors (Wenner, Figueredo, & Jacobs, 2005), adolescent sexual restrictedness (Brumbach, Walsh, & Figueredo, 2007), assortative mate pairing across cultures (Figueredo & Wolf, 2009), romantic relationship satisfaction (Olderbak & Figueredo, 2009; Olderbak & Figueredo, 2010), sexual coercion (Gladden, Sisco, & Figueredo, 2008), morality and religiosity (Gladden, Welch, Figueredo, & Jacobs, 2009), and general health, the Big Five personality traits, and general cognitive ability (Figueredo et al., 2007; Gladden, Figueredo, & Jacobs, 2009).

The current research provided valuable extensions of this work. Again, I found a strong relation between the K-Factor and antagonistic behaviors. However, I also found that self-reported self-regulation serves as a significant mediator between the two (see Figure 4). Moreover, I found that antagonistic behaviors, as previously measured, are better conceived of as *attitudes* and *behaviors*, with the former predicting the later. Finally, a tertiary but important finding is the role of general cognitive ability (i.e., *g*) in predicting antagonistic attitudes and behaviors. General cognitive ability has a negative correlation with antagonistic behaviors, as well as a negative correlation with antagonistic attitudes, however, this later effect occurs, again, via self-regulation as a mediator. And, notably, general cognitive ability is not associated with the K-Factor.

All of this indicates that self-regulation is a critical mediator between LH strategy and antagonistic attitudes and behaviors. Further, general cognitive ability appears to be correlated alongside the K-Factor in its positive relation with self-regulation and negative relation with antagonistic attitudes and behaviors. However, the present data suggest that general cognitive ability is not correlated with LH strategy.

I also found that within our community sample from Study II, our neuropsychological measures of self-regulation typically did not correlate; that the few neuropsychological measures that did load on a single common factor did not correlate with our self-report factor of self-regulation, nor did they correlate with any of our other higher-order factors.

The model predictions in the current research targeted the relations among LH strategy, measured with the K-Factor; self-reported self-regulatory abilities measured with the SR-Factor; socially antagonistic attitudes and behaviors measured with the A-Factor and B-Factor, and general mental ability measured with the *g*-Factor.

Our final hypothesized model (Figure 4) begins with the assumption that gene-based LH strategies provide a blue-print for neurological function, that this raw function interacts with environment during ontogenetic development (neither of which are currently measured) to produce extant neurological function (such as self-regulation). One's self-regulatory abilities mediate the relationship between LH strategy and the extent to which people have and exhibit typical and antagonistic attitudes and behaviors. In our final analysis, Structural Equations Modeling (SEM) revealed a path model similar to our specified model, with some intriguing surprises. Most notably, the SR-Factor mediated the relation between the *g*-Factor and the A-Factor, while the *g*-Factor was negatively correlated with the B-Factor.

Further, exploratory analyses found no direct path between the K factor and the A factor, nor did the SR factor serve as a moderator between the A factor and B factor.

Outcomes of Specific Predictions

Study I

Although low sample size prevented Structural Equations Modeling (SEM) in Study I, exploratory factor analyses (EFA) and bivariate correlations permitted statistical testing of our hypotheses.

Prediction 1 stated there is a feedback loop with interactions between each of the three domains of brain function: Frontal Function, Hippocampal Function, and Amygdala Function. This association was not found. We found inconsistent correlations within pre-specified lower-order factors and no higher-order factors (i.e., frontal, amygdalar, and hippocampal) in three different theoretically specified EFAs, one based on brain region and two based on brain function. We did find lower-order shifting and updating factors that loaded well on a higher-order frontal function (i.e., self-regulation) factor however.

Prediction 2 stated that the three neuropsychological phenotypic composites (i.e., frontal, amygdalar, and hippocampal) predict the K-Factor. This association was not found. Only the lower-order shifting factor within Frontal Function correlated with the K-Factor.

Prediction 3 stated that slow LH strategy, socially antagonistic attitudes, and behaviors are negatively associated. This association was not found.

In whole, these pilot results led us to focus our efforts on the self-regulatory abilities (e.g., shifting and updating) within the executive functions as neurologically salient LH variables that influence people's propensity to have and use socially antagonistic behaviors.

Study II

Our larger sample size that included collapsed data from Sample I and Sample II within Study II allowed for factor analyses, bivariate correlations, as well as SEM. A summary of our findings within the domains of self-regulation, neuropsychological measurement, and our full measurement model are presented here.

Self-Regulation

Prediction 1.1 stated that results from our self-report instruments of self-regulation load on the following three lower-order factors: Shifting, Updating, and Inhibition. This prediction was not supported for the EFQ alone, nor for the EFQ combined with the BRIEF and DEX. In each of these two sets of analyses, results from these instruments loaded on one common factor.

Prediction 1.2 stated that the Shifting, Updating, and Inhibition factors load on a single higher-order factor, the Self-Regulation (SR) Factor. This prediction was supported.

Neuropsychological Measurement

Prediction 2.1 stated that our neuropsychological tests of self-regulation load on three lower-order factors: Shifting, Updating, and Inhibition. Again, this prediction was not supported. These three anticipated lower-order factors are better described as a single factor that measures general self-regulatory abilities. Moreover, performance on these neuropsychological tests of self-regulation are not correlated with data from our self-report measures of self-regulation.

Prediction 2.2 stated that the Shifting, Updating, and Inhibition neuropsychological factors load on a single higher-order factor, the Neuropsychological Self-Regulation (NSR) Factor. Although this prediction was supported, the majority of the subtests did not contribute to the single factor solution.

Prediction 2.3 stated that the higher-order self-report self-regulation factor correlate highly and positively with the higher order self-regulation factor based on neuropsychological test scores. This prediction was not supported. Moreover, the NSR-Factor and SR-Factor did not correlate – nor did they correlate with *any* of our other identified higher-order factors.

The Structural Model

Prediction 3.1 stated that Slow LH strategy and self-regulation abilities positively associate. We expected people in the age-range of our sample who have LH traits of slower strategists to be more "neurologically adult" in terms of frontal function than faster strategists. This prediction was supported.

Prediction 3.2 stated that Slow LH strategy, socially antagonistic attitudes, *and* behaviors negatively associate. This prediction was supported.

Prediction 3.3 stated that self-regulation mediates relations among Slow LH strategy, socially antagonistic attitudes, and behaviors. Slower LH strategists possess increased frontal ability to control their impulses, to maintain antagonistic attitudes, and engage in antagonistic behaviors. This prediction was supported.

Prediction 3.4 stated that socially antagonistic attitudes and antagonistic behavior associate moderately but positively. Although these attitudinal and behavioral constructs are theoretically distinguishable and factor analysis in Study I distinguished the two constructs, the former leads to the latter. This prediction was supported.

Prediction 3.5 stated that general cognitive ability (*g*) and Slow LH strategy do not correlate. *g* was primarily included for discriminant validation purposes: to parse out at least this one other function (general cognitive ability) from LH strategy and self-regulation. This prediction was supported.

Prediction 3.6 stated that general cognitive ability (*g*), socially antagonistic attitudes, and behaviors do not correlate. This prediction was not supported. Contrary to expectation, *g* and antagonistic behaviors associate directly and negatively. Moreover, *g* and self-regulation, which serves as a mediator between *g* and antagonistic attitudes, associate positively.

Clinical Significance and Relevance

Profiling Approaches to Life and Employment (PALE)

In collaboration with our colleagues at the community agency, the applied aim of the PALE research program is to implement an iterative profile development program for agency youth. The long-term clinical aim is to integrate measures of LH strategy, self-regulation, and antagonistic attitudes and behaviors, among others (e.g., work-ethic). We expect these theoretically specified psychological domains to cohere in a validated battery that can be used to create practical and meaningful nomothetic and ideographic profiles of at-risk agency youth. We expect these profiles to identify youth strengths and weaknesses relevant to youth and agency goals. Details of the applied aims of this research program will be reserved for another document.

This research provides a nomothetic guide for further theoretical and empirical investigation of these composite latent variables, as well as a battery of principled, meaningful, and clinically useful instruments for identifying group-level characteristics in these domains. Ideographically, this research, with refinement, may provide the foundation for development of a clinically useful battery of assessment instruments to be used for needs assessment and identification of individual's psychological strengths and weaknesses.

Life history theory implies that many aspects of peoples' ability to adjust to environmental demands predicts the relative success of their approach to solving ongoing problems. By identifying individual differences in the behavioral, social, and cognitive traits described here, and using them in meaningful profiles of intrapersonal, and interpersonal skills, we anticipate their use as predictors of practical social behaviors such as employment success.

PALE Future Directions. As currently conceived, the PALE program consists of five phases. *Study I (i.e., the Pilot)*. Refine the assessment instruments. Our first pass administered already established questionnaires that assess social interests, attitudes, and abilities of agency youth. We used these data to identify group-level correlations among these constructs. *Study II (i.e., Sample I)*. Refined and validated assessment instruments and identified group-level relationships among constructs. *Study II (i.e., Sample I)*. Analyzed data from an age-similar university sample for normative data comparison and established universality of our measures. *Upcoming Studies* will establish development of individual student profiles and offer consultation with agency personnel regarding their interpretation and use. *Youth Outcome*. We intend to direct attention to the problem of external validity: Do the measures help predict both short-term and long-term youth outcomes mandated for the agency?

The benefits to the agency in “Upcoming Studies”, above, are potentially of greatest value. Interventions tailored to the specific strengths and weaknesses of each youth as designated by individualized profiles. By appropriately matching the psychological strengths and weaknesses of each individual to the characteristics of various interventions, the effectiveness of these targeted interventions may be increased, enabling staff to invest their time more productively when working with a given individual. This benefit may be manifested in two distinct ways. First, this individual information may permit a decrease in the number of staff hours required to obtain a given outcome. Second, given fixed staff hours, this information may serve to optimize the number of youth "successes" at the agency.

Neuropsychological Tests and Self-Report Measures of Self-Regulation Do Not Correlate

Within the data from Study II, our neuropsychological measures of self-regulation did not consistently correlate. The factor based on neuropsychological test scores did not correlate with our self-report factor of self-regulation. These results question the convergent validity of these tests with our self-report data as other have noted elsewhere (Aron, 2008; Ehmann, Goldman, Yager, Xu & MacEwan, 2007). Reynolds and colleagues (Reynolds, Ortengren, Richards, & de Wit, 2006), for example, found that among healthy adults, multiple self-reports of impulsivity correlated with each other but that the self-report data did not correlate with performance on behavioral tasks of impulsivity.

Nonetheless, the question of whether or not neuropsychological tests have adequate ecological, external, and convergent validity is typically answered affirmatively. For example, research on the relations between neuropsychological test scores and final diagnoses of dementia (Bondi, Salmon & Kaszniak, 1999; Meyer, Finn & Eyde, 2001), between neuropsychological test scores and imaging data (Bigler, 2001), and between neuropsychological test scores and employability (Shordone & Long, 1996; Wilson, 1993) are typically strong and positive. Moreover, predictive validity of tests of executive functions are typically strong. For example, rehabilitation patients with TBI, orthopedic disorders, and spinal cord injury demonstrated strong positive correlations of test scores of executive functions (Letter-Number Sequencing, Controlled Oral Word Association

Test, Trail-Making Test-B, Wisconsin card Sorting Test) with functional outcome 6-months following rehabilitation (Hanks et al., 1999).

Limitations

Taking a consilient approach to any research program calls for measurement of many domains and the pragmatics of any design will necessarily exclude some important domains. For example, thus far in PALE, we did not have measure the past or present local environment to include in our model. Doing so is certainly feasible with self-report questionnaires (see Brumbach et al., 2009) or observational or behavioral measures (see Mehl, Gosling, & Pennebaker, 2006).

Second, our program did not include direct genetic measures, although such data were anticipated in our original conceptualization of PALE (Figueredo et al., 2006).

Third, we did not incorporate measures of reproductive success. Although we did include *The Family Tree* measure in Study II, integrating those data with the current analyses and model was beyond the scope of the current analyses and document. *The Family Tree* is a self-report chart recently developed by our group that measures reproductive success and variation by way of participant's genetic relatives (e.g., number of cousins, siblings, half-siblings, etc.).

Fourth, our current LH and antagonistic behavior measures do not differentiate Life-Course Persistent and Adolescent-Limited participants. Thus, when we designate participants by scores identifying them as fast strategists or people who engage in antagonistic attitudes and behaviors, we cannot identify the course of these traits. Doing so would illuminate the depth of their traits (e.g., as fleeting tactics or ongoing comprehensive strategies). Modifications or additions to our current scales that capture life-course data may be had by measuring age of onset, temporal patterns, frequency and breadth of the traits as well as generalizability of attitudes and behaviors.

Fifth, we did not include measures that identify differential trait/situation interactions. We know that personality traits vary with social variation, with selective pressure leading to specific personality traits (Figueredo, Wolf, Gladden, Olderbak, Andrzejczak, & Jacobs, 2010).

And sixth, it is possible that some of the antagonistic attitudes and behaviors endorsed by our participants are best explained be evolutionary mismatch theory. Mismatch theory describes cases in which modern environmental demands for an organism's survival or reproductive success shift, rendering once optimal behaviors suboptimal and sometimes maladaptive (Nesse & Williams, 1994). More specifically, at least some antagonistic behaviors are likely spandrels, non-functional byproducts of adaptations (Buss, Haselton, Shackelford, Bleske, & Wakefield, 1998). An example is the ubiquitous presence of supernormal stimuli, e.g., the use of refined psychotropic drugs such as cocaine that once served adaptively in the form of chewed coca leaves or refined sugar that once served as a reliable signal of an essential vitamin or minerals. Measures ought to be incorporated that distinguish adaptive traits from spandrels.

A clinically relevant example is well illustrated with an interaction the author had with a prison inmate during a psychological assessment. The inmate had a long recidivism record of polysubstance abuse, property crimes and violent crimes. He described what may have been an undesirable but reproductively "successful" life history strategy, evolutionary mismatch, lack of conventional options, compromised self-regulatory ability, or, most likely, a combination thereof:

> "…I don't want to keep doing these [criminally antagonistic] things. But I get a real job on the outs and can't keep it together. I got kids and the money's no good. And pretty soon I do some stupid shit, get fired. Do some more stupid shit. And here I am. It's like it just can't be helped."

Future Directions

Future directions ought to address the limitations identified above. Moreover, our research program ought to invest in correlational and experimental studies aimed to *disconfirm* (Popper, 1968) our consistently strong K-Factor results. Correlational research with orthogonal results, such as the virtual orthogonality described above between the K-Factor and the *g*-Factor is an example. Another approach is to design disconfirmatory studies that attempt to identify life history behaviors as maladaptive or as non-strategic behavior patterns.

Significance of Research

The current research provides significant and important contributions to our expanding understanding of human life history within an over-arching integrative scaffolding of consilience. Primarily, this research tested the contributions of self-regulation to understanding the causal role of LH strategies in the development of antagonistic attitudes and behaviors. Notably, this research also identified a scientifically and clinically significant fissure among neuropsychological test scores of self-regulation, as well as a fissure between these scores and self-report scores.

Further, this research is an exemplar of a bridge with which the pure psychological sciences (e.g., evolutionary and developmental psychology) may integrate and apply their deep history of human understanding (e.g., life history theory) to create adaptive behavioral change in fields such as clinical neuropsychology and community psychology (see The Evolution Institute, 2010).

Table 1. Study I Sample Size Comparisons and Cronbach's Alpha's Across Measures

	N	Cronbach's α
Measures of Life History Strategy		
Mini-K	66	.72
Multidimensional Work Ethic Profile	65	.95
Mate Value Inventory	66	.82
Hopkins Symptom Checklist	60	.93
Impulse Control Questionnaire	63	.91
Socially Antagonistic Attitudes and Behaviors		
Antagonistic Attitudes		
Mating Effort Scale	66	.85
Self-Monitoring Scale	60	.68
Psychopathic Personality Inventory	60	.83
Jake's Temptations Questionnaire	55	.93
Antagonistic Behaviors		
Impulsive Behaviors Questionnaire	64	.83
Life Experiences Questionnaire-R	66	.91
Delinquency Short Form	61	.93
Drug Abuse Screening Test	66	.79

Table 2. Study I Instrument Means for Community Sample and Comparison Sample

	Sample			
	Community	Comparison	*t*	*df*
Life History Strategy				
Mini-K	1.19 (0.73)	1.03 (0.63)	1.61 ns	259
Multidimensional Work Ethic Profile	249.7 (26.5)	169.31 (25.4)	22.19**	650
Multidimensional Work Ethic Profile	249.7 (26.5)	142.11 (24.7)	30.75**	793
Delay of Gratification (*MWEP*) *University Comparison*	24.10 (4.07)	24.29 (6.43)	0.21 ns	650
Delay of Gratification (*MWEP*) *Air Force Comparison*	24.10 (4.07)	19.42 (5.76)	5.86**	793
Socially Antagonistic Attitudes/ Behaviors				
Mate Value Inventory	1.67 (0.69)	1.73 (0.65)	0.60 ns	258
Hopkins Symptom Checklist	0.93 (0.63)	1.15 (0.45)	3.36**	787
Mating Effort Scale	25.80 (8.85)	24.70 (5.60)	1.15 ns	284
Delinquency Short Form	0.58 (0.61)	0.88 (0.61)	3.22**	259
Drug Abuse Screening Test	0.22 (0.24)	0.55 (0.48)	4.89**	259

Note. ns = Nonsignificant, * = $p < .05$, ** = $p < .01$. Standard Deviations appear in parentheses below means.

Table 2 (continued). Study I Instrument Means for Community Sample and Comparison Sample

	Sample			
	Community	Comparison	*t*	*Df*
Neuropsychological Tests				
Mini-Mental State Examination	27.51 (2.20)	29.00 (2.23)	4.91**	1378
Reading the Mind in the Eyes Test	21.11 (4.76)	26.23 (3.61)	7.82**	174
Trail-Making Test B *Comparison sample ages 15-19*	73.62 (36.00)	49.80 (15.23)	5.34**	135
Trail-Making Test B *Comparison sample ages 20-29*	73.62 (36.00)	58.71 (15.92)	2.30*	87
Rey-Osterrieth 30-Minute	13.07 (4.65)	19.28 (7.29)	5.19**	100
General Mental Ability				
Shipley Institute of Living Scale	94.82 (12.50)	112.00 (5.60)	9.90**	116

Note. ^{ns} = Nonsignificant, * = $p < .05$, ** = $p < .01$. Standard Deviations appear in parentheses below means.

Table 3. Study I Correlations Among K-Factor Scales

	Mini-K	*ICQ*	*MVI*	*MWEP*	*HSCL*
Mini-*K*	1.0	-.23[1]	-.44***	.28*	-.40***
Impulse Control Questionnaire		1.0	.25*	.37**	-.03 [ns]
Mate Value Inventory			1.0	-.42***	-.40***
Multidimensional Work Ethic				1.0	-.13[ns]
Hopkins Symptom Checklist					1.0

Note. [ns] = Nonsignificant; [1]α = .06; *α < .05; **α < .01; ***α < .001.

Table 4. Study I Correlations of each Variable's Standardized Mean Score with the K-Factor

K-Factor correlations	
Mini-*K*	.71
Impulse Control Questionnaire	.58
Mate Value Inventory	.76
Multidimensional Work Ethic Profile	.67
Hopkins Symptom Checklist	-.61

Note. All correlations significant at $p < .001$.

Table 5. Study I Correlation of Shifting Factor with Updating Factor

	Shifting	*Updating*
Shifting	1.0	.42
Updating		1.0

Note. Correlation is significant at $p < .001$.

Table 6. Study I Correlations of the Shifting and Updating Factor's Standardized Mean Scores with the SR-Factor

SR-Factor correlations	
Shifting	.84
Updating	.85

Note. All correlations significant at $p < .001$.

Table 7. Study I Correlations of Antagonistic Attitude and Behavior Scales with AB-, A-, and B-Factors

	AB-factor	*A-factor*	*B-factor*
Antagonistic Attitudes and Behaviors			
Antagonistic Attitudes			
Mating Effort Scale	.65***	.76***	.39***
Self Monitoring Questionnaire	.44***	.76***	.07 ^{ns}
Psychopathic Personality Inventory	.69***	.81***	.40***
Antagonistic Behaviors			
Impulsive Behaviors Questionnaire	.70***	.51***	.65***
Life Experiences Questionnaire-R	.63***	.16 ^{ns}	.81***
Delinquency Short Form	.74***	.36**	.83***
Drug Abuse Screening Test	.61***	.19 ^{ns}	.77***

Note. ^{ns} = Nonsignificant; **$\alpha < .01$; ***$\alpha < .001$.

Table 8. Study I Correlations Among the AB-, A-, and B-Factors

	AB-factor	*A-factor*	*B-factor*
AB-factor	1.0	.78	.88
A-factor		1.0	.40
B-factor			1.0

Note. All correlations significant at $p < .001$.

Table 9. Study I Correlations of Higher Order Factors with the SR-Factor, Shifting-Factor, and Updating-Factor

	SR-Factor	Shifting Factor	Updating Factor
K-Factor	-.11 ^{ns}	-.02 ^{ns}	-.13 ^{ns}
AB-Factor	-.18 ^{ns}	-.28*	.02 ^{ns}
A-Factor	-.38**	-.44***	-.11 ^{ns}
B-Factor	.01 ^{ns}	-.09 ^{ns}	.10 ^{ns}
g-Factor	.25*	.30*	.14 ^{ns}

Note. ^{ns} = Nonsignificant; *$\alpha < .05$; **$\alpha < .01$; ***$\alpha < .001$.

Table 10. Study I Bivariate Correlations Among Individual Test Scores and *Brain Region* Factors

	Frontal	*Amygdala*	*Hippocampus*	*Temporal*	*Parietal*
Test Scores					
Mini-Mental State Exam	.49***	.06	.42***	.41***	.40**
Digit Span Forward	.57***	.32*	.32*	.25	.24
Digit Span Backward	.61***	.25	.36**	.32*	.28*
Rey-O Copy	.63***	.14	.53***	.53***	.61***
Rey-O 3 Min	.70***	.01	.54***	.54***	.71***
Rey-O 30 Min	.73***	-.01	.56***	.60***	.63***
Trails-A	-.37**	-.07	-.37**	-.24	-.16
Trails-B	-.52***	-.10	-.46***	-.33**	.30*
Shipley Vocabulary	.53***	.44***	.43***	.45***	.50***
Shipley Abstraction	.65***	.36**	.38**	.36**	.50***
Logical Memory I Recall	.38**	.29*	.69***	.79***	.37**
Logical Memory II Recall	.29*	.30*	.64***	.73***	.34**
Recognition	.30*	.16	.61***	.72***	.29*
The Eyes Test	.27*	1.0***	.28*	.26*	.44***
AZ Map Test	.33*	.04	.55***	.45***	.52***
US Map Test	.38**	.15	.57***	.52***	.57***
Rivermead Subtests					
First Name	.09	.30*	.28*	.07	.12
Last Name	.13	.23	.31*	.14	.04
Belongings	-.15	.03	-.01	.03	-.14
Appointments	.28*	.24	.48***	.56***	.34**
Picture Recognition	.21	.17	.24	.28*	.46***
Story Immediate	.37**	.10	.65***	.62***	.35**
Story Delayed	.39**	.21	.64***	.61***	.32*
Face Recognition	-.06	.51***	-.06	-.09	.23
Route Immediate	.45***	.12	.41***	.25*	.50***
Route Delayed	.49***	-.09	.43***	.26*	.41**
Messages Immediate	.15	.10	.30*	.34*	.31*
Orientation & Date	.14	.32*	.22	.26*	.38**

Note. *$p < .05$; **$p < .05$; ***$p < .001$.

Table 11. Study I Correlations Among *Brain Region* Factors

	Frontal	*Amygdala*	*Hippocampus*	*Temporal*	*Parietal*
Frontal	1.0	.27*	.77***	.67***	.73***
Amygdala		1.0	.28*	.26*	.44***
Hippocampus			1.0	.92***	.77***
Temporal				1.0	.67***
Parietal					1.0

Note. *$p < .05$; **$p < .05$; ***$p < .001$.

Table 12. Study I Bivariate Correlations Among Individual Test Scores and *Brain Function-I* Factors

	Attention-I	*STM*	*LTM*	*Verbal*	*Spatial-I*	*Social*
Test Scores						
Mini-Mental State Exam	.34**	.39**	.40**	.21	.45***	.07
Digit Span Forward	.47***	.57***	.31*	.31*	.33**	.22
Digit Span Backward	.63***	.64***	.29*	.37**	.35***	.11
Rey-O Copy	.55***	.48***	.40**	.30*	.51***	.05
Rey-O 3 Min	.44***	.52***	.41**	.21	.54***	.05
Rey-O 30 Min	.49***	.56***	.41***	.28*	.55***	-.04
Trails-A	-.46***	-.36**	-.21	-.23	-.22	-.09
Trails-B	-.53***	-.55***	-.29*	-.20	-.33*	-.10
Shipley Vocabulary	.55***	.50***	.44***	.60***	.45***	.32**
Shipley Abstraction	.51***	.40**	.41***	.34**	.50***	.21
Logical Memory I Recall	.65***	.58***	.71***	.83***	.69***	.34**
Logical Memory II Recall	.59***	.49***	.69***	.80***	.63***	.38**
Recognition	.59***	.43***	.61***	.71***	.59***	.17
The Eyes Test	.51***	.31*	.52***	.53***	.39**	.80***
AZ Map Test	.40***	.36**	.55***	.32*	.55***	.07
US Map Test	.43***	.37**	.59***	.41**	.61***	.15
Rivermead Subtests						
First Name	.17	.19	.37**	.26*	.28*	.63***
Last Name	.18	.20	.35**	.29*	.30*	.64***
Belongings	-.07	-.07	.06	-.07	-.02	.08
Appointments	.35**	.28*	.57***	.41	.50***	.40
Picture Recognition	.22	.41***	.37**	.18	.24	.16
Story Immediate	.58	.54***	.57***	.72***	.64***	.17
Story Delayed	.60***	.55***	.60***	.76***	.63***	.21
Face Recognition	.05	-.00	.03	-.04	.06	.54***
Route Immediate	.32**	.39***	.36**	.21	.44***	.14
Route Delayed	.30*	.40**	.24	.13	.38**	.04
Messages Immediate	.38**	.48***	.16	.21	.26	.13
Orientation & Date	.29*	.27*	.42***	.34**	.37**	.11

Note. *$p < .05$; **$p < .05$; ***$p < .001$.

Table 13. Study I Correlations Among *Brain Function I* Factors

	Attention-I	*STM*	*LTM*	*Verbal*	*Spatial-I*	*Social*
Attention-I	1.0	.89***	.78***	.81***	.86***	.40***
STM		1.0	.73***	.68***	.82***	.28*
LTM			1.0	.82***	.94***	.63***
Verbal				1.0	.81***	.50***
Spatial-I					1.0	.50***
Social						1.0

Note. *p < .05; **p < .05; ***p < .001.

Table 14. Study I Bivariate Correlations Among Individual Test Scores and *Brain Region* Factors

	Recall	*Spatial-II*	*Attention-II*	*Executive*
Test Scores				
Mini-Mental State Exam	.34**	.44***	.37**	.49***
Digit Span Forward	.24	.20	.53*	.20
Digit Span Backward	.28*	.22	.56***	.20
Rey-O Copy	.40**	.65***	.32*	.41**
Rey-O 3 Min	.55***	.53***	.21	.55***
Rey-O 30 Min	.70***	.54***	.21	.62***
Trails-A	-.21	-.17	-.27*	-.08
Trails-B	-.26	-.27*	-.49***	-.43
Shipley Vocabulary	.34**	.22	.52	.15
Shipley Abstraction	.39**	.44***	.31*	.27*
Logical Memory I Recall	.59***	.33**	.70***	.20
Logical Memory II Recall	.51***	.27*	.65***	.09
Recognition	.79***	.31*	.45***	.30*
The Eyes Test	.18	.12	.51***	.07
AZ Map Test	.44***	.60***	.36**	.22
US Map Test	.57***	.63***	.31*	.13
Rivermead Subtests				
First Name	.03	.10	.38**	.07
Last Name	.08	-.03	.41***	.02
Belongings	-.20	-.16	.21	.05
Appointments	.28*	.33	.47***	.13
Picture Recognition	.13	.22	.35**	.05
Story Immediate	.72***	.48***	.45***	.25*
Story Delayed	.74***	.42***	.48***	.22
Face Recognition	-.25*	-.05	.23	-.07
Route Immediate	.23	.68***	.22	.78***
Route Delayed	.24	.64***	.14	.77***
Messages Immediate	.17	-.02	.40**	.07
Orientation & Date	.23	.19	.42***	.18

Note. *p < .05; **p < .05; ***p < .001.

Table 15. Study I Correlations Among *Brain Function II* Factors

	Recall	*Spatial-II*	*Attention-II*	*Executive*
Recall	1.0	.53***	.48***	.50***
Spatial-II		1.0	.45***	.73***
Attention-II			1.0	.33***
Executive				1.0

Note. *p < .05; **p < .05; ***p < .001.

Table 16. Study I Bivariate Correlations Among Individual Test Scores and Mini-K, K-Factor, AB-Factor, General Brain Function, and g-Factor.

	Mini-K	*K-Factor*	*AB-Factor*	*General*	*g-Factor*
Test Scores					
Mini-Mental State Exam	-.13	-.10	-.10	.45***	.32*
Digit Span Forward	-.14	-.18	.15	.50***	.47***
Digit Span Backward	-.19	-.13	.04	.53***	.53***
Rey-O Copy	.33*	.32*	-.17	.53***	.41**
Rey-O 3 Min	.18	.18	-.33*	.52***	.45***
Rey-O 30 Min	.13	.19	-.21	.53***	.49***
Trails-A	.15	.13	-.24	-.34**	-.11
Trails-B	.06	.18	.20	-.45***	-.24
Shipley Vocabulary	-.19	-.05	-.00	.56***	.83***
Shipley Abstraction	.01	.10	.06	.54***	.83***
Logical Memory I Recall	.03	.10	.10	.67***	.35**
Logical Memory II Recall	.18	.14	-.01	.61***	.30*
Recognition	.03	.08	-.14	.53***	.18
The Eyes Test	-.27*	-.28*	.05	.50***	.48***
AZ Map Test	.15	.05	-.09	.51***	.25
US Map Test	.16	.06	-.12	.55***	.38**
Rivermead Subtests					
First Name	-.04	-.17	.01	.29*	.16
Last Name	-.09	-.24	-.05	.29*	.17
Belongings	-.24	-.27*	.17	-.01	-.16
Appointments	.11	.13	-.01	.48***	.32*
Picture Recognition	.09	.06	.01	.32*	.11
Story Immediate	.04	.04	-.04	.58***	.28*
Story Delayed	.02	-/03	.00	.60***	.36**
Face Recognition	-.06	-.05	.16	.08	-.08
Route Immediate	.04	-.04	-.04	.37**	.12
Route Delayed	.18	.05	.02	.32*	-.02
Messages Immediate	-.33*	-.18	.02	.29*	.06
Orientation & Date	-.10	-.01	-.16	.36**	.25

Note. *p < .05; **p < .05; ***p < .001.

Table 17. Study I Correlations of *Brain Region & Brain Function* Factors with Mini-K, K-Factor, AB-Factor, General Brain Function, and g-Factor.

	Mini-K	*K-Factor*	*AB-Factor*	*General*	*g-Factor*
Brain Factors					
Frontal	-.00	-.01	-.10	.83***	.71***
Amygdala	-.27*	-.28*	.05	.50***	.48***
Hippocampus	.05	-.03	-.15	.94***	.49***
Temporal	.05	.07	-.13	.87***	.48***
Parietal	.06	-.00	-.19	.81***	.48***
Attention-I	-.10	-.07	-.04	.93***	.63***
STM	-.06	-.08	-.11	.90***	.54***
LTM	-.00	-.09	-.12	.92***	.51***
Verbal	-.05	-.01	-.02	.81***	.57***
Spatial-I	.04	.00	-.13	.96***	.57***
Social	-.16	-.25	.02	.53***	.32*
Recall	.06	.08	-.18	.72***	.44***
Spatial-II	.23	.09	-.13	.73***	.39**
Attention-II	-.12	-.15	-.03	.89***	.50***
Executive	-.03	-.11	-.18	.56***	.25*

Note. *$p < .05$; **$p < .05$; ***$p < .001$.

Table 18. Study II Sample Size and Cronbach's Alpha's for Combined Samples

	N	Cronbach's α
Measures of Life History Strategy		
Arizona Life History Battery		
Mini-K	267	.75
Insight, Planning, and Control	266	.91
Parental Investment	258	.93
Family Support	260	.92
Friends Support	260	.89
Partner Attachment	261	.90
General Altruism	259	.92
Religiosity	263	.97
Measures of Self-Regulation		
Dysexecutive Questionnaire	271	.90
Behavioral Rating Inventory of Executive	275	.96
Executive Function Questionnaire	227	.85
Measures of Antagonistic Attitudes		
Psychopathic Personality Inventory-SF	247	.73
Risk Taking Questionnaire	235	.84
Impulsive Behavior Questionnaire	257	.80
Measures of Antagonistic Behaviors		
Life Experiences Questionnaire	236	.90
Delinquency Short Form	238	.93
Drug Abuse Screening Test	235	.84
Measure of Social Desirability		
Marlow-Crowne Social Desirability Scale	263	.47

Table 19. Study II R^2 and Slope of Scales Residualized on Social Desirability

	N	R^2	Slope
Measures of Life History Strategy			
Arizona Life History Battery			
Mini-K	237	.017	0.43*
Insight, Planning, and Control	238	.037	0.82**
Parental Investment	238	.002	-0.15 ns
Family Support	236	.002	-0.15 ns
Friends Support	235	.006	-0.22 ns
Partner Attachment	233	.035	0.85**
General Altruism	242	.041	0.66**
Religiosity	234	.003	0.41 ns
Measures of Self-Regulation			
Behavioral Rating Inventory of Executive	240	.08	-0.47***
Dysexecutive Questionnaire	237	.036	-0.58**
Executive Function Questionnaire	195	.058	0.76***
Measures of Antagonistic Attitudes			
Psychopathic Personality Inventory-SF	240	.008	-0.11 ns
Risk Taking Questionnaire	239	.03	-0.68**
Life Experiences Questionnaire	241	.000	-0.06 ns
Measures of Antagonistic Behaviors			
Delinquency Short Form	238	.018	-0.36*
Drug Abuse Screening Test	240	.003	-0.006 ns
Impulsive Behavior Questionnaire	238	.047	-0.97***
Measures of General Cognitive Ability			
Shipley Vocabulary Test	178	.027	-11.09*
Shipley Abstraction Test	180	.036	-16.75**

Note. ns = Nonsignificant; [1]$\alpha = .06$; *$\alpha < .05$; **$\alpha < .01$; ***$\alpha < .001$.

Table 20. Study II Factor Loadings for Three-Factor Solution, with K-, A-, and B -Factors

	Percentage of Variance Accounted For
K-Factor	40.6
A-Factor	29.5
B-Factor	15.7

Table 21. Study II Factor Loadings for the Executive Functions Questionnaire

Indicators	Executive Functions Questionnaire
Shifting	.51
Updating	.71
Inhibition	.58

Table 22. Study II Factor Loadings for the SR-Factor

	SR-factor
Dysexecutive Questionnaire	.84
Behavioral Rating Inventory of Executive Function	.87
Executive Function Questionnaire	-.48

Table 23. Study II Unit-Weighted Higher-Order Factor Loadings
(Reported as Standardized Regression Coefficients)

	Factor Loading
Measures of Life History Strategy	
Arizona Life History Battery	
Mini-K	.79
Insight, Planning, and Control	.64
Parental Investment	.52
Family Support	.62
Friends Support	.54
Partner Attachment	.42
General Altruism	.61
Religiosity	.34
Measures of Self-Regulation	
Behavioral Rating Inventory of Executive	-.88
Dysexecutive Questionnaire	-.85
Executive Function Questionnaire	.72
Measures of Antagonistic Attitudes	
Psychopathic Personality Inventory-SF	.80
Risk Taking Questionnaire	.80
Life Experiences Questionnaire	.87
Measures of Antagonistic Behaviors	
Delinquency Short Form	.83
Drug Abuse Screening Test	.83
Impulsive Behavior Questionnaire	.75
Measures of General Cognitive Ability	
Shipley Vocabulary Test	.78
Shipley Abstraction Test	.90

Note. All coefficients are significant at the $p < .001$ level.

Table 24. Study II Correlations Among Higher Order Factors

	K-factor	*A-factor*	*B-factor*	*SR-factor*	*g-factor*
K-factor	1.0	-.12[1]	-.07	.33***	-.10
A-factor		1.0	.30***	-.28***	-.19*
B-factor			1.0	-.26***	-.26***
SR-factor				1.0	.27***
g-factor					1.0

Note. [1]α = .06; *α < .05; ***α < .001.

Table 25. Study II Correlations Among Higher Order Factors, with Neuropsychological Factor (Sample I Only)

	K-factor	*A-factor*	*B-factor*	*SR-factor*	*g-factor*	*NSR-factor*
K-factor	1.0	-.22*	-.09	.33***	-.12	.08
A-factor		1.0	.10	-.17[1]	-.03	.13
B-factor			1.0	-.22*	-.08	-.36*
SR-				1.0	.16	-.09
g-factor					1.0	-.19

Note. [1]$\alpha = .06$; *$\alpha < .05$; ***$\alpha < .001$.

Table 26. Study II ANOVAs Showing F-Statistics and Effect Size for Sex, Sample, and Sex x Sample

	Sex		Sample		Sex x Sample	
	F	Effect Size	*F*	Effect Size	*F*	Effect Size
Measures of Life History Strategy						
Arizona Life History Battery						
Mini-K	3.82	-0.20	0.04	-0.04	0.14	0.07
Insight, Planning, and Control	0.17	0.11	2.07	-0.11	0.54	-0.20
Parental Investment	0.19	-0.00	20.66***	0.35	0.02	0.02
Family Support	1.14	-0.01	0.00	0.08	0.97	-.19
Friends Support	0.54	-0.08	3.80	0.10	0.44	0.10
Partner Attachment	0.02	0.16	0.12	0.16	1.46	-0.28
General Altruism	0.07	-0.17	17.23***	-0.43	1.70	0.22
Religion	0.02	-0.31	8.89**	-0.77	0.91	0.39
Measures of Self-Regulation						
Behavioral Rating Inventory of Executive	3.59	-0.14	5.02*	-0.14	1.63	0.11
Dysexecutive Questionnaire	0.40	-0.17	11.81***	-0.33	1.04	0.16
Executive Functions Questionnaire	1.08	0.25	0.80	0.19	1.69	-0.23

Note. * $p < .05$; ** $p < .01$; *** $p < .001$. A positive effect size for Sex indicates that males have a higher value on the measure. A positive effect size for Sample indicates that our university sample has a higher value on the measure. There were no interaction effects for the reported measures, thus no effect size coefficients were reported for Sex x Sample.

Table 26 (continued). Study II ANOVAs showing F-statistics and Effect Size for Sex, Sample, and Sex x Sample

	Sex		Sample		Sex x Sample	
	F	Effect Size	*F*	Effect Size	*F*	Effect Size
Measures of Antagonistic Attitudes						
Psychopathic Personality Inventory-SF	25.87***	0.11	21.06***	-0.15	0.60	0.05
Risk Taking Questionnaire	41.60***	0.77	1.91	0.26	2.82	-0.32
Life Experiences Questionnaire-R	13.24***	0.24	14.75***	-0.30	0.00	0.00
Measures of Antagonistic Behaviors						
Delinquency Short Form	16.00***	0.31	12.05***	-0.16	1.36	-0.16
Drug Abuse Screening Test	0.65	-0.03	14.19***	-0.14	1.40	0.07
Impulsive Behaviors Questionnaire	1.72	0.08	3.01*	-0.23	0.10	0.07
Measures of General Cognitive Ability						
Shipley Vocabulary Test	0.19	1.38	47.60***	13.13	0.00	0.01
Shipley Abstraction Test	0.35	3.99	36.98***	16.96	0.98	-4.92

Note. * $p < .05$; ** $p < .01$; *** $p < .001$. A positive effect size for Sex indicates that males have a higher value on the measure. A positive effect size for Sample indicates that our university sample has a higher value on the measure. There were no interaction effects for the reported measures, thus no effect size coefficients were reported for Sex x Sample.

Table 27. Study II Moderator Hypothesis with B-factor serving as the Dependent Variable

	F
*K-factor * g-factor*	0.00
*A-factor * SR-factor*	0.22
*A-factor * K-factor*	3.42
*A-factor * g-factor*	0.08
*SR-factor * K-factor*	1.64
*SR-factor * g-factor*	0.00
*A-factor * SR-factor * K-factor*	3.60
*A-factor * SR-factor * g-factor*	2.48

Note. All alphas are nonsignificant at the $p < .05$ level.

Figure 1. Study I Conceptual Path Model

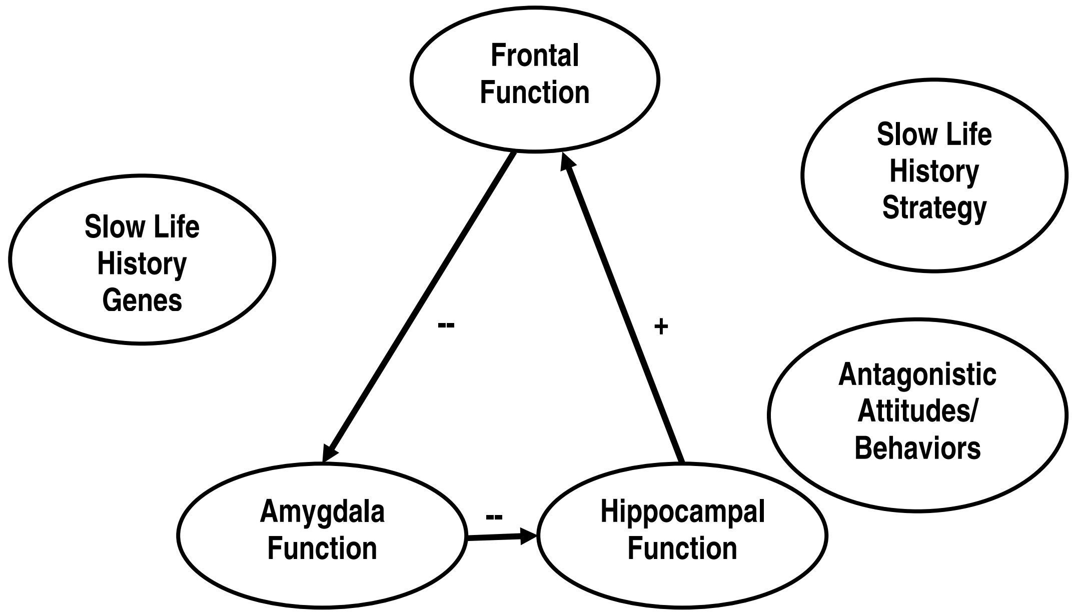


Figure 2. Study I Conceptual Path Model Depicting Hypothesized Pathways

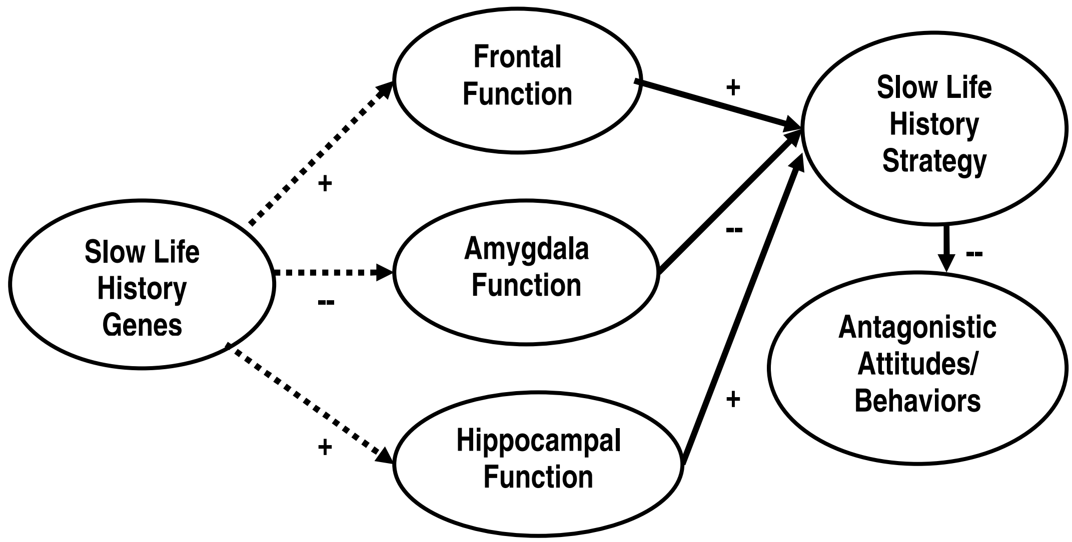


Figure 3. Study II Conceptual Path Model

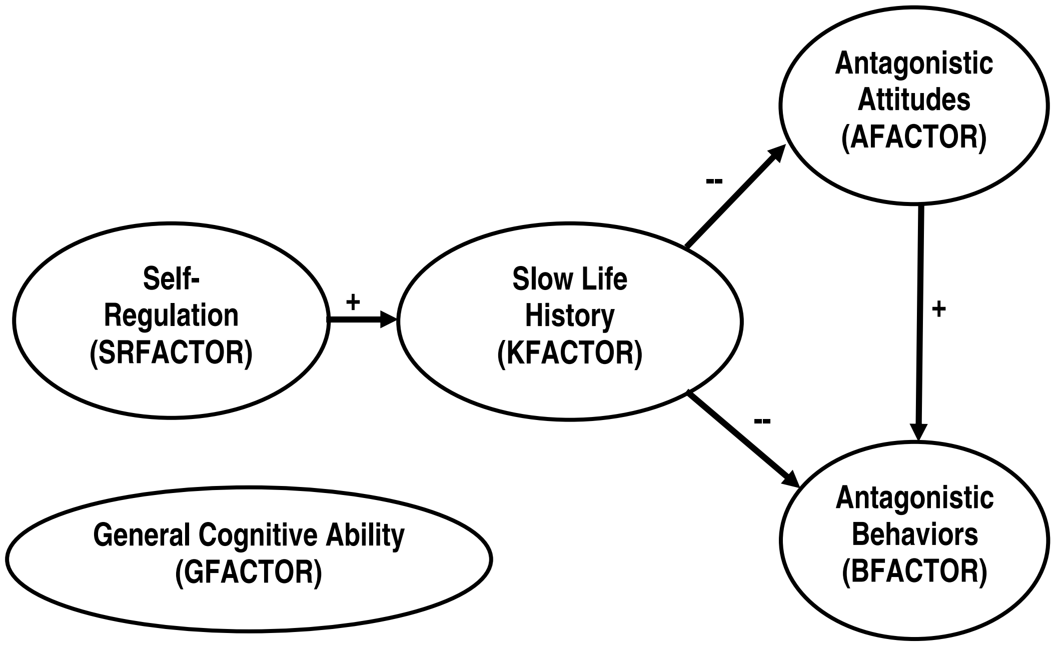


Figure 4. Study II Cross-Validated Structural Equations Model

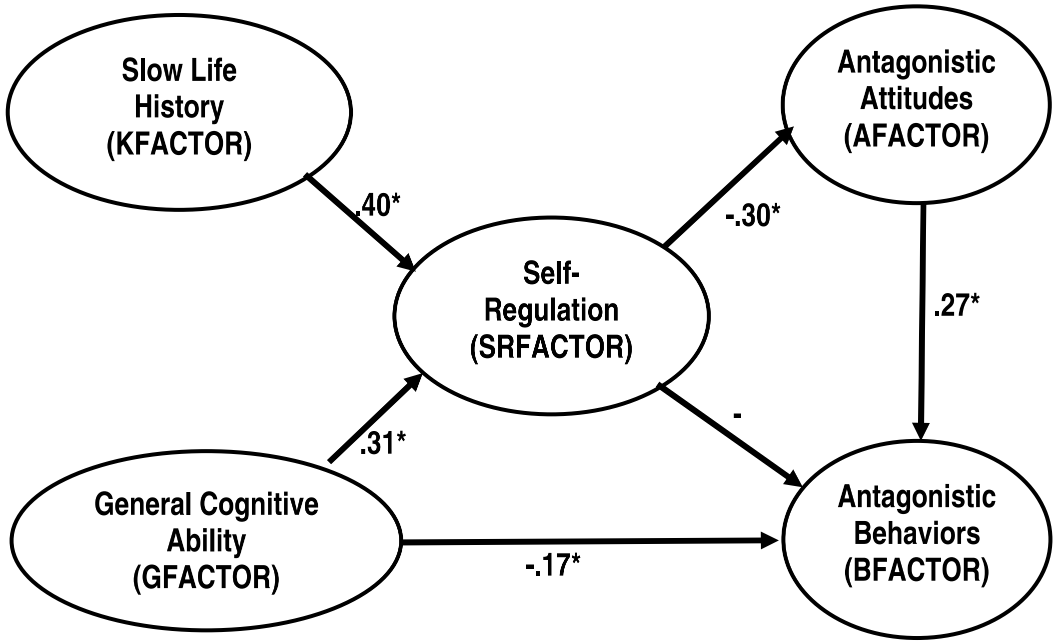
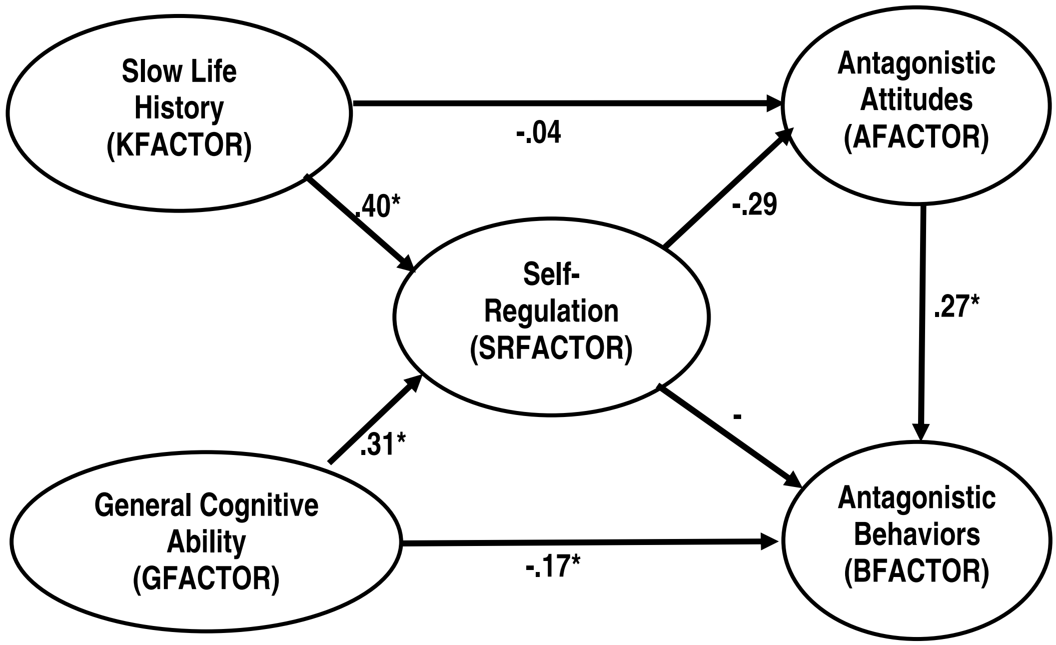


Figure 5. Study II Exploratory Cross-Validated Structural Equations Model



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