

SOCIOSEXUAL DEVELOPMENT: INFUSING THE BELSKY, STEINBERG, AND
DRAPER MODEL WITH SEXUAL SELECTION

by

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DEDICATION

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ABSTRACT

Life history theory attempts to explain between- and within-species variation in maturational and reproductive patterns, whereas sexual selection attempts to explain between- and within-sex differences in intersexual mate choice and intrasexual competition for members of the opposite sex. These two expansive evolutionary theories have been used by developmental scientists and social/personality psychologists to explain the variation observed in human reproduction, including the timing of reproductive events and individual differences in orientation toward mating and parenting. In Part I of the following paper, I review research related to life history theory and sexual selection in humans. I then show how integrating the principles of sexual selection with life history models of human reproductive strategies can address existing limitations. In Part II, I empirically examine many of the unique propositions that emerge from theoretical integration using a longitudinal dataset on adolescent development. Under investigation is an expanded model of sociosexual development that incorporates key principles from Belsky, Steinberg, and Draper's (BSD) psychosocial theory and sexual selection theory. I specifically examine the role of early rearing conditions within the home, as specified by BSD, and self-perceived mate value, as highlighted by a sexual selection perspective, on timing of sexual debut and sexual risk taking. The current study combines variable-centered and person-centered methods to assess specialized developmental trajectories. In total, the study provides novel support for BSD theory, while also highlighting needed revisions to account for the role of self-perceived mate value on adolescent sexual behavior.

CHAPTER 1: INTRODUCTION

Human sexuality, reproduction and parenting are topics that cut across multiple disciplines, including psychology, biology, anthropology, sociology, demography, and economics. Scientists in these disciplines have observed and recorded meaningful variation in almost every variable related to reproduction. Individual variation in variables such as timing of sexual maturation, timing of first sexual intercourse, sexual attraction, mate preferences, courtship rituals, desire to maintain long-term pairbonds and short-term sexual relationships, number of sexual partners, number of offspring, and parental rearing strategies have all intrigued researchers, who have created expansive literatures concerning possible proximate determinants and sequela. In an attempt to provide a single integrative theory, evolutionary scientists have begun to conceptualize and explain human reproductive behavior within an adaptive framework.

All evolutionary models are based on the premise that human reproduction is strategic, meaning that it is guided by a distinct set of physiological, psychological, and behavioral mechanisms that evolved because they solved the adaptive problems (i.e., problems of survival and reproduction) encountered by our ancestors (Buss, 1999; Tooby & Cosmides, 1992). These mechanisms are also referred to as adaptations. Adaptations are the systematic result of natural selection, which is defined by changes in a species inherited characteristics over time due to differential reproductive success of some inherited variations over others. Adaptive traits are those that repeatedly enhanced survival and/or reproductive success within the environments in which the species evolved. Given that differential reproduction is the engine that guides natural selection, it

is logical to assume that mating, reproduction, and parenting are prime candidates for traits that would have been shaped by evolutionary forces.

Tinbergen's (1951) conceptualization of multiple levels of analysis is particularly useful for highlighting the contribution of an evolutionary approach. Tinbergen distinguished between two complementary levels of explanation: *proximate* explanations and *ultimate* explanations. Proximate explanations are concerned with immediate mechanisms and explain *how* experiences foster particular patterns of development and behavior. Ultimate explanations are concerned with the evolution of a trait and address *why* development and behavior function in the way described at the proximate level. Traditional approaches to the question of variation in sexual development and behavior have focused on discovering the physiological (e.g., genetic, neuronal, hormonal) and psychological (e.g., attitudes, motivations, emotions) mechanisms that underlie behavior and the immediate environmental experiences (e.g., economic, familial, and extrafamilial) which give rise to it. An evolutionary approach is unique in that it explicitly addresses an ultimate level of analysis, which can guide and inform existing proximate level theories (Tooby & Cosmides, 1992).

For instance, while other theorists seek to explain an organism's general reaction to environmental contingencies, evolutionary scientists focus on how an organism's reaction to environmental contingencies might be fitness-promoting, or would have been in the environments in which the species evolved. Evolutionary scientists argue that within a species-typical range of environments, organisms have evolved to deal with certain environmental contingencies in adaptive, nonrandom ways. The organism does

not passively experience the environment. Contrary to the misperception of genetic determinism, evolutionary theory represents a truly interactionist framework. Evolved adaptations must take input from the environment for their expression and they may be expressed differently across different environmental contexts (Buss, 1999; Tooby & Cosmides, 1990). Psychological and behavioral plasticity is itself an evolved adaptation to spatially and temporally varying environments that posed consequences to survival and reproduction (Tooby & Cosmides, 1990; West-Eberhard, 2003).

Humans, as a species, have occupied a wide range of physical environments, and due to the evolution of human intelligence and behavioral flexibility, we have generated an equally diverse set of social environments that can change very rapidly in time and in space (Chisholm, Burbank, Coall, & Gemmiti, 2005; Flinn, Geary & Ward, 2005; Kaplan, Hill, Lancaster, & Hurtado, 2000; Low, 1998). This unstable diversity of physical and social environments is precisely the context where adaptive psychological and behavioral plasticity would enjoy great advantage over genetically fixed traits (West-Eberhard, 2003; Wilson & Yoshimura, 1994). Thus, evolutionary scientists have focused not just on species-specific traits (human universals), but also on adaptive flexibility in human psychology and behavior (Buss, 1999; Tooby & Cosmides, 1990). Adaptive plasticity provides an organism with the ability to adjust to specific environmental circumstances in ways that enhance reproductive fitness.

In regard to human sexuality, reproduction, and mating, evolutionary scientists have attempted to understand its species-specific characteristics, its variation across differing ecological and social contexts, and its variation between and within the sexes

(e.g., Buss, 1994; Chisholm, 1999; Daly & Wilson, 1978; Geary, 1998; Symons, 1979). By focusing on questions of ultimate causation, evolutionary theorists hope to provide a unifying foundation for disparate proximate level theories of human reproductive behavior (Buss, 1999). The following paper will review two research areas within the psychological sciences that have focused a great deal of theoretical and empirical attention on understanding variation in human reproduction from an evolutionary standpoint. While these two areas have a lot in common, they have emerged from different subdisciplines within psychology: developmental psychology and social/personality psychology. They have proceeded somewhat independently of each other, and they have drawn from two distinct evolutionary theories: life history theory and sexual selection theory.

Both developmental (e.g., Belsky, Steinberg, & Draper, 1991; Chisholm, 1999; Ellis, 2004; Geary, 1998) and social/personality (e.g., Buss, 1999; Buss & Schmitt, 1993; Gangestad & Simpson, 2000) perspectives conceptualize variation in reproductive psychology and behavior as integrated set of physiological, psychological, and behavioral adaptations, otherwise known as reproductive strategies or sexual/mating strategies. Adaptive variation in each perspective is conceptualized as falling along a continuum that is anchored by two distinct reproductive strategies or sociosexual orientations (e.g., Belsky et al., 1991; Buss & Schmitt, 1993; Gangestad & Simpson, 1990; Simpson & Gangestad, 1991). One strategy is a short-term opportunistic mating orientation toward close relationships, especially mating and parenting. This orientation is geared toward increasing the quantity of offspring at the expense of their individual quality. The second

strategy entails a long-term, investing orientation toward mating and parenting. This orientation is geared toward maximizing offspring quality at the expense of increasing offspring quantity.

Developmental scientists (e.g., Belsky et al., 1991; Chisholm, 1999; Ellis, 2004) have focused on clusters of covarying characteristics, such as reproductive physiology (e.g., age at menarche), psychological orientation toward the world (e.g., attachment models), and overt behavior (e.g., time of first sexual intercourse, number of sexual partners). They conceptualize variation in reproductive strategies as a developmental process that involves the specialization and canalization of psychological and behavioral traits. To explain the evolution and maintenance of alternative reproductive strategies, developmental scientists draw from life history theory. Life history theory is a metatheoretical framework for studying the biological structure of the life course (Charnov, 1993; Roff, 1992; Stearns, 1992). It seeks to account for the timing of reproductive and lifespan developments in terms of evolved strategies for distributing metabolic resources between the competing demands of growth, maintenance, and reproduction. The relative success of a strategy depends on the physical environment, and thus individuals are expected to monitor the physical environment when making decisions about how to allocate effort to growth vs. reproduction.

Social and personality psychologists (e.g., Buss & Schmitt, 1993; Gangestad & Simpson, 1990; 2000; Simpson & Gangestad, 1991) have emphasized evolved psychological mechanisms and have focused specifically on motivation for long-term and short-term sexual relationships, as well as the mate preferences that evolved to solve

problems in each temporal domain. They tend to focus on a plurality of mating tactics that are situation-dependent rather than specialized developmental pathways. Social and personality psychologists have argued that the principles of sexual selection provide a strong foundation upon which to explain human sex differences in mating psychology and behavior. More recently, evolutionary scientists have begun to look at variation within the sexes and propose models of alternative reproductive strategies. Alternative strategies, according to a sexual selection perspective, emerge due to social competition and are contingent on individual characteristics and overall mate value (Darwin, 1871; Gross, 1996). Thus, individuals are expected to monitor the social environment when making decisions about how to allocate effort to mating vs. parenting.

Evolutionary developmental and social/psychological approaches, which reflect applications of life history theory and sexual selection, have thrived somewhat independently, generating a healthy amount of theoretical debate and empirical attention in their respective fields. Each perspective has garnered enough empirical support to be considered a valid and useful theoretical framework for understanding and explaining variation in human reproductive strategies. However, neither of these perspectives alone can completely account for the factors that shaped variation in human reproductive strategies. I express the view that a synthesis between these two perspectives can address several limitations associated with each theory, and lay the groundwork for a more comprehensive theoretical model (see Geary, 2002 also).

The following paper unfolds in two parts. The goal of Part I is to provide a synthesis of the principles of life history theory and sexual selection in order to develop a

more comprehensive theoretical foundation. To provide the necessary background and to introduce human developmental scientists to relevant work in evolutionary biology, I review each theoretical framework in Chapter 2 and then describe the specific treatment of these theories in the human psychological literature. I then review the empirical literature concerning each theory. I focus particularly on outstanding issues and limitations to highlight how each theoretical model is in need of the other. Ultimately, I suggest that a developmental approach to social and sexual competition is needed to pave the way for a comprehensive model of human reproductive strategies.

In Part II, I empirically examine several of the ideas brought forth by the theoretical synthesis developed in the first half of the paper. I focus specifically on the life history model presented by Belsky, Steinberg, and Draper (1991) and expand it to include core tenets from sexual selection theory. The overall goal of the study is to examine how early family relations and self-perceptions of mate value during adolescence contribute to the development of sexual behavior in males and females. Variable-centered and person-centered analyses are used to uncover multiple developmental trajectories in each sex.

CHAPTER 2: THEORETICAL FRAMEWORK

Life history theory and sexual selection are two prominent and active areas of research in evolutionary biology. Life history theory attempts to explain between- and within-species variation in maturational and reproductive patterns, whereas sexual selection attempts to explain between- and within-sex differences in intersexual mate choice and intrasexual competition for members of the opposite sex. I express the view that synthesizing these two approaches could lead to a more complete understanding of sexual development. In the following chapter, I review theory and research related to life history theory and sexual selection in humans. I then attempt to integrate the major principles of each theory to arrive at a more comprehensive model of human reproductive variation. Finally, I discuss unique propositions that emerge from this synthesis.

Life History Theory

The purpose of the following section is to familiarize readers with the concepts that, from an evolutionary biological standpoint, are important for understanding the nature of human reproductive variation. The fundamental concept that emerges from this section is that of *alternative reproductive strategies*. I focus on life history theory in order to elucidate the adaptive problems (i.e., trade-offs) that lead to the evolution of alternative strategies; their maintenance via environmental or genetic mechanisms; and their development and expression across the lifespan. These concepts are important because they serve as the foundation for any evolutionary theory of reproductive variation between and within species. I conclude with a comprehensive animal model that

illustrates each of the points discussed and provides a picture of what we might expect to find in humans.

A Framework for Understanding Reproductive Strategies

Life history theory (Charnov, 1993; Roff, 1992; Stearns, 1992) is a firmly established evolutionary theory that attempts to explain species' patterns of growth, maturation, reproduction, aging, and mortality. Life history models recognize that organisms are faced with the problem of how to apportion effort across life's fundamental tasks, such as somatic growth and reproduction. Functional trade-offs between life history tasks are inherent in the 'decisions' made by organisms, as time, energy, and resources invested in one life task (e.g., growth and development) cannot then be invested in another task (e.g., reproduction).

According to life history theory, several trade-offs must be negotiated across the lifespan. These trade-offs are based on the demands of the environment that an organism inhabits. At the broadest level of organization, an organism must "decide", given current environmental conditions, how much effort to allocate to somatic effort (i.e., growth, development, and maintenance of the body) vs. reproductive effort (i.e., mating and parenting). An organism that invests more in somatic effort early in life may be more physically and socially competitive later in life, enhancing its reproductive fitness. However, it would be unwise to allocate effort to future reproductive opportunities at the expense of current opportunities if the environment presents high threats to survival and/or does not provide the resources necessary for extended growth and development. Organisms that find themselves in such harsh conditions would do better to commence

reproductive development at the earliest possible time. In this way, organisms must attend to prevailing environmental conditions and solve the life history problem of investing in *current reproduction vs. future reproduction* or stated differently *somatic effort vs. reproductive effort* (see Figure 1).

Reproductive effort itself presents another life history trade-off that must be negotiated: how much mating effort vs. parenting effort to expend? An organism that invests more in mating effort may produce more offspring across the lifespan. However, focusing on attracting and retaining mates detracts from parenting effort, which offspring may require in order to survive and successfully reproduce. The trade-off between mating effort vs. parenting effort is in some ways contingent upon the decisions made by the organism concerning somatic vs. reproductive effort. Those organisms that allocated more time and energy to somatic development may be those who are best able to invest in and benefit from parental care of offspring. Thus, reproductive strategies, as adaptations that organize and guide reproductive effort, are nested within an overarching life history strategy.

Between- and Within-species Variation in Life Histories

Through a process of natural selection, individual responses to the environment that facilitated survival and reproduction shaped species-level life history patterns. For example, humans tend to emphasize growth and development, as seen in our extended childhood and delayed sexual maturation. In addition, we engage in long-term pairbonds, produce relatively few offspring, and engage in extensive biparental care. Yet, despite this species-level pattern, there exists systematic variation within-species in terms of how

effort is apportioned to growth, mating, and parenting. This variation is thought to be adaptively patterned as well (Low, 1998; Stearns & Koella, 1986).

Species, including humans, often inhabit ecologically and socially heterogeneous environments that present different environmental demands. In such complex environments, natural selection is unlikely to converge on a single “best” phenotype. Rather, alternative life history strategies evolve that are specialized to the unique demands of each environment. Alternative life history and reproductive strategies are defined as “suites or constellations of functionally integrated anatomical, physiological, psychological, and developmental mechanisms for optimizing trade-offs among the components of fitness in the way that maximizes number of descendents throughout the life cycle” (Chisholm, 1999, p.42-43).

Alternative life history strategies are most easily illustrated by the r-k continuum¹ (MacArthur & Wilson, 1967; Pianka, 1970; Promislow & Harvey, 1990). The r and K strategies represent differential investment in somatic growth and reproduction. The r strategy is thought to evolve in unstable and unpredictable environments that undermine extended growth and parental care, and thus, is characterized by early sexual maturity, early and more frequent mating in adulthood, and less extensive parental care. In contrast, the K strategy emphasizes the quality of offspring over the quantity of offspring and is characterized by extended development, delayed maturity, and extensive parental care at the expense of mating effort later in life. While the r-K continuum was originally

¹ It has been argued that classifying complex life history traits as being r- and K-selected is too limited (see Roff (2002) and Stearns (1992) for a review of the problems surrounding use of the r-K continuum). Here I use the terms as heuristics only, and remain agnostic to the exact mode of selection responsible for coordinated life history trade-offs.

developed to reflect species-level differences in life history strategies, both strategies can be represented within the same species given a heterogeneous physical and social environment (Belsky, Steinberg, & Draper, 1991; Chisholm, 1999; Figueredo et al., 2005).

The evolution of alternative strategies within a species can be maintained via genetic and/or environmental mechanisms (West-Eberhard, 2003). Genotypic-regulation of alternative strategies results when one of several alleles has a facultative and decisive effect on phenotypic development (e.g., adaptive genetic polymorphism). A good example of genotypic-regulation is genetic sex determination. For instance, biological sex in humans is determined by the presence or absence of a single gene, the H-Y antigen on the Y chromosome (Bull, 1983). Conversely, environmental-regulation of alternative strategies results when one of several environmental cues has a facultative and decisive effect on phenotypic determination (e.g., adaptive phenotypic plasticity). In contrast to genetic sex determination, for instance, there are many species for which sex is determined by the temperature at which eggs incubate (Bull, 1983).

At the proximate level of analysis, what is important is that the alternatives are expressed in an adaptive manner regardless of the ultimate mechanism (i.e., genetic or environmental regulation). However, at the evolutionary level of analysis, genotypic and environmental forms of regulation evolve under somewhat distinct circumstances. For instance, genotypic-regulation imposes the somewhat strict requirement of equal fitness payoffs among the alternatives and can only be maintained under specific forms of selection (e.g., frequency-dependent selection). Environmentally-contingent strategies, on

the other hand, are more pervasive in nature as the evolutionary circumstances for their maintenance are much broader than those for the maintenance of adaptive genotypic-regulation (see West-Eberhard, 2003 for an exhaustive review of these issues, as well as Ellis, Jackson, & Boyce, 2006 for a recent treatment of these issues concerning human adaptive individual differences). Furthermore, environmentally-contingent strategies allow an organism to detect and encode reliable cues in the environment and then structure development in a way that matches the organism to the features of the environment in which it finds itself. The theoretical models reviewed herein are models of environmentally-contingent alternative strategies.²

Illustrative Animal Model of Environmentally-Contingent Life History Strategies

In nature, environmentally-contingent strategies within a species are quite common. Michael Meaney and colleagues provide a clear animal model of environmentally-contingent reproductive strategies and the neuroendocrine mechanisms that support their development (e.g., Cameron et al., 2005; Meaney; 2001; Meaney & Szyf, 2005; Weaver et al., 2004). At its core, their model is an environmentally-induced “maternal effects” model. Environmentally-induced parental effects occur when the environment experienced by the parents, causes phenotypic effects in offspring that are independent of the genes provided (Lacey, 1998; Mousseau & Fox, 1998). Parental behavior tends to be a reliable indicator of the environment into which offspring are born

² It is customary in biology, like in the behavioral and social sciences, to refer to traits as “genetically determined” or “environmentally determined.” However, a close look almost always reveals the dual nature of trait determination and the imprecision of these terms. Most if not all “environmentally-controlled” alternative phenotypes yield less than 100% of the expected phenotype under a given condition, suggesting some genetic influence on the phenotype. Conversely, “genetic” traits are almost always conditionally-expressed (West-Eberhard, 2003).

because the resources obtained during growth and development are to a large extent determined by the parents. Thus, the nature of the early environment, whether it is harsh and unpredictable or benign and conducive to extended growth and development, is mediated by maternal and paternal behavior toward the offspring. Parental effects can be temporary or they can have effects on offspring morphology and behavior that persist into adulthood.

Based on a number of studies in the rat, Meaney and colleagues propose that levels of maternal care are the prevailing mechanism through which ecological conditions are transmitted to offspring (e.g., Cameron, Fish, & Meaney, 2004; Champagne, Francis, Mar, & Meaney, 2003). Natural, species-typical variation exists in a variety of maternal behaviors in the rat, such as licking and grooming (LG) and arch back nursing of pups (ABN). Differences in these maternal behaviors have been linked to the defensive and reproductive strategies of adult pups. For instance, the pups of low LG-ABN mothers develop defensive strategies characterized by fearfulness and increased responsivity to threat, while the female offspring, in particular, exhibit reproductive strategies characterized by earlier onset of puberty, increased sexual proceptivity to novel males, increased lordosis in response to male mounts, higher rates of pregnancy, and lower levels of maternal care with their own offspring (low LG-ABN). To the contrary, the pups of high LG-ABN mothers are less fearful and responsive to threat, and the female pups experience later onset of puberty, display more agonistic behavior toward mounting males, impose longer intervals between sexual pairings with males, have lower rates of pregnancy, and provide higher quality care for their own pups.

To determine the mode of transmission (i.e., genetic or environmental) of these different defensive and reproductive strategies, Meaney and colleagues conducted a series of cross-fostering experiments, whereby pups born to high LG-ABN mothers were fostered at birth to low LG-ABN mothers (and vice versa) (e.g., Francis, Diorio, Liu, & Meaney, 1999). In each case, the pups resembled their foster mothers rather than their biological mothers in their defensive and adult reproductive strategies, demonstrating that the intergenerational transmission of these alternative strategies is primarily the result of maternal care and not genetic transmission. Furthermore, Champagne and Meaney (2000) have demonstrated that exposing mothers to stress during gestation induces low licking and grooming behaviors in previously high licking and grooming mothers. Thus, it appears that stressful conditions, mediated by the quality of maternal care, lead to the development of lifelong differences in offspring profiles of stress reactivity, sexual maturation, and reproductive behavior.

There is a way in which genes do play a role in the development of rodent defensive and reproductive strategies; however, it is not via the *presence* of specific allelic variants for a given strategy. Rather, through an elegant epigenetic process, maternal care induces differential *expression* of genes in the infant's central neural circuitry (e.g., Cameron et al., 2005; Champagne, Weaver, Diorio, Sharma, & Meaney, 2003; Weaver et al., 2004). Reproductive and parental behaviors map onto differences in estrogen receptor alpha and MRNA expression, which is related to oxytocin receptor binding. These differences are tissue specific with a distinct pattern of estrogen alpha expression and subsequent oxytocin binding in brain regions that regulate maternal and

sexual behavior. The estrogen-oxytocin circuit of the medial preoptic area (MPOA) mediates the expression of maternal behavior, while the estrogen-oxytocin circuit of the ventromedial nucleus of the hypothalamus (VMNh) mediates the expression of sexual behavior. In the female pups of high LG-ABN mothers, there is increased estrogen alpha expression in the MPOA and decreased expression of estrogen alpha in the VMNh. The opposite pattern appears in low LG-ABN female pups. Meaney and colleagues note that such epigenetic changes represent 'active' changes to maintain specific receptor profiles in selected brain regions rather than deficits in one group.

In sum, two environmentally-contingent strategies, which roughly approximate the r- and K-strategies previously discussed, are distinguishable within the rodent model. Ecological stress and instability result in low-quality parental care, which then impacts regulatory mechanisms in offspring that guide the development of r-like reproductive strategies. Conversely, more stable ecological conditions that support higher quality parental investment may foster the opposite pattern of development, producing more K-like reproductive strategies. In this manner the developing pup's survival and reproductive strategies are adaptively calibrated to the resources and threats of the environment into which it is born. This structured matching of phenotypes to environmental conditions has human analogs in the observations of exaggerated stress reactivity and early pubertal development and sexual activity found among children growing up in economically and psychosocially adverse environments (see Ellis, 2004; Boyce & Ellis, 2005; and Ellis, Jackson & Boyce, 2006 for relevant reviews).

Developmental, Life History Models of Human Reproductive Variation

Draper and Harpending (1982; 1988) provided the first ultimate-level explanation of human reproductive variation. Their evolutionary developmental model linked family structure during childhood to adolescent and adult reproductive outcomes. According to *paternal investment theory*, children have evolved to attend to the pair-bond status of their mother in order to establish a developmental track that will facilitate the expression of adaptive reproductive behaviors in adulthood. The presence or absence of the biological father within the home during early childhood is thought to serve as a critical cue to the nature of adult male-female relations, particularly the need for and availability of male investment in offspring.

Draper and Harpending (1982) argued that girls and boys growing up in father-absent homes pursue a distinct reproductive strategy from those growing up in father-present homes, and that these distinct strategies reflect evolved alternatives. Specifically, father-absent females perceive (consciously or unconsciously) that male parental investment is not crucial to reproduction, and thus are less discriminatory in regard to mate choice, engage in sexual activity earlier, and form less stable pairbonds with their male partners in adulthood. Father-absent males perceive that the “appropriate” male strategy is to compete for multiple sexual partners rather than invest heavily in any single relationship and its resulting offspring. Father-present males and females, on the other hand, perceive that the “appropriate” reproductive strategy is one characterized by high mate selectivity, durable and persistent pairbonds, and high parental investment in offspring.

Following Draper and Harpending, Belsky, Steinberg, and Draper (BSD; 1991) developed a broad life-span model of reproductive strategies. While BSD incorporated many of the original principles of the Draper and Harpending model, their main contribution was to ground the model firmly within life history theory and expand the central premise of sensitive-period learning to include a multitude of psychosocial stressors within the home. As a result they developed a far more general model of experience in early childhood and its result on subsequent development. The central tenet of their *psychosocial theory* is that humans have evolved to be sensitive to cues of the availability of resources in the environment, the trustworthiness of others, and the enduringness of long-term pairbonds, all of which are thought to affect how individuals apportion somatic and reproductive effort across the lifespan.

In the BSD model, it is exposure to different ecological conditions (e.g., harsh and stressful ecologies vs. consistent and rich ecologies) that lead to the development of alternative reproductive strategies in adulthood, with father presence-absence being just one variable among many that reflects the nature of the local ecology. The BSD model is a parental effects model like that proposed by Meaney and colleagues in the rat. BSD theorize that levels of parental investment are derivative of the general ecology in which families reside, and that the level and quality of child rearing practices actually mediate the relationship between the external environment and the development of alternative life history strategies. The types of ecological factors thought to influence parental investment strategies are levels of economic and relationship stress, such as lack of financial and material resources, spousal conflict, and divorce. Depending on the

environmental conditions inhabited by the parents, children will either experience sensitive and supporting parenting or harsh and rejecting parenting. These parenting practices are thought to effect the development of the child's interpersonal orientation, timing of sexual maturation, adult sexual behavior, and level of parental investment in their own offspring (see Figure 2).

BSD distinguished two prototypic developmental trajectories that facilitate the expression of alternative reproductive strategies in adulthood. Under conditions of environmental stress (i.e., resource scarcity or unpredictability) children are hypothesized to develop opportunistic reproductive strategies characterized by early sexual maturation, early onset of sexual relationships, and the development of unstable pair-bonds in adulthood with low levels of parental investment in offspring. In contrast, children whose rearing context is characterized by relatively low levels of ecological stress (i.e., consistent availability of resources) are hypothesized to develop less opportunistic reproductive strategies characterized by later sexual maturation, later onset of sexual relationships, and the development of long-term pair-bonds coupled with high levels of parental investment in offspring. Thus, individuals engage in either a quantity or quality strategy of mating and parenting. These alternative reproductive strategies evolved to maximize the reproductive success of children in the different environments in which they may find themselves.

Based on the principles of life history theory, BSD hypothesized that the local ecology, mediated by parental rearing strategies, should affect not only psychological and behavioral outcomes, but also the allocation of bodily resources to somatic growth. Thus,

a critical prediction of the BSD model is that early rearing experiences should influence the timing of pubertal maturation. In particular, the timing of reproductive maturity should be linked to rearing context in ways that facilitate reproductive success. In environments that are unable to support extended growth and development, individuals should reach reproductive age earlier. In environments that allow for extended growth, individuals should delay reproductive maturation, within a biologically acceptable range, in order to reap the benefits of an extended period of development. In more benign environments, reproductive fitness could be enhanced by deferring reproduction until individuals have acquired the skills and resources necessary to maximize the quality of their future offspring.

Both James Chisholm and Bruce Ellis have proposed extensions or modifications to the original BSD model. Chisholm (1993, 1996, 1999) has expanded the model in three specific ways. Following Stearns (1992), Chisholm (1993) has argued for a particular extrapolation of life history theory, emphasizing mortality risk as the primary cue that shunts people down different developmental and reproductive pathways. Chisholm (1999) also called attention to an additional psychological mediator linking childhood experience and reproductive strategy, time preference. Time preference reflects the degree to which individuals prefer or believe they will achieve their desire now vs. later. Chisholm argues that individuals should prefer immediate payoffs (even if delayed payoffs might be better) in harsh and/or uncertain environments.

A third notable contribution that Chisholm made to thinking about developmental influences on human reproductive strategies involved his elaboration of attachment

security in entraining the development of alternative reproductive strategies. Specifically, Chisholm (1996) distinguished two different manifestations of insensitive parenting (i.e., unwillingness to invest vs. inability to invest) and theorized that each has distinctive developmental consequences. He proposes that children have evolved to detect and respond to these different forms of threat to parental investment. Avoidant attachment is a facultative adaptation to parents' unwillingness to invest (regardless of their ability), which is conveyed to the infant by cold/rejecting caregiving. Anxious-ambivalent attachment is a facultative adaptation to parents' inability to invest, which is conveyed to the infant by inconsistent/unpredictable caregiving.

Ellis's work follows the Draper and Harpending model more closely, highlighting the unique influence of the father-child relationship and step-father presence. While BSD draw no particular distinction between contributions of mothers and fathers in shaping offspring reproductive strategy, Ellis and colleagues (Ellis, 2004; Ellis et al., 2003; Ellis, McFadyen-Ketchum, Dodge, Pettit, & Bates, 1999; Ellis & Garber, 2000) hypothesize that fathers may assume a special role in the development of female reproductive strategies. Ellis claims that father absence or stepfather presence might serve as particularly important paternal investment cues signaling low, unpredictable, or changing levels of paternal investment within families.

Empirical Evidence

A growing body of evidence lends support to the developmental, life history perspective. Belsky (2007), Chisholm (1999), and Ellis (2004) have all provided excellent reviews of this literature. For the purpose of the current paper, I summarize the

empirical evidence for the features of the model that are uniquely specified by the developmental, life history theory approach. In doing so, I highlight potential limitations and issues in need of additional research.

The first two links in the model, family context (A) → parenting practices (B), and parenting practices (B) → child attachment and interpersonal orientation (C) are widely established (see Figure 2). In accord with non-evolutionary theories, stressful environments appear to undermine the quality of parental investment. Under stressful economic and/or conflictual familial conditions, parents tend to engage in insensitive, harsh, rejecting and inconsistent forms of childrearing. Furthermore, these parenting practices are linked with the development of insecure attachments to caregivers in offspring. Attachment insecurity is related to a host of behavioral problems in children, such as increased aggression, disobedience, and general insensitivity toward others. According to the BSD and Chisholm models, insecure working models prepare children for more non-communal and opportunistic relationships later in life.

The features of the model that are unique to an evolutionary, life history perspective include the last two links in the model, which posit that stressful environments and conflictual family relationships will lead to a reproductive strategy characterized by (a) early pubertal maturation (i.e., reproductive effort over extended somatic growth) and (b) early sexual activity, greater sexual risk taking, and/or the formation of unstable pairbonds (i.e., mating effort over parenting effort).

Psychosocial effects on pubertal maturation. As reviewed by Belsky and colleagues (Belsky, 2007; Simpson & Belsky, 2007), there are three pieces of evidence

that support the pubertal timing prediction made by Belsky, Steinberg, and Draper (1991). First, greater familial warmth/positivity, parental approval, and closeness/cohesion predict delayed pubertal maturation in prospective longitudinal studies (Belsky, Steinberg, Houts, Friedman, DeHart, et al., 2007; Ellis, McFadyen-Ketchum, Dodge, Pettit, & Bates, 1999; Graber, Brooks-Gunn, & Warren, 1995; Steinberg, 1988), retrospective studies (Kim & Smith, 1998a; Kim, Smith, & Palermiti, 1997; Miller & Pasta, 2000; Romans, Martin, Gendall, & Herbison, 2003) and concurrent studies in girls (Rowe, 2000). Furthermore, greater parent-child conflict and coercion predicts earlier pubertal maturation in prospective longitudinal studies (Belsky et al., 2007; Ellis & Garber, 2000; Moffitt, Caspi, Belsky, & Silva, 1992; although see Ellis et al., 1999 and Steinberg, 1988 for exceptions), retrospective studies (Jorm, Christensen, Rodgers, Jacomb, & Easteal, 2004; Kim & Smith, 1998a; 1998b; Kim et al., 1997; Romans et al., 2003; although see Miller & Pasta, 2000 for an exception) and concurrent studies in girls (Mezzich et al., 1997; Wierson, Long, & Forehand, 1993). And finally, the more harmonious and less conflict-ridden the spousal relationship, the later pubertal maturation occurs in both prospective longitudinal studies (Ellis et al., 1999; Ellis & Garber, 2000) and retrospective studies (Kim et al., 1997; Kim & Smith, 1998b; Romans et al., 2003) in girls.

The more narrow prediction concerning the role of father absence, initially made by Draper and Harpending (1982) and later emphasized by Ellis (Ellis et al., 1999; Ellis & Garber, 2000; Ellis, 2004), is also well supported by research using a variety of methods and samples (Ellis, 2004 provides an extensive review). Father absence does, in

fact, predict accelerated pubertal development in girls in prospective and retrospective studies. It appears that father-absent girls are two- to three-times more likely to experience earlier age of menarche than father-present girls (Jones, Leeton, Mcleod, & Wood, 1972; Moffit et al., 1992; Quinlan, 2003; Romans et al., 2003, although see Belsky et al. 2007 for an exception). The mean difference across studies examining age of menarche for father-absent and father-present girls ranges from -1 to -9 months, with an average of -3.9 months across studies (Campbell & Udry, 1995; Doughty & Rodgers, 2000; Hetherington & Kelly, 2002; Hoier, 2003; Jorm et al., 2004; Surbey, 1990; Wierson et al., 1993). Similar results are found when composite measures of pubertal maturation have been used by researchers rather than the single item, age of menarche (Ellis et al., 1999; Ellis & Garber, 2000; Rowe, 2000).

In line with the concept of a sensitive period for acquisition of reproductive strategies, the timing and duration of father absence appears to be critical. Several researchers have demonstrated that the earlier the exposure to father absence, the earlier pubertal development tends to occur (Ellis & Garber, 2000; Moffit et al., 1992; Quinlan, 2003; Surbey, 1990). Ellis et al. (1999) demonstrated that it is not just the presence or absence of the biological father, but that the amount of time that fathers actually spend caring for their daughters and the frequency of father-daughter interaction during the first 5 years of life that predict pubertal maturation in daughters. Furthermore, in accord with Ellis's emphasis on the unique role that fathers play in the development of female reproductive strategies, the quality of the father-daughter relationship is more strongly associated with rate of physical maturation than the quality of the mother-daughter

relationship (although see Belsky et al., 2007 for an exception). Stepfather presence may also be important and account for some of the father absence effects. For instance, there is evidence that stepfathering predicts menarcheal age and the longer the duration of stepfather presence the earlier the age of menarche in stepdaughters (Ellis & Garber, 2000). In sum, there are good empirical reasons for distinguishing the effects of family processes and family structure when examining the influence of childhood experience on female reproductive strategies.

Limitations. One apparent discrepancy between the empirical literature and the theory is the lack of evidence concerning pubertal timing in males. Almost all studies are based on female samples, and in the few studies that have included boys, parallel pubertal timing effects have not been found (Belsky et al., 2007; Ellis, 2004). It is possible that methodological constraints offer an explanation for the lack of findings. Pubertal maturation in males lacks a salient and discrete event comparable to menarche. This simple fact means that it is more difficult for researchers to ascertain pubertal timing in males, and the accuracy of males' retrospective reports may be limited.

Belsky et al. (2007) provide the most in-depth examination of the family rearing antecedents of pubertal timing in both males and females. To assess pubertal onset, Belsky et al. obtained repeated physical assessments of pubertal development conducted by a trained nurse or physician. Thus, greater confidence could be placed in assessments of boys' pubertal status than in prior studies. Results showed that rearing experiences predicted pubertal maturation among girls, but not boys. Boys' pubertal onset was not predicted by any of the rearing variables studied: time spent with a biological parent in

the home, father absence-presence, maternal and paternal sensitivity, maternal and paternal harsh control, maternal and paternal report of parent-child closeness, and maternal and paternal report of parent-child conflict. In contrast, girls' pubertal timing was predicted by mothers' age of menarche and maternal harsh control at 54 mos. of age and in primary school.

Belsky et al. concluded that female reproductive development is more sensitive to social experience than is that of males. Such a position is supportable given a variety of empirical and theoretical evidence. First, empirical work in other species, which does not pose the same methodological constraints, shows a similar pattern of findings. For instance, in the rat model so clearly explicated by Meaney and colleagues, only female pubertal maturation and sexual behavior appear to be 'programmed' by maternal care. While they found maternal effects on male adult defensive strategies, male reproductive strategies were not affected in the same manner. Meaney and colleagues consider their sex-specific findings as evidence for the intergenerational transmission of maternal care. This is a logical conclusion given that females are the sole provisioners of offspring in the rat.

Theoretical research also suggests that the early ecological environment should not affect boys and girls in a similar manner (reviewed in *Synthesis between Life History Theory and Sexual Selection*). For instance, the reproductive strategies of human females are likely to be more sensitive to the natural environment than human males.

Developmental, life history models have not been sufficiently sensitive to the different roles that men and women assume in reproduction. Draper and Harpending (1982) were

unique in that they presented sex-specific hypotheses about the effect of early father absence on later adolescent and adult outcomes. According to their original model, father absence among boys should influence the nature of male-male competition for mates whereas father-absence among girls should influence the actual mating tactics of females (i.e., mate preferences, sexual precociousness, and the desire to maintain pairbonds in adulthood). Although BSD did hypothesize sex differences in the internalizing and externalizing behaviors thought to precede pubertal maturation, in regard to sex differences in tracking the environment and subsequent developmental trajectories they state that “it remains unclear whether the phenomena and processes we detail are equally characteristic of male and female development” (Belsky, Steinberg, & Draper, 1991, p.649). A comprehensive model of the development of reproductive strategies will need to address this issue of possible sex differences in environmental tracking.

Psychosocial and maturational effects on adult reproductive strategy. The final link in the model involving the association between family rearing context (B), somatic effort (D) and reproductive strategy (E) has the least amount of direct support. However, there is converging evidence from the vast literature on the antecedents of sexual initiation and sexual risk taking (e.g., contraceptive use and teen pregnancy) that supports the predictions made by the BSD model.

In the extensive literature on the developmental antecedents of adolescent sexual behavior, family process variables have been consistently linked to both timing of first intercourse and sexual risk taking behaviors. For instance, Zimmer-Gembeck and Helfand (2008) recently reviewed the longitudinal research conducted within the last ten

years on the developmental correlates of timing of sexual debut. In 6 out of the 13 longitudinal studies, warm, positive parent-child relations were associated with delayed sexual debut in both boys and girls. The association between harsh or negative parent-child relations and timing of sexual debut is less clear. Zimmer-Gembeck and Helfand found a significant association between harsh parental control and timing of sexual intercourse in only 2 out of 8 longitudinal studies on the topic (Ellis, Bates, Dodge, Fergusson, Horwood, Petit, et al., 2003; Upchurch, Aneshensel, Sucof, & Levy-Storms, 1999). However, harsh, coercive, and controlling parent-child relationships appear to have a significant impact on engagement in sexual risk taking behaviors. For instance, Rodgers (1999) found that the degree to which parents exert psychological control over their daughters was associated with higher odds for sexual risk taking. In the same study, there was no direct relationship between parental support and sexual risk behaviors for male or female adolescents. Thus, the quality of the parent-child relationship has been consistently associated with timing of sexual debut and sexual risk taking, with positive, supportive processes serving as a protective factor against early sexual debut and negative, controlling processes serving as a risk factor for sexual risk taking.

There is also substantial evidence that family structure is causally linked to adolescent sexual debut and sexual risk taking per paternal investment theory. Zimmer-Gembeck and Helfand (2008) documented 17 studies in which the relation between family structure and timing of sexual intercourse was studied. In 10 of these studies, researchers found that living in an intact family was related to delayed sexual debut. Furthermore, adolescents who live with both biological parents are less likely to have

sex, have sex less frequently, have fewer sexual partners, and are less likely to become pregnant (or cause a pregnancy) or give birth (father a child) (Kirby, Lepor, and Ryan, 2005; Kotchick, Shaffer, & Forehand, 2001).

And finally, early pubertal development is predictive of earlier ages of sexual debut for both males and females (e.g., Capaldi, Crosby, & Stoolmiller, 1996; Miller, Norton, Curtis, Hill, Schvaneveldt, & Young, 1997; Miller, Norton, Fan, & Christopherson, 1998; Resnick, Bearman, Blum, Bauman, Harris, et al., 1997). However, the association between pubertal development and sexual behavior is more clear in samples of adolescent females (Kotchick, Shaffer, & Forehand, 2001; Zimmer-Gembeck & Helfand, 2008). Less research has directly examined the specific effect of pubertal development on greater willingness to engage in casual sex, sexual risk taking, and pairbond formation. Mezzich, Tarter, Giancola, Lu, Kirisci, & Parks (1997) did find that earlier age of menarche was associated with higher levels of risky sexual behavior in a clinical sample of adolescent females.

Limitations. In his review of the literature on this topic, Ellis (2004) points out that pubertal timing itself does not predict specific features of reproductive strategy, as hypothesized by the BSD model. He states that, “although earlier timing of puberty clearly predicts earlier onset of major forms of sexual experience and reproduction, there is currently no empirical basis for the hypothesis that earlier timing of puberty leads to a more unrestricted sociosexual orientation, unstable pairbonds, greater number of sexual partners, or lower parental investment (Ellis, 2004, p. 947).” Ellis (2004) admits that this conclusion may be premature as only six studies have examined the topic to date.

Further research is definitely needed before strong conclusions can be drawn. Nonetheless, Ellis (2004) has put forward a revision in order to address this discrepancy, as well as other limitations of the earlier theories. In his *child development theory*, Ellis reconceptualizes the prediction made by BSD that pubertal timing is part of an integrated reproductive strategy that links social and ecological conditions in childhood to sociosexual and parenting behavior in adulthood. He theorizes that pubertal timing is instead part of an integrated developmental strategy designed to conditionally alter the length of childhood in response to the family's capacity to enhance the child's social competitiveness.

In response to such critiques, Belsky (2007) has stated that research examining the final link in the model has not taken into account the important qualification made by Belsky et al. (1991) that an alternative, conditional probability model might more accurately characterize the dynamics of human development than a linear model (i.e., $A \times B \rightarrow C$; $B \times C \rightarrow D \dots$). Such a theory presumes multiple paths to an outcome and greater or lesser probabilities of an outcome given varying antecedent conditions. Thus, subsequent development in the chain could be a function of the co-occurrence of multiple previous links. Belsky (2007) concludes that by examining only the direct effects of pubertal timing on reproductive strategy, researchers may not have been able to detect its impact on specific features, such as sociosexual attitudes and behaviors. Belsky's caveat regarding the original theory and Ellis's reconceptualization will need to be addressed by future research.

Summary and Evaluation

A number of developmental, life history models have been put forward as an ultimate-level explanation of variation in sociosexual development. In essence, these models contend that humans evolved to be responsive to the parent-child relationship in order to structure the development of behavioral and psychological patterns that will guide reproductive development and subsequent pair-bonding and child-rearing behavior.

Based on the review of the literature, I would argue that the developmental life history theory of variation in human reproductive strategies is defensible and fairly well supported. However, it is not without its limitations. For instance, it is well explicated and supported for girls, but the empirical evidence concerning boys' developmental trajectories is lacking. Furthermore, certain links in the model have not been empirically supported (e.g., pubertal timing does not predict sociosexual attitudes and behaviors).

The life history models discussed herein could be further expanded and refined by the infusion of additional evolutionary considerations. Life history models do not address all the factors that, from an evolutionary standpoint, should govern the adoption of specific reproductive strategies in adulthood. Environmentally-contingent strategies are not only attuned to recurrent features of the natural world, such as the quality of parental investment, but are also attuned to the evaluation of the self relative to others (Tooby & Cosmides, 1990). Within the developmental literature, an often-neglected set of proximal cues is relative standing in social competition or status. Status in humans is determined by multiple factors, and individuals pick mates based on a number of characteristics, leaving open the potential for individuals to diversify in order to avoid direct competition in the mating market.

In the next section, I introduce the theory of sexual selection, a theoretical model that emphasizes mate choice and relative standing in intrasexual competitive hierarchies (otherwise known as mate value hierarchies) as factors that influence the adoption of alternative reproductive strategies. I review a recent theoretical account provided by Gangestad & Simpson (2000) of how sexual selection factors in humans account for the variation we see in reproductive strategies.

Sexual Selection

Just as alternative life history strategies are found in a wide range of species, environmentally-contingent strategies resulting from sexual selection are also found widely among animals (Gross, 1996; West-Eberhard, 2003). The difference between alternative life history strategies and those resulting from sexual selection are as follows. Traditionally, life history theory is based on the principles of natural selection, whereas sexual selection is based on the principles of social selection. Natural selection occurs as a consequence of forces in nature. Accordingly, life history strategies are produced as a result of success or failure in dealing with aspects of the natural environment, such as food shortages, predators, pathogens, and harsh climate. The specific feature or cue that individuals have evolved to attend to is the quality of the ecological environment, particularly the relative payoff of parental investment in that ecology. Social selection, on the other hand, arises from competition among conspecifics rather than from traditional extrinsic pressures. Adaptations produced from social and sexual selection are a result of success or failure in dealing with the social environment, and the specific feature or cue

in the environment that individuals have evolved to attend to is position relative to others on relevant status hierarchies (e.g., resource acquisition, attractiveness).

Sexual selection refers to the process of competition among members of the same sex for mates (intrasexual competition) and the processes associated with choosing mates (intersexual choice; Darwin, 1871). Sexual selection combined with *parental investment theory* (Trivers, 1972) is the explanatory framework for sex differences in hundreds of species, which most typically takes the form of male-male competition over access to females and female choice of mating partners (Anderson, 1994). The anatomy and physiology of reproduction in mammals result in an asymmetry between the sexes in the amount of time, energy, and risk devoted to reproduction and parental investment. Triver's theory relates sex differences in parental investment to the components of sexual selection.

Parental investment is the allocation of time, energy, risk, and resources to the care and nurturance of offspring, reducing the amounts available to alternative activities. Similar to life history theory, the logic of the theory is based on the consideration of how an organism should budget its time, energy, and other resources among the competing demands of growth, maintenance, repair, reproduction, parental investment and so forth, in a way that fitness is maximized. The sex that is biologically obligated to invest more resources and energy in producing and rearing offspring should be more discriminating in terms of mate choice, as the cost of each reproductive act should be minimized. The lower-investing sex, on the other hand, must compete with members of their own sex for sexual access to the higher-investing sex. This competition is based on the mate choice

criteria of the high-investing sex. Competition increases variance in reproductive success among the members of the lower-investing sex, such that those individuals that embody the mate characteristics preferred by the members of the higher-investing sex encounter more mating opportunities. Furthermore, the lower-investing sex is predicted to allocate more effort to mating at the expense of parenting relative to the higher-investing sex. This is due to the fact that the lower-investing sex is relatively freed up from certain parental duties and has more to gain reproductively by rejoining the mating market.

Mammalian physiology, characterized by internal gestation and the need for postnatal care, requires at minimum almost no parental investment from males, while females are biologically obligated to commit more resources from the outset. This asymmetry of obligate parental investment leads to sex differences in strategies of reproductive behavior. The males' reproductive success may be furthered by impregnating as many females as possible. Conversely, the females' reproductive success is limited by time, energy, and the costs of ovulation, conception, successful parturition and in the case of altricial young, the constraints of nurturing her offspring until they can survive on their own. In support of parental investment theory, females of most mammalian species show greater discrimination regarding mate choice and timing of reproduction than is shown by males and greater commitment to parental effort. For males, it appears that sexual selection processes have acted more strongly on male intrasexual competitive abilities and the specialized signals. In sum, the female strategy is biased more toward selective mate choice and parental effort, whereas the male strategy is biased more toward intrasexual competition and mating effort (Clutton-Brock, 1989).

Within-sex Variation in Reproductive Strategies

The principles of sexual selection have led to well-explicated accounts of alternative male mating strategies and female mate preferences. Both good-genes sexual selection and good-provider sexual selection are needed to address female mate choice. In many species, males provide little or no parental investment. Yet, even in these species females are selective and consistently prefer certain males over others as mates. Good-genes sexual selection occurs when females select males based on indicators of viability and good condition, that is, adaptive attributes that can be passed on to their offspring through genetic inheritance.

Alternative male mating strategies result from the mate preferences of females and hierarchies based on these preferences (e.g., resources acquisition, attractiveness, etc.). Those at the top of the hierarchy (i.e., those who have higher mate value) have more mating opportunities than those at the bottom. The social, sexual, and behavioral strategies that emerge as a result of social and sexual selection are best thought of as status-related alternatives (Gross, 1996; West-Eberhard, 2003). Such alternatives are a function of variable competition for necessary resources due to phenotypic traits that can help one gain status (e.g., size, degree of aggressiveness, attractiveness, social relations with others). When status relations become an important determinant of resource acquisition (e.g., food, shelter, and mates), selection tends to favor the establishment of status early in ontogeny with continued competition for status throughout the lifespan. Status-dependent alternatives do not require equal fitness among alternative tactics.

Therefore, those who fail to ascend to the top of status hierarchies often adopt a secondary alternative that can be thought of as “making the best of a bad situation”.

The mate preferences of females and the hierarchies that emerge as a result of competition for mates or the resources needed to attract mates help define the nature of the overall mating system. For instance, in mammalian species where paternal investment is needed and desired by females, males can vary their commitment of resources between the extremes of maximizing copulation with a large number of females and maximizing provision of parental care to their offspring. Among mammals the empirical correlates of the low male parental effort strategy are male dominance hierarchies, male-male aggression and violence, and high morphological dimorphism between the sexes, since fitness of a male seems to be determined by competition with other males. In contrast, when male parental effort is high, the empirical correlates for numerous species are relatively stable male-female monogamous associations, reduced male-male competition for access to females and reduced dimorphism. Human male reproductive strategies fall somewhere along this continuum, within considerable variation within males as to the amount of effort allocated to mating effort vs. parenting effort.

A Sexual Selection Model of Human Reproductive Variation

Strategic pluralism theory (SPT; Gangestad & Simpson, 2000) provides an account of environmentally-contingent human reproductive strategies based on the principles of sexual selection. The theory contends that both men and women have evolved alternative reproductive strategies that are dependent on the circumstances of the natural and social environment. According to their model, males and females shift

between short-term sexual pairings and long-term committed relationships based on the demands of the local environment. Their approach primarily addresses adaptive individual differences in human mating psychology and their behavioral manifestations (e.g., mate preferences, desire and or willingness to engage in long-term romantic relationships vs. short-term sexual encounters) rather than constellations of life history traits, although the two are assumed to be related. For instance, Gangestad and Simpson define mating strategies as “integrated sets of adaptations that organize and guide and individual’s reproductive effort (p. 575).” Accordingly, mating strategies influence how individuals select mates, how much mating effort they expend, and how much parental effort they expend (p.575)”

Based on parental investment theory, Gangestad and Simpson (2000) assert that the strategies for allocating reproductive effort are unique to each sex. In our own species, it is the female that assumes the role of the higher-investing sex. Due to internal gestation and lactation, females have a higher obligatory parental investment cost at the outset. Although, males do tend to invest a great deal in their offspring once they are born. According to this logic, Gangestad and Simpson argue that women have evolved to evaluate men on two dimensions (a) the extent to which a male is able and willing to invest in the relationship and any subsequent offspring and (b) the extent to which a male shows evidence of having good genetic quality.

According to Gangestad and Simpson (2000), good genetic quality is related to an individual’s underlying phenotypic condition, or stated differently, their ability to effectively garner and convert energy into fitness returns. Phenotypic condition is thought

to be related to many factors, including mutations, toxins, developmental stress, heterozygosity, some of which are partly heritable. Pathogen resistance assumes an important and central role in the “good genes” argument laid out by SPT. To further illustrate the meaning of good genes, consider the hypothesis that individuals who are heterozygous for genes that code for proteins involved in immune function are more passively resistant due to the diverse biochemical environments they represent for parasites compared to individuals who are homozygous for the same genes. Due to their passive resistance to parasites, heterozygous individuals can afford to divert less energy to immune functioning and more energy to other developmental demands (e.g., physical growth). Thus, a specific genetic profile might confer benefits related to immune response. To the extent that this profile is heritable, females might be able to pass on these benefits to their offspring, enhancing their own reproductive success.

All else being equal females should prefer mates high on both dimensions. However, females likely had to make trade-offs between the two throughout evolutionary history because males of high genetic quality probably encountered more opportunities for mating, and therefore, were able to invest less in any single relationship. Gangestad and Simpson summarize the nature of female trade-offs in the following quote. “If some women could have appreciably improved their fitness by mating with men who offered better genetic benefits, these women should either have preferred long-term mates who had markers of genetic fitness or they should have engaged in short-term mating (especially opportunistic extra-pair matings) with males who had such indicators, even if it meant “trading –off” or risking the loss of material benefits they could have garnered

from a long-term mate. Conversely, if other women could have enhanced their fitness by obtaining mates who provided (or could provide) superior material benefits, these women should have pursued long-term mates who were able and willing to provide the material benefits they most needed (2000, p. 583).”

According to SPT, it is the differential value of genetic vs. material benefits that produces adaptive variation in female reproductive strategies. The authors predict that this exchange is contingent upon factors in the local environment, such as pathogen prevalence. When pathogens account for the majority of infant mortality, women are expected to place greater weight on genetic quality. Alternatively, when biparental care is necessary for offspring survival and development, females are expected to place greater weight on paternal investment. In this way, female mate preferences are tied to the nature of the local ecology.

Gangestad and Simpson (2000) add that female status related to her ability to attract highly competitive males and her ability to access resources independently of her male partner should also influence the cost-benefit ratio of trade-offs between a man’s genetic benefits and his willingness to invest in offspring. For instance, a female with relatively high mate value might have been able to obtain mates high on both dimensions moderating the hypothesized trade-off. Furthermore, women’s access to resources through cooperation, competition, or social influence would have had the influence of diminishing the need for high paternal investment, as parental investment often reaches diminishing returns.

Men, on the other hand, were not reproductively constrained by the nature of the local ecology per se, but by their ability to attract mates. Thus, it is the differential value of mating effort vs. parenting effort that produces adaptive variation in male mating strategies. Gangestad and Simpson (2000) contend that men have evolved to evaluate themselves in terms of the attributes desired by females. Males who can meet the mate preferences of females, particularly short-term mate preferences, should allocate more effort to mating than parenting. In sum, men have evolved to “decide” conditionally to allocate more vs. less effort to mating or parenting, depending on the degree to which they possess indicators of good genetic quality.

Empirical Evidence

A substantial amount of empirical evidence has accumulated in recent years in support of the sexual selection model of human reproductive variation, including the strategic pluralism model of within-sex alternative mating strategies. Buss & Schmitt (1993), Buss (1994) and Gangestad and Simpson (2000) all provide excellent reviews of this literature. I briefly review the evidence regarding female mate choice and alternative male mating strategies, and highlight potential limitations.

Female mate choice. In their strategic pluralism theory, Gangestad and Simpson (2000) argue that in the absence of seeking or receiving long-term investment, females should seek the benefits of good genes from potential short-term mates. Thus, female mate preferences should be relatively context-specific, with women emphasizing paternal investment qualities when seeking long-term partners and emphasizing indicators of good genes when seeking short-term or low-investment relationships. In support of this

hypothesis, women do emphasize different male traits in the contexts of long-term and short-term mating. For instance, females prefer indicators of status or status potential, such as ambition and earning potential, particularly when seeking long-term romantic partners (e.g., Buss & Schmitt, 1993). Females also prefer physical attractiveness and physical prowess in males, but emphasize such traits in the context of short-term sexual relationships (Buss & Schmitt, 1993). In a recent study that made use of the economic concepts of necessities and luxuries, participants were provided with different “mating budgets” in order to constrain mate preferences. Women considered status to be a necessity in the long-term mating context, while they considered physical attractiveness to be a necessity in the short-term mating context (Li, Bailey, Kenrick, & Linsenmeier, 2002).

Additional evidence regarding the context-specific nature of female mate preferences comes from research linking sociosexual orientation and mate preferences. Women who are more willing to engage in short-term sexual relationships (unrestricted sociosexual orientation) find a man’s physical attractiveness to be more important than women who are less willing to engage in short-term sexual relationships (restricted sociosexual orientation) (Simpson & Gangestad, 1992). Furthermore, when these women were asked to make trade-offs between attractiveness and reliability in a future romantic partner, unrestricted women were more likely to select a romantic partner who is more attractive but less reliable, whereas restricted women were more likely to select a romantic partner who is less attractive but more reliable.

Important to the premise concerning female environmental tracking, there is tentative evidence that female mate preferences are in fact tied to the need for paternal investment vs. the need for genetic quality. Gangestad and Buss (1993) examined the mate preferences of individuals in 29 different countries and found that in the regions that contained the most pathogens, males and females placed greater importance on a prospective mate's attractiveness. Additionally, females in pathogen-prevalent regions rated attributes associated with male parental care as less important than females in less pathogen-laden environments. These findings suggest that females make trade-offs between male parental investment and male genetic quality in ways predicted by SPT.

Male reproductive strategies. There is an abundance of evidence across multiple disciplines, which suggests that males who possess high status encounter more mating opportunities. For instance, anthropological evidence indicates that social status is directly related to male reproductive success in horticultural, agricultural, and pastoral societies (see Pérusse, 1993 for an extensive review). Men with higher status in industrial societies, as measured by education, occupation, and income, also report a greater number of sex partners than men of lower social status (Pérusse, 1993). Furthermore, men who report that they are more attractive to the opposite sex also report having sex at an earlier age, a greater number of sex partners since puberty, a greater number of sex partners during the past year, a greater number of sexual invitations during the past three years, having sexual intercourse a greater number of times, less need for attachment to a person before having

sex, and an unrestricted sociosexual orientation (Jackson & Kirkpatrick, 2007; Lalumiere, Seto, & Quinsey, 1995³).

A specific prediction of SPT is that men evolved to allocate effort to short-term versus long-term mating strategies depending on their ability to satisfy the short-term mate preferences of females. These preferences, in turn, are thought to have evolved via good-genes sexual selection, such that females prefer short-term mates who possess honest indicators of genetic fitness. In recent years, a substantial amount of research has been conducted examining the relationship between fluctuating asymmetry (FA) and male mating success. FA is related to pathogen resistance and a lack of deleterious alleles, and as such it is used as a marker of genetic quality (see Gangestad & Thornhill, 2003 for a review).

In support of SPT, Thornhill & Gangestad (1994) found that more symmetrical males report greater numbers of sexual partners than less symmetrical men over the course of a lifetime. As expected, similar findings were not found for females. Furthermore, symmetrical males are more likely to encounter multiple mating opportunities while in a committed relationship, and females are more likely to choose symmetrical males as short-term partners outside of their own existing long-term relationships (Gangestad & Thornhill, 1997).

To address the question of whether men who possess indicators of good genes trade long-term mating strategies for short-term mating strategies, Gangestad and Thornhill (1999) assessed male FA and self- and partner-report scores on the

³ As cited in Buss (1999).

Relationship Specific Investment Inventory (RSI; Ellis, 1998). As reviewed in Gangestad and Simpson (2000), the authors found that more symmetrical men provided less overall investment in their relationships. However, it appears that trade-offs between long-term and short-term mating tactics do not occur across the board; instead, they occur only in specific investment domains. Although symmetrical men reported spending less time with their partners, being less honest, and a tendency to sexualize other women, low FA and high FA men did not differ in the following investment acts: being expressive/nurturing, being committed, being sexually proceptive, investing money, being attentive in social contexts, and having a relationship with their partner's family. These data suggest that symmetrical males may pursue a dual or mixed mating strategy rather than an exclusive short-term mating strategy. This is in keeping with the observation that in species like our own, that exhibit high levels of biparental care, males may invest heavily in a single female and her offspring, but remain open to short-term, opportunistic matings (e.g., extra-pair matings) when the costs are low and the benefits are high (Trivers, 1972).

Finally, it is important to note that researchers examining relations between FA and mating success in males do not assume that females directly assess and prefer symmetry. Rather, researchers assume that females infer the genetic quality of males based on physical features that serve as honest indicators or signals of genetic quality. As reviewed by Gangestad and Simpson (2000), research regarding these possible physical features indicates that physical attractiveness, body mass, physicality (e.g., muscularity, robustness, and vigor), and social dominance all mediate the link between male FA and

number of lifetime sexual partners, suggesting that they too are indicators of genetic fitness.

Limitations

Strategic pluralism theory has been challenged or critiqued on the following grounds: (a) the concepts of “long-term” and “short-term” mating and their conceptualization as alternatives is problematic, (b) SPT is well-explicated for males, but it is lacking in its ability to explain female strategic variation, and (c) SPT does not provide guidance about the ontogeny of strategic variance or its proximate mechanisms. In the following section, I briefly review each of these critiques in turn.

The terms “long-term” mating and “short-term” mating are problematic. The terms used by Gangestad and Simpson (2000), and other evolutionary psychologists studying variation in human mating strategies, are deeply problematic (e.g., Archer & Mehdikhani, 2000, Beckerman, 2000, Broude, 2000). First, it is the degree of parental investment that distinguishes alternative reproductive strategies rather than the amount of time spent with a particular mate. Thus, high-investing vs. low-investing might be better terms (Archer & Mehdikhani, 2000).

Second, the conceptualization of a trade-off between these two strategies is too simplistic, as it fails to recognize that pairbonding and marriage are human universals. Accordingly, short-term/low-investing mating often represents an opportunistic addition to long-term/high-investing mating. Over evolutionary history, desirable men may have pursued both long-term/high-investing and short-term/low-investing relationships successfully, especially as parental investment reached diminishing returns. Less

desirable men were probably not presented with the opportunity to engage in extra-pair sex. Females, on the other hand, may have desired extra-pair partners to the extent that they would reap genetic benefits and to the extent the costs of pursuing such relationships were low (i.e., female infidelity is widely and harshly punished). In sum, strategic pluralism theory should incorporate the notion of a dual or mixed reproductive strategy, especially to the extent that it broadens our thinking about strategic variation related to mating effort vs. parenting effort.

Female strategic variation is not adequately addressed. There are two limitations of strategic pluralism theory regarding its explication of alternative female strategies. First, the logic that one mate dimension might be more in demand than the other in a given ecology, does not explain mate preference trade-offs that occur within that ecology. Instead, strategic variation results primarily because all women are not equally constrained by prevailing ecological factors. Important individual differences exist among females, such as physical attractiveness, maternal competence, and social position, which may influence strategy and mate choice. Although mentioned by the authors, the theory itself does not adequately address these individual differences and their impact on social competition among females. Empirical evidence is also lacking. For example, does possessing high mate value result in the ability to attract a male who is high on both mate choice dimensions, decreasing the need for an explicit trade-off. Furthermore, how do personal attributes such as age, maternal competence, and support and resources from kin influence the need for male parental investment in offspring, and thus one's willingness to trade this investment for good genes?

A second limitation is that the trade-off between mating and parenting effort is well-explicated for males but not females. According to Gangestad and Simpson (2000), males allocate energy to mating effort vs. parenting effort depending on their ability to meet the short-term mate preferences of females. Females, on the other hand, make trade-offs in their mate preferences. The good genes vs. good parenting trade-off in mate selection does not boil down to the mating effort vs. parenting effort trade-off inherent in alternative reproductive strategies. A female seeking genetic resources at the expense of material resources is not necessarily engaging in mating effort (quantity strategy) at the expense of parenting effort (quality strategy), as these genetic resources will likely enhance offspring quality. While SPT does a fine job of explicating women's mate preferences as they are tied to specific ecologies, it does not adequately address alternative reproductive strategies in females within the same ecology.

Lack of specification regarding ontogeny and proximate mechanisms. Strategic pluralism theory is lacking in that it does not provide guidance about the ontogeny of male and female strategic differences (e.g., Bailey, 2000; Berry & Kuczaj, 2000). For instance, what is the proximate mechanism that allows men to adopt a particular strategy based on their level of attractiveness or social competitiveness? What is the proximate mechanism that allows women to deduce from the environment their need for male investment in offspring and/or genetic benefits (e.g., parasite resistance)? When do these mechanisms operate – at birth, across development, or continuously and unconsciously with preferences and behavior tracking relevant changes across the lifespan?.

The proximate mechanism implied by Gangestad and Simpson is that alternative strategies are adopted during development based on the possession of personal attributes and the opportunities they afford. Such factors in men alter the relative cost-benefit ratios of mating effort vs. parental effort while the same factors in women may alter the relative cost-benefit of good genes vs. good parenting qualities in a mate. In their commentary on Gangestad and Simpson (2000), Figueredo and Jacobs (2000) detail the reactive heritability model implied. They contend that, “psychosexual development involves a self-assessment of sociosexual capabilities and opportunities, calibrating optimal utilization of physical assets such as size, strength, health, and attractiveness, as well as psychosocial assets such as intelligence, self-efficacy, social skills, personality, and SES and/or prospects.” Thus, the possession of strategically relevant characteristics may bias an individual’s selection of alternatives. The reactive heritability model is a promising model of the proximate mechanisms involved in strategy assessment and adoption that needs to be further developed.

Summary and Evaluation

Strategic pluralism theory is based on the principle that female mammals tend to track their environments for the resources they require for parental investment, while males tend to track females for opportunities to mate. In essence, human females attend to the local environment and then base their mate choice priorities on the resources needed for offspring, their own access to resources, and their ability to impose their mate choice demands based on mate value. When pathogens account for the majority of infant mortality, women are expected to place greater weight on genetic quality. Alternatively,

when biparental care is necessary for infant survival, females are expected to place greater weight on paternal investment. Males, on the other hand, conditionally allocate effort to mating and parental investment based on their possession of indicators of genetic fitness.

Based on the review of the literature, I would argue that the sexual selection model has been successful at addressing the unique roles that males and females play in reproduction and their consequences for sex-specific and alternative reproductive strategies. While strategic pluralism theory is empirically supported, there are many theoretical and empirical gaps that are yet to be filled. For instance, the theory itself is agnostic as to the developmental processes that result in strategic variation in males and females. It will be important for future research to address the proximate mechanisms involved and their development across the lifecourse. Second, more theoretical and empirical attention is needed to adequately address female mate preferences within populations, and female strategic variation in relation to the problem of mating effort vs. parenting effort.

Synthesis between Life History Theory and Sexual Selection

The developmental, life history perspective and the sexual selection perspective each provide a lengthy, detailed, and fairly consistent story of variation in human mating, reproduction, and parenting, attesting to the explanatory power of an evolutionary approach. While each theoretical model sheds light on a unique and important part of the overall picture, the fundamental question is the same: What are the selection factors that influence the reproductive opportunities and constraints of males and females? As we have seen, the answer to this question is likely to be varied, as a number of selection

factors should govern the adoption of specific reproductive strategies in adulthood. To the extent that these factors varied but reoccurred across generations and within the lifetime of organisms, we might expect evolved responses to certain environmental contingencies. These prepared responses are the evolved alternative reproductive strategies that each theory attempts to explain.

How Can a Synthesis Address Unresolved Issues?

A synthesis between the two theories should be especially valuable because the weakness of one theory is often the strength of the other (Geary, 2002). For instance, life history theory has provided the basis for a useful set of models for explaining development of variation in female reproductive strategies (e.g., explaining developmental trade-offs between current vs. future reproduction; see Belsky, Steinberg, & Draper, 1991; Ellis, 2004). However, because life history models have not adequately addressed social-sexual competition for mates, they have been limited in their ability to explain strategic variation among men. Sexual selection models, by contrast, have been successful in explaining how males apportion reproductive effort to mating vs. parenting in relation to current levels of social-sexual competitiveness (e.g., Gangestad & Simpson, 2000; Gross, 1996), but do not provide an adequate developmental model for how and when males should make these adaptive shifts.

Sex Differences in Environmental Tracking

An important premise moving forward is that of sex differences in the tracking of environmental information, or at least the weight given to specific environmental cues (see Gangestad & Simpson, 2000; Thiessen, 1994). This is due to the fact that selection

factors impact males and females differently, as each sex fulfills a unique reproductive role. Females are ultimately concerned with the resources that are needed to successfully produce and rear offspring. To the extent that these resources are tied to the local ecology and the social hierarchies that control access to resources, females should monitor the local environment across development and their position within hierarchies. Their life history traits and mate preferences should match these cues, which signal the unique opportunities and constraints that they face. Males, on the other hand, are ultimately concerned with their ability to access, attract and retain females. Thus, they should monitor the demands and desires of females and compete among members of their own sex to attract females. Male status/mate value hierarchies will to some extent reflect the local ecology as well.

The proposition of sex differences in environmental tracking can address unresolved issues in the empirical literature. For instance, research testing the BSD model has consistently demonstrated that early rearing conditions influence the timing of puberty in females, but not males. Although methodological issues are responsible for a lack of empirical study among males, the sexual selection perspective casts existing findings in a new light. It may be that females are more likely to track the physical environment and adjust their reproductive development accordingly. Males, on the other hand, may be more likely to track their mate value relative to other males (e.g., Gangestad & Simpson, 2000; Wrangham, 1980).

In support of this idea, Thiessen (1994) has noted that age at menarche, menstrual cycles, menopause, food restrictions, response to living conditions, reactions to cultural

factors, and responses to sexual stimuli and potential mates are unique to or are more variable among females than males. For instance, changes in body weight effect age of menarche, menstruation, and ovulation. A female must have a minimum of 22% to 24% of body fat in order to ovulate and be fertile (Frisch, 1990). In contrast, male reproductive capabilities do not appear to be affected by these same nutritional and body weight fluctuations. Instead, the male adjusts his sexual activities to the physiology and behavior of females (Schweiger, 1991).

This notion is not unique to our species. Many mammalian species that live under cyclic or seasonal changes in ecology show a greater pattern of sexual dimorphism in the capacity for reproduction, with females being more dependent on environmental cues. Specifically, females are only able to reproduce seasonally, whereas males remain fertile. Although rare in human populations, researchers conducting endocrine studies of the San, who inhabit the Kalahari desert in South Africa, have documented seasonal suppression of ovulation in females, which is linked to food shortages (Traswell & Hansen, 1968; Vander Walt, Wilmsen, & Jenkins, 1978; Warren, 1983). In conclusion, the ability to anticipate the quality of the environment must be particularly important for females.

The Need for an Evolutionary-Developmental Model of Peer Status and Mate Value

Another important conclusion is that researchers currently lack a developmental model of social competition as it relates to mating success. Outlining a developmental model of how social and sexual competition entrains alternative reproductive strategies represents an important step moving forward. With a preliminary framework in place, researchers can begin to theoretically and empirically examine the interactions between

the two selection factors on the adoption of alternative reproductive strategies. For the purposes of the current paper, I briefly review the literature of peer status during adolescence as it relates to intrasexual and intersexual competition. I then focus on the self system as a proximate means for calibrating reproductive strategies across development based on feedback from the social environment.

Does adolescent peer status reflect processes related to intrasexual competition and intersexual mate choice? Consistent with the prediction that peer status is, in part, concerned with competition for mates, sexually-selected characteristics appear to be strong determinants of status during adolescence. Among adolescent males, status is strongly associated with physical attractiveness, athletic ability, and social dominance (e.g., Coleman, 1961; Dodge, 1983; Pellegrini & Long, 2003; Pellegrini & Bartini, 2001; Savin-Williams, 1987; Sherif & Sherif, 1964; Weisfeld, Muczenski, Weisfeld, & Omark, 1987). Among adolescent females, physical appearance or attractiveness is the single best physical predictor of peer status (e.g., Adams, 1977; Benenson, 1999; Eder, 1985; Kennedy, 1990; Weisfeld, Bloch, & Ivers, 1984).

Several lines of research suggest that these particular traits are also related to romantic and sexual behaviors in ways consistent with the sexual selection model. For instance, attractive adolescents of both sexes are more likely to have a steady dating partner (Chess, Thomas, & Cameron 1976). Socially dominant males are preferred by adolescent females as dating partners and report a high frequency of dating (Bukowski, Sippola, & Newcomb, 2000; Pellegrini & Bartini, 2001; Pellegrini & Long, 2003). Weisfeld, Muczenski, Weisfeld, and Omark (1987) found in a study of six high school

classes that attractive, athletic boys were ranked as desirable dates and party guests by girls. Miller et al. (1997) found that among males, but not females, those who were more attractive relative to their peers had an increased risk of early first sexual intercourse. Thus, attractiveness, social dominance, and athletic ability appear to be associated with increased access to romantic partners and earlier onset of sexual activity, particularly among males.

What is the proximate mechanism through which status impacts the development of alternative reproductive strategies? If peer status does in fact impact the adoption of alternative reproductive strategies in males and females, what is the proximate mechanism through which it occurs? Several evolutionarily-minded researchers have proposed that self-assessment of standing relative to others on dimensions related to reproductive success (i.e., mate value) might serve to guide the development and adoption of alternative reproductive strategies (e.g. Harris, 2005; 2006; Kirkpatrick & Ellis, 2001; Figueredo & Jacobs, 2000; Gangestad & Simpson, 2000).

In their domain-specific model of self-esteem, Kirkpatrick and Ellis (2001) propose that one crucial function of self-esteem is to guide personality development. They hypothesize that self-perceptions of success in the domain of mating (i.e., self-perceived mate value) guides the development and calibration of alternative reproductive strategies. Similarly, Judith Rich Harris (2005; 2006) has proposed the idea of a behavioral strategy mechanism dedicated to the task of monitoring social feedback from others concerning one's relative standing on competitive dimensions. The proposed

function of this behavioral strategy mechanism is to construct adaptive strategies that are consistent with the individual's ability to compete within the group.

When do reliable self-perceptions develop? For self-evaluations to effectively guide the development of reproductive strategies, a stable self-representation of where one stands relative to others on the competitive landscape is necessary. Without a baseline from which to operate, self-perceptions cannot effectively guide future behavior. Indeed, self-theorists contend that self-representations are best conceptualized as theories that are cognitively and socially constructed over time (Harter, 1999). Self theories, like scientific theories, must be empirically valid and internally consistent in order to be useful for guiding future behavior. They must also be testable and are always subject to minor revision based on current data. Demo (1992) has referred to this process of constructing stable self-representations and updating them based on current conditions as the "moving baseline." Thus, one can conclude that baseline levels of self-perceived status are constructed during a specific phase of the lifespan, but are subject to minor revisions based on immediate contextual and environmental changes.

The extant literature on when and how stable self-perceptions are formed suggests that it is not until middle to late childhood that individuals are cognitively capable of internalizing the perceptions of others and utilizing social comparison information for personal assessment (Damon & Hart 1982; Moretti & Higgins, 1990). Moreover, it is during this time that self-attributes become interpersonal in nature and relations with peers become an increasingly salient dimension of the self (Harter 1999; Rosenberg, 1979). Demo (1992) maintains that during late childhood and early adolescence self-

evaluation becomes possible and a lifelong concern. However, the use of specific self-evaluative mechanisms in the construction of self-representations changes across the lifespan. For instance, the use of social comparison information in the construction of self-representations tends to decrease from middle to late adolescence (Harter, 1999), and the locus of self-knowledge shifts from external to internal around the age of 16 (Ellis, Gehman, & Katzenmeyer, 1980). Therefore, it appears that the construction of stable assessments of the self develop during the span of pre-adolescence to late adolescence. This is when we might expect adaptive assessments to be made, and thus guide the specialization and calibration of reproductive strategies.

Summary. In sum, self-perceptions of competency or success in the domains of social dominance, physical attractiveness, and athletic ability might be useful indicators of relative standing in intersexual competition for mates. Such measures could be added to the developmental trajectories modelled by life history theorists. Based on the literature concerning the formation of stable self-perceptions, researchers will want to focus on the period of middle to late adolescence.

Conclusion

Developmental, life history and sexual selection models of reproductive strategies have proceeded along two relatively independent lines of inquiry. The two lines of research have a lot in common (e.g., both are based on environmentally-contingent strategies) but they emphasize different selection pressures. The developmental literature has focused on how ecological stressors influence the development of reproductive strategies, and thus, is concerned primarily with rearing context within the home. Sexual

selection models of human reproductive strategies emphasize social and sexual competition for mates, and thus, are focused on proximate social events that occur outside of the home. Life history models are better at predicting variation in female reproductive strategies, while sexual selection models are better at predicting variation in male reproductive strategies.

Researchers are in need a comprehensive model of human reproductive strategies. Those that currently exist are insufficient on their own. I have argued that adding the principles of sexual selection (particularly parental investment theory) to developmental, life history models helps address empirical problems. For research to progress in these areas, I think that it will be necessary to develop a single integrative model. An important assumption garnered from life history theory is that the solutions to trade-offs devised at earlier stages of development affect the solutions devised at later stages of development. Thus, I contend that a necessary next step will entail placing the component of social competition within the developmental trajectories laid out by developmental, life history theorists. In the next chapter, I outline an empirical study that examines an integrated model of sociosexual development. Specifically, I examine how the early rearing conditions and self-perceived mate value developed during adolescence predict timing of sexual debut and sexual risk taking in a longitudinal study of adolescent development. I examine critical predictions from both life history theory and sexual selection theory, and test for multiple developmental trajectories across and within the sexes.

CHAPTER 3: THE PRESENT STUDY

As reviewed in the preceding chapter, there are multiple selection factors that influence the reproductive opportunities and constraints of males and females. Life history models have focused on ecological stress and the early rearing conditions, whereas sexual selection models have emphasized social competition, status, and mate value. The current study is the first to empirically examine an integrated model that draws from both perspectives. It examines the role of early rearing conditions, per the Belsky, Steinberg, and Draper (BSD; 1991) model, and self-perceived mate value, as highlighted by a sexual selection perspective, on timing of sexual debut and sexual risk taking in a longitudinal study of adolescent development.

Research Questions

Are Early Rearing Conditions, Pubertal Maturation, and Sexual Behavior Causally Related in a Manner Consistent with the BSD Model?

According to the BSD model, early rearing conditions, pubertal maturation, and sexual behavior are linked in a casual chain. Children whose rearing context is characterized by harsh or insensitive parenting are hypothesized to experience earlier pubertal maturation, and through it, earlier sexual debut and greater sexual risk taking. In contrast, children whose rearing context is characterized by warm and supportive parent-child relationships are hypothesized to experience later pubertal maturation, which in turn delays the onset of sexual relationships and reduces of sexual risk taking.

To date, only one study has directly tested the full model proposed by BSD using prospective, longitudinal data. Belsky, Steinberg, Houts, Halpern-Felsher and the NICHD

Early Child Care Research Network (2010) examined the critical prediction that rearing practices influence sexual behavior via their effect of pubertal maturation in a sample of adolescent females. Results demonstrated that greater harsh maternal control at age 54 months predicted earlier age of menarche, which in turn predicted greater sexual risk taking (e.g., frequency of sexual behavior), but not risk taking in other domains (e.g., alcohol, drugs, delinquency). Moreover, there was a significant indirect effect of harsh maternal control on sexual risk taking via pubertal maturation. The current study extends this research by examining the direct and indirect pathways linking early family relations, pubertal maturation, and sexual behavior using prospective data with both male and female participants. Furthermore, the differential effects of positive family relations, negative family relations, and family structure (father absence vs. presence) are studied.

Recent research demonstrates that positive and negative family relations reflect correlated, yet separate dimensions of the family rearing environment (Park, Garber, Ciesla, and Ellis, 2008), which do not always predict the same developmental outcomes (e.g., Petit & Bates, 1989; Petit, Bates, & Dodge, 1997). Few studies have examined the differential effects of positive and negative family relationships despite the fact that BSD emphasized the developmentally accelerating effect of negative rearing conditions and the delaying effect of positive rearing conditions. Ellis et al. (1999) found that the *frequency* of both positive and negative father-daughter interactions predicted pubertal development in daughters. However, when overall *levels* of familial warmth/positivity and conflict/coercion were examined, only warmth/positivity predicted daughters' pubertal maturation. Belsky et al. (2007) examined the unique effects of positive and

negative family relations on pubertal maturation in males and females. In contrast to Ellis et al. (1999), the researchers found that the negative aspects of the parent-child relationship uniquely predicted pubertal maturation, whereas the positive aspects did not. In the current study, both positive and negative family relations are included in the model in an attempt to tease apart their unique effects on pubertal maturation and sexual behavior. Per the BSD model, it is predicted that negative family relations will be associated with earlier pubertal maturation, earlier sexual debut and greater sexual risk taking, whereas the opposite pattern will emerge with positive family relations.

The differential effect of family structure on pubertal maturation and sexual behavior is also examined. Paternal investment theory posits a unique role for father presence-absence in the regulation of sexual development (Draper & Harpending, 1982; Ellis, 2004; Ellis & Garber, 2000). However, the BSD model posits that it is not father absence, per se, but a variety of stressors associated with father absence (e.g., divorce, poverty, conflictual family relationships) that accelerates development. A family structure variable that reflects father presence-absence is also included in the model. Per paternal investment theory, it is predicted that father absence will uniquely predict earlier pubertal maturation, earlier sexual debut, and greater sexual risk taking, particularly in females.

Do Perceptions of Competency in Domains Relevant to Mate Value Predict Sexual Behavior per the Sexual Selection Model?

According to a sexual selection perspective, individuals who are socially and sexually competitive relative to peers will encounter more mating opportunities, and as a

consequence may be more likely to initiate sexual relationships at an earlier age. As reviewed in the previous chapter, self-assessment of success relative to others on dimensions related to mate value during adolescence could serve as an important mechanism that entrains sociosexual development. The current study extends the previous literature by examining the role of social competence, athletic competence, and physical appearance (collectively labeled self-perceived mate value) on timing of sexual debut and greater sexual risk taking. The associations among family relations and structure, pubertal maturation, and self-perceived mate value are also explored.

To date, there are no studies that examine self-perceived mate value during adolescence and sexual behavior from a sexual selection perspective. However, there is a literature relating general and domain-specific measures of self-esteem to sexual behavior outcomes. This literature has provided mixed results. Previous research indicates that self-esteem and timing of sexual intercourse are largely unrelated (Zimmer-Gembeck & Helfand, 2008). However, recent research has shown that gender and age moderate the relationship, possibly masking important associations. For instance, Longmore, Manning, Giordano, and Rudolph (2004) found that among boys age 17 or older higher self-esteem was associated with earlier age of first intercourse. The same association was not found among younger boys or females. Domain-specific measures seem to provide more precise information about the relationship between self-esteem/competencies and sexual behavior. For instance, Waller and Dubois (2004) found that positive athletic self-evaluation was associated with increased risk of early first intercourse.

For the purpose of the current study, three self-competency domains related to intrasexual mate choice and intersexual competition during adolescence are combined into a composite self-perceived mate value measure. Based on theory and previous research, it is predicted that adolescents who possess higher mate value relative to their peers will experience earlier sexual debut. It is unclear whether self-perceived mate value will be predictive of sexual risk taking.

Are There Differences in the Developmental Trajectories of Males and Females?

As reviewed in Chapter 2, an integrated theoretical approach highlights the unique adaptive problems that males and females must solve when negotiating life history trade-offs. An important idea to emerge from the synthesis between life history theory and sexual selection theory is that of sex differences in the tracking of environmental information (see Gangestad & Simpson, 2000; Thiessen, 1994). Females are ultimately constrained by the resources that they can extract from the environment, their relatives, and their mates in order to successfully produce and rear offspring; accordingly, they should be especially attuned to the nature of the local ecology and support in and around their home environments, per life history models. Males, on the other hand, are ultimately constrained by their ability to access, attract, and retain females; accordingly, their own reproductive strategies should be especially attuned to the demands and desires of females and their ability to successfully engage in intrasexual competition, per sexual selection models.

Using multisample path analysis, the current study explicitly examines sex-differentiated pathways to timing of sexual debut and sexual risk taking. It is predicted

that female pubertal maturation and sexual behavior will be closely associated with early rearing conditions. In contrast, it is predicted that male pubertal maturation will not be associated with early rearing condition and sexual behavior will be closely associated with self-perceived mate value.

Are There Multiple Developmental Pathways Within the Sexes?

And finally, a synthesis between the principles of life history theory and sexual selection brings to light the possibility that there are two types of strategies among males that result in similar patterns of sexual behavior. The strategy inferred by the sexual selection model is that of the socially competitive/high mate value male, who initiates sex at earlier ages, pursues multiple romantic relationships, and engages in short-term sexual pairings afforded by his desirability to the opposite sex. These short-term relationships however will often represent an opportunistic addition to an overall long-term/high-investing strategy (i.e., a dual or mixed reproductive strategy). Such dual strategists might share some of the same developmental antecedents and behavioral characteristics as the Type I strategist proposed by the BSD, but might resemble the Type II strategist in other ways (see Figure 2).

For instance, the Type I strategist proposed by BSD is predicted to have a history of negative rearing practices, which accelerate pubertal maturation and lead to the adoption of a more opportunistic mating strategy characterized by earlier sexual debut, a more avoidant romantic attachment style, greater sexual risk taking, and the use of less prosocial mating tactics. During adolescence, the socially competitive strategist might also experience earlier pubertal maturation and onset of sexual relationships. Earlier

pubertal maturation is expected given that it gives rise to the traits that males need to successfully compete for sexual partners. However, in contrast to the Type I strategist, the socially competitive male is expected to adopt a more prosocial orientation toward relationships, characterized by more a more secure romantic attachment style, less sexual risk taking, and use of more prosocial mating tactics. This is due to the fact that early sexual debut is likely the result of increased opportunity to engage in sexual relationships, rather than the expression of an overall opportunistic, short-term strategy.

In order to explore the data for these distinct pathways toward early sexual debut and sexual risk taking, a person-centered approach to analysis was also adopted. Latent variable modeling techniques were used to identify groups of individuals within the male and female subsamples who had similar patterns of sexual behavior. Groups were further distinguished based upon their relation to a diverse set of developmental antecedents and proximal correlates.

The Present Study

The present study unfolds in two parts. In Part I, I pursue a variable-centered approach to analysis. Using path modeling techniques, the longitudinal relations among positive family relations, negative family relations, family structure, pubertal maturation, and sexual behavior are examined per the BSD model. The longitudinal relations among self-perceived mate value and sexual behavior are also included in the model, per the sexual selection perspective. The direct and indirect relationships linking early rearing conditions, pubertal maturation, and self-perceived mate value across development are

explored. Multisample path analysis was used to examine the fit of the integrated model and test for sex moderation in developmental pathways.

In Part II, I pursue a person-centered approach to analysis in order to explore the data for multiple developmental trajectories within each sex. A person-centered focus is useful for representing heterogeneity in developmental trajectories that can be masked by more traditional, variable-centered approaches. Thus, using latent class analysis, the relations among early rearing conditions, pubertal maturation, and self-perceived mate value are examined within groups of individuals who possess different patterns of sexual behavior. The groups are further defined based on a number of proximate correlates, such as adult romantic attachment and tactics of manipulation in romantic relationships.

CHAPTER 4: METHOD

Method

Participants

Participants in this study were derived from a longitudinal study of maternal depression and adolescent development. Participants were 240 mothers and children who were first assessed in 6th grade (mean age = 11.86, $SD = .57$). Of the 240 children, 130 were female and 110 were male. Eighty-two percent were Caucasian, 14.7% were African-American, and 3.3% were of other ethnicities (Hispanic, Asian, Native American). The sample was predominantly working (e.g., nurses aid, sales clerk) to middle class (e.g., store manager, teacher) with a mean socioeconomic status (Hollingshead, 1975) of 41.84 ($SD = 13.25$).

Procedure

Parents of 5th grade children from metropolitan public schools in a county in a Southeastern state were invited to participate in a study about parents and children. A brief health history questionnaire comprised of 24 medical conditions and 34 medications was sent with a letter describing the project to over 3500 families. Of the 1495 mothers who indicated an interest in participating, the 587 who endorsed either a history of depressive symptoms, use of antidepressants, or no history of psychopathology were interviewed further by telephone. The remaining families were excluded, because the mother did not indicate depression or indicated other kinds of psychiatric problems without depression or serious medical illness (e.g., cancer, multiple sclerosis). On the basis of these screening calls, 349 mothers were identified who reported either a history of depressive symptoms ($n = 247$) or no history of psychiatric problems ($n = 102$). These individuals

were interviewed in person with the Structured Clinical Interview for DSM–III–R diagnoses (SCID; Spitzer, Williams, Gibbon, & First, 1990) to confirm the presence or absence of a lifetime diagnosis of a depressive disorder. On the basis of these SCID interviews, 109 families were excluded for the following reasons: They did not indicate sufficient symptoms to meet criteria for a depressive disorder (38%); they had other psychiatric disorders that did not include a depressive disorder (19%); they or the target child had a serious medical condition (14%); they were no longer interested (21%); the target child either was in the wrong grade or was in special education (6%); or the family had moved out of the area (2%). The final sample of 240 families consisted of 185 mothers who had had depressive disorders and 55 mothers were life-time free of psychiatric diagnoses.

Children were first assessed in sixth grade (Time 1). An interviewer who was unaware of the mothers' psychiatric history individually administered a battery of questionnaires separately to the mothers and their children. Subsequent evaluations were conducted annually over a six year period. Measures central to the current study are described below. In many cases composite measures were created to serve as more reliable manifest variables. The sample size precluded the use of multiply-indicated latent variables in subsequent analyses. A list of the measures used in the study and the composite measures created is presented in Table 1.

Measures

Positive and Negative Family Relations at Time 1

Questionnaires. The *Family Environment Scale* (FES; Moos & Moos, 1986) is a

widely used 90-item measure of perceptions of the family environment. The three subscales (Cohesion, Expressiveness, Conflict) comprising the Relationship dimension of the FES were used in the present study. The Cohesion subscale measures the degree of support and commitment provided by family members (e.g., “There is a feeling of togetherness in our family”). The Expressiveness subscale measures the degree to which family members are encouraged to express their emotions directly (e.g., Family members often keep their feelings to themselves”). The Conflict subscale measures the extent to which expressed anger and conflict are characteristic of the family (e.g., “We fight a lot in our family”). Each item is endorsed as either “true” or “false”. These FES subscales have demonstrated reliability and validity (e.g., Holahan & Moos, 1987; Moos & Moos, 1986). Because the FES items are scored in a dichotomous manner, tetrachoric reliability analyses were conducted yielding the following results in the current sample: Cohesion (Mother-report = .93), Expressiveness (Mother-report = .68), and Conflict (Mother-report = .88).

The *Family Assessment Device* (FAD; Epstein, Baldwin, & Bishop, 1983) is a 53-item measure with seven subscales. The general functioning subscale, which consists of 12 items (e.g., “There are a lot of bad feelings in the family”; “We don’t get along well together”) was used in the present study. Response categories range from 1 (*strongly agree*) to 4 (*strongly disagree*), with a mean greater than 2 indicating difficulty in this area of functioning. The FAD has adequate internal consistency and test-retest reliability and also has differentiated between clinician-rated healthy and unhealthy families (Miller, Epstein, Bishop & Keitner, 1985). Cronbach’s alpha for the FAD general functioning subscale in this sample was .90 (mother-report).

The *Conflict Behavior Questionnaire* (CBQ; Prinz, Foster, Kent, & O'Leary, 1979) is a 75-item measure of the degree of conflict and negative communication between the child and parent (e.g., "My child often seems angry at me"; "My child and I have big arguments about little things"). Each item is endorsed as either "yes" or "no" with higher scores indicating greater conflict. The 20-item short form was used in this study (Robin & Foster, 1989). The short and long forms of the CBQ have been shown to correlate at .96 (Robin & Foster, 1989). The internal consistency in the current sample was assessed using tetrachoric correlations: mothers' ratings of conflict with child = .97.

The *Children's Report of Parent Behavior Inventory* (CRPBI; Schaefer, 1965; Schludermann & Schludermann, 1970) contains 108 items descriptive of parents' child-rearing behaviors. The CRPBI has 18 subscales representing 3 dimensions: acceptance/rejection, autonomy/psychological control, and firm/lax control. Mothers rated how similar they were to the behaviors described. The acceptance/rejection dimension (e.g., "I seem proud of the things my child does"; "I wish my child were a different kind of person") was used in the present study. Response categories range from 1 to 3 (1 = *not true*, 2 = *somewhat true*, 3 = *true*). Cronbach's alpha in this sample was .87.

Observations. The Conflict Resolution Task (CRT) is an interaction method in which for 10 minutes a parent and child discuss and work toward resolving some issue that both the parent and child indicated was a problem they often discussed. In the current study, the behaviors of both the mother and child were coded by nine trained raters with regard to two broad constructs: positive relations and negativity. Both mothers and children were rated on the following 14 items: expresses positive emotions, is

positively assertive, maintains good eye contact and interactive body posture, listens/responds, communicates well, displays negative facial expressions, tone of voice conveys negative emotions, is coercive, is blaming/accusatory/critical, shows dysphoria, is involved in interaction, directs the interaction, the child [mother] seemed to enjoy him/herself, and the child [mother] seemed comfortable with the mother [child] during the interaction. In addition, mothers were rated on three items designed to assess parental control: attempted to influence the child in an appropriate/constructive fashion, attempted to influence the child in an inappropriate/destructive fashion, and issues orders to the child. Finally, children were rated on five items to assess compliance: displays defiant body posture, is off task, wants to terminate the interaction, is rebellious, and complied with parent's wishes. Thus, in total, mothers were rated on 17 and children were rated on 19 behavioral/affective items.

Following Simpson, Ickes, and Blackstone (1995), inter-rater reliabilities were assessed by treating the nine raters as items and then calculating an alpha reliability coefficient for each 9-item variable. Because the inter-rater reliabilities were high for all of the variables (mean $\alpha = .91$ and $.93$ for mother and child ratings, respectively), the nine ratings for each variable were averaged together. These composites (17 composited ratings of mothers and 19 composited ratings of children) then were used in the subsequent factor analyses. Exploratory factor analyses revealed three distinct factors for mothers and children separately: negativity, positive relations, and active involvement. The first two factors (negativity and positive relations) were used in the present study. Factor scores were based on unit-weighted composites of variables with factor loading

above .60 on a given factor.

Expressed Emotions. Maternal expressed emotion was measured with the Five Minute Speech Sample (FMSS; Magana, Goldstein, Karno, & Miklowitz, 1986). Mothers were asked to talk for five minutes about their thoughts and feelings about the target child and their relationship with the child. The audio-taped recordings were scored by researchers who were trained and experienced in assessing EE, in Dr. Michael Goldstein's laboratory at UCLA.

The FMSS yields 3 scores: an overall rating of EE, a criticism rating, and a rating of emotional over-involvement. A high criticism score is given for 1) presence of overall negative relationship rating based on overall quality of the relationship described, 2) one or more critical comments, or 3) a negative initial statement. Critical comments are not just statements of dissatisfaction with the child or his/her behavior, but rather are statements that contain negative or hostile emotions based on verbal content or vocal quality. A high emotional over-involvement score is given if the mother makes comments suggesting that her emotional well-being and affect regulation are strongly predicated on her child's emotional state. In the present study, the number of criticisms and number of positive remarks were used in the analyses.

The FMSS has adequate inter-rater reliability. Kappa ranges from .60 to .80 for independent raters using high and low categories (Magana et al., 1986). The FMSS also has been found to have concurrent validity with the Camberwell Family Interview, an in-depth 90-minute interview that was originally designed to assess EE (Magana et al., 1986). Inter-rater reliability in the current sample was scored on a random subset of tapes

by a second trained rater. Both raters were unaware of study hypotheses, participants' risk group, and each other's ratings. Kappas were $> .84$.

Creation of composite scores. Using confirmatory factor analysis, Park, Garber, Ciesla, and Ellis (2008) demonstrated that the multiple methods of assessing the family environment used in this study converge and tap similar underlying constructs related to “positive” and “negative” family environments. Based on their analysis, I created composite measures across the different methods of assessment. In order to eliminate any method variance between the family environment composites and subsequent measures of pubertal maturation, self-perceived mate value, and sexual behavior, we only focused on mother-report of family relations, maternal expressed emotions, and observations of conflict resolution. Thus, I averaged across the following scales to create a composite measure of *Positive Family Relations*: FES: Cohesion and Expressiveness Subscales (mother-report), CRPBI: Acceptance-Rejection Dimensions (mother-report), CRT: Observed Positive Relations, and EE: Number of Positive Remarks. Cronbach's alpha for the composite measure was .65. I averaged across the following scales to create a composite measure of *Negative Family Relations*: FES: Conflict (mother-report), FAD: General Functioning (mother-report), CBQ (mother-report), CRT: Observed Negativity, and EE: Number of Criticisms. Cronbach's alpha for the composite measure was .70.

Family Structure at Time 1

One hundred and eight mothers reported being married to the biological father of the child at the time of the study (1 = *father present*), while 132 mother's reported that

they were no longer with or married to the biological father of the child (0 = *father absent*).

Pubertal Maturation at Time 1 and Time 3

Questionnaires. Adolescents completed a questionnaire that combined the Pubertal Developmental Scale (PDS; Petersen, Crockett, Richards, & Boxer, 1988) with additional items from Morris and Udry's (1980) Index of Adolescent Development. Both scales have shown good internal consistency and reliability across raters (Morris & Udry, 1980; Petersen et al., 1988). Furthermore, the validity of the PDS measure has been evaluated by comparing PDS self-ratings with physicians' ratings (mean correlation = .71; Brooks-Gunn, Warren, Rosso, & Gargiulo, 1987). In boys and girls, growth spurt, changes to skin, and body hair growth were assessed. Additional items are sex-specific: girls report on their breast development, hip development, and age at menarche, whereas boys report on facial hair and voice change. Items from the PDS and IAD are rated on likert scales (PDS: 1 = *development not yet started*, 4 = *development seems complete*; IAD: 1 = *have no body hair at all*, 5 = *have a lot of body hair that is very thick*"), with the exception of menarche (which is rated dichotomously as pre- or postmenarcheal, and scored 1 and 4 respectively). Individual items were standardized and averaged to create an overall pubertal development scale score. *Pubertal timing* scores were constructed from the pubertal development scores by partialling out age. Therefore, higher scores indicate greater pubertal maturation, controlling for age.

Creation of composite score. Data from two time points were used to address the issue of cross-sex censoring and measurement reliability. At age 12, pubertal development is underway for most girls, but has just begun for most males. At age 14, the majority of girls are approaching completion of development, whereas most boys are still undergoing important developmental changes. Furthermore, Dick, Rose, Pulkkinen, and Kaprio (2001) reported normative data on the PDS and found that adequate reliability is observed by age 12 in girls, but is not observed in boys until age 14. The current study made use of Time 1 data for females and Time 3 for males, as this was when the pubertal development scores were most reliable (Females: $\alpha = .83$; average age = 12.0; Males: $\alpha = .81$; average age = 13.5).

Self-Perceived Mate Value at Time 4

Questionnaire. Adolescents' reported their perceived competencies using the Self-Perception Profile for Children (SPPC; Harter, 1985). The SPPC is a 36-item scale that measures perceived competence relative to other children or adolescents in six domains: scholastic competence, social competence, athletic competence, physical appearance, behavior conduct, and global self-worth. Each subscale is measured by six items. Respondents are presented with a "structured alternative format" (Harter, 1985, p. 7) which involves an initial decision on which target person is most like them, and then asked to rate the degree of similarity ('Really true of me' or 'Sort of true about me'). The subscales and global measures have shown good internal consistency in previous research (e.g., Harter, 1985; Hess & Petersen, 1996; Eapen, Naqvi, & Al-Dhaheri, 2000).

Creation of composite score. The following domains are of particular relevance to the current study: social competence, athletic competence, and physical appearance. Social competence assesses acceptance by others (e.g., “Some kids find it hard to make friends,” “Other kids find it pretty easy to make friends”). Athletic competence assesses ability to participate in sports (e.g., “Some kids wish they could be a lot better at sports,” “Other kids feel they are good enough at sports”). Physical appearance assesses general attractiveness and body profile (e.g., “Some kids think they are good looking,” “Other kids think they are not very good looking”). Subscale scores were standardized and averaged to create an overall *self-perceived mate value* composite ($\alpha = .70$).

Timing of Sexual Debut and Sexual Risk Taking at Time 7

Questionnaire. A romantic relationships questionnaire was devised to assess adolescent and young adult dating and sexual behaviors by the study authors. The questionnaire assessed the age at which participants started dating, experienced their first sexual encounter, experienced first sexual intercourse, and experienced a pregnancy or fathered a child. Participants also reported use of contraception on a 1 to 5 scale (1 = *never*, 5 = *always*).

Creation of composite scores. From these items, two measures were created that reflect timing of sexual debut and sexual risk taking. Previous research in the area of adolescent sexual behavior has demonstrated that adolescent sexual activity exists along a continuum, with some behaviors riskier than others, and these differences are obscured by creating a single measure of sexual activity (e.g., Luster & Small, 1994; Miller, Clark, Wendell, Levin, Gray-Ray, et al. 1997). Following Kotchick, Shaffer, and Forehand

(2001), I treated timing of sexual debut separately from sexual risk taking behaviors. In the current study, early sexual debut is considered a risk factor for later sexual risk taking, rather than a risk behavior itself.

A *timing of sexual debut* composite was created by averaging across two items: age at first sexual experience and age at first sexual intercourse ($\alpha = .90$). In the current sample, age of first sexual experience ranged from 7-18 with the average age being 14.6. Age of first sexual intercourse ranged from 12-18 with the average age being 15.4. Based on reported ages, adolescents were divided into three groups for each item. *Early* indicated first sexual experience by the age of 14 and first sexual intercourse by the age of 15; *middle* indicated initiation of sexual activity between the ages of 15-17 and initiation of sexual intercourse between the ages of 16-18; *late* indicated initiation of sexual activity at age 18 or later and initiation of sexual intercourse by age 19 or later. Those who were sexually inactive by Time 7 were placed in the late category. Use of timing categories rather than raw scores allowed for the retention of late initiators in the analyses, limiting bias. Furthermore, it allowed for the determination of whether late initiators represent a distinct group in terms of their familial, physical, and social development.

A *sexual risk taking* composite was created by averaging across two items: use of contraception and incidence of teen pregnancy ($\alpha = .60$). Specifically, participants were asked how often they used birth control when they had sex (1 = *never*, 5 = *always*), and whether or not they had ever been pregnant (female participants) or fathered a child (male

participants) (0 = *no*, 1 = *yes*). Items were scored in the same direction and standardized prior to being aggregated.

Orientation toward Romantic Relationships at Time 7

Adult romantic attachment. Adult romantic attachment was assessed using Simpson's (1990) Adult Attachment Questionnaire, which has demonstrated reliability. The measure was developed using a college sample that ranged in age from 18-20. Following the scoring scheme for Brennan, Clark, & Shaver (1998), adult attachment was scored as two continuous dimensions: secure-avoidant attachment and anxious attachment. The avoidance dimension indexes the level of discomfort with closeness and dependence. For example, one item states, "I'm uncomfortable being too close to guys/girls." The anxiety dimension measures anxiety concerning relationship abandonment (e.g., "I often worry that my boyfriend/girlfriend doesn't really love me."). Response categories range from 1 to 7 (1 = *disagree strongly*, 7 = *agree strongly*). Scale scores were created by averaging across items. Higher scores reflect higher attachment avoidance or anxiety.

Tactics of manipulation. Tactics of manipulation in close, romantic relationships were assessed using the Tactics of Manipulation Scale (Buss, Gomes, Higgins, and Lauterbach, 1987). The scale assesses five tactics that individuals use to manipulate their partners: Charm (e.g., "I try to be loving when I ask him/her"), Silent Treatment (e.g., "I am silent until she/he agrees to do it"), Coercion (e.g., "I threaten him/her with something"), Reason (e.g., "I point out all the good things that will come from doing it"), and Regression (e.g., "I sulk until he/she does it."). The scale instructs individuals to rate

how likely (1 = *not at all likely*, 7 = *extremely likely*) they are to do each of the following when trying to get their partner to do something. Buss et al. (1987) demonstrated scale reliability strong individual differences across contexts for these tactics.

CHAPTER 5: RESULTS

Multisample Path Analysis

Data Analytic Strategy

To test the longitudinal associations among variables, path analyses were run using maximum likelihood with Mplus 5.21. Missing data were handled using the Full Information Maximum Likelihood (FIML) procedure. To test whether sex moderated the associations between the variables, a multiple group analysis was conducted on the full sample with separate models run simultaneously for males and females. Model fit for a constrained model (with all the direct paths constrained to be equal among males and females) was compared to a series of partially constrained models (where select paths were free to vary).

Correlations

The correlations among the study variables are shown in Table 2. Among girls, positive family relations, negative family relations, family structure, and pubertal maturation were all significantly related to timing of sexual debut and sexual risk taking in a manner predicted by the BSD model. Specifically, positive family relations in early adolescence were associated with later timing of sexual debut and less sexual risk taking during late adolescence. Psychosocial stressors within the home, such as negative family relations and father absence, were associated with greater pubertal maturation, earlier timing of sexual debut and greater sexual risk taking. Furthermore, greater pubertal maturation was associated with earlier timing of sexual debut and greater sexual risk taking, suggesting the possibility for an indirect path through which rearing conditions

could influence sexual behavior. Self-perceived mate value was not significantly related to pubertal maturation, timing of sexual debut, or sexual risk taking among girls.

Among males, the only significant correlate of sexual behaviors was positive family relations. Boys whose mothers reported greater positive family relations in early adolescence experienced later sexual debut and engaged in less sexual risk taking during late adolescence/young adulthood. These correlations are consistent with the BSD model. In contrast to the female subsample, family relations and family structure were not significantly related to pubertal maturation, sexual debut, or sexual risk taking among males. Furthermore, there were no significant correlations between measures of early family conditions and pubertal maturation. Consistent with the sexual selection model, greater pubertal maturation was associated with higher self-perceived mate value, which in turn was related to earlier sexual debut ($p = .07$) in late adolescence. Self-perceived mate value was not significantly related to sexual risk taking.

Multisample Path Analysis

A multisample path analysis was run on the full model (including all direct and indirect pathways to sexual debut and sexual risk taking), constraining all paths to be equal for males and females. A series of nested model comparisons that were based on theoretical predictions and examination of modification indices followed. Goodness of fit indices for the various models are presented in Table 3. The fully constrained model provided an adequate fit to the data. As is frequently found with relatively large sample sizes, the chi-square value for the model was significant $\chi^2(21) = 34.88, p < .05$ (Bentler, 1990). The Root Mean Square Error of Approximation (RMSEA) was equal to the .08

threshold required for modest fit (Browne & Cudeck, 1993) and the Comparative Fit Index (CFI) was over the .90 threshold indicating acceptable fit between the model and the data.

Two nested models directly tested for sex moderation of the longitudinal associations among rearing conditions, pubertal maturation, self-perceived mate value, and sexual behavior. The first nested model tested for sex differences in the associations between measures of family context and pubertal maturation. In this model the pathways linking positive family relations, negative family relations, and family structure to pubertal maturation were freely estimated across the sexes. While the model provided a good fit to the data, it was not significantly better than the fully constrained model. The second nested model tested for sex differences in the association between self-perceived mate value and sexual behavior. In this model the pathways linking self-perceived mate value to timing of sexual debut and sexual risk taking were freely estimated across the sexes. Again, the model provided a good fit to the data, but was not significantly better than the fully constrained model.

A final model was identified via a specification search that was guided by theoretical considerations (MacCallum, 1986). Examination of the modification indices suggested that three path constraints attenuated the fit of the model. The longitudinal path from pubertal maturation to self-perceived mate value, $\chi^2(1) = 5.62, p < .05$, was stronger in males than females (.29 vs. -.02). The longitudinal path from pubertal maturation to sexual risk taking, $\chi^2(1) = 4.93, p < .05$, was stronger in females than males (.18 vs. -.03). Furthermore, there was a trend level difference in the paths linking positive family

relations to pubertal maturation in males and females, $\chi^2(1) = 3.15, p < .10$. The final path model, which allowed for these three pathways to be freely estimated across the sexes, provided a significantly better fit than the fully constrained model ($\chi^2_{\text{diff}}(3) = 12.28, p < .05$).

The standardized path coefficients for males and females are shown in Figures 1 and 2 respectively. The final model accounted for 17.4% of the variation in timing of sexual debut and 45.1% of the variation in sexual risk taking among males. The model accounted for 22.2% of the variation in timing of sexual debut and 48.4% of the variation in sexual risk taking among females. Several direct and indirect paths account for the associations among family relations, pubertal maturation, self-perceived mate value, timing of sexual debut and sexual risk taking. In Tables 4 and 5 total effects are parsed into direct and indirect components for timing of sexual debut and sexual risk taking respectively.

Per the BSD model, father absence and more negative family relations directly predicted earlier timing of sexual debut and indirectly predicted greater sexual risk taking (via timing of sexual debut) at Time 7 in both the males and females. More negative family relations at Time 1 also predicted greater pubertal maturation at Time 1 in females and Time 3 in males. Among females, but not males, negative family relations exerted a significant indirect effect on sexual risk taking via pubertal maturation. Among males, more positive family relations at Time 1 were predictive of greater pubertal maturation at Time 3, despite the high negative correlation between the two family relations constructs.

Per the sexual selection model, there was a modest direct effect of self-perceived mate value on timing of sexual debut in both males and females. Specifically, higher self-perceived mate value at Time 4 predicted earlier timing of sexual debut at Time 7. Among males, but not females, pubertal maturation exerted an indirect effect on timing of sexual debut (via self-perceived mate value). Males who were more physically mature at Time 3 reported higher self-perceived mate value at Time 4, which predicted earlier timing of sexual debut at Time 7. Self-perceived mate value was indirectly linked to sexual risk taking via its effect on timing of sexual debut. In contrast to the prediction that female sociosexual development would be more sensitive to conditions in the early rearing environment, there were no sex differences in pathways linking negative family relations and family structure to pubertal maturation, timing of sexual debut, and sexual risk taking.

Summary

In sum, the study provided novel support for BSD theory while also highlighting needed revisions to account for the role of self-perceived mate value on adolescent sexual behavior. Both family structure and negative family relations predicted pubertal maturation, timing of sexual debut, and sexual risk taking in a manner predicted by BSD. Specifically, children from homes characterized by more negative family relations experienced earlier pubertal maturation, earlier onset of sexual relationships, and engaged in greater levels of sexual risk taking. Furthermore, father absence was predictive of earlier onset of sexual behavior and greater sexual risk taking. Father absence was not predictive of female pubertal maturation as in prior research. In contrast to the prediction

that female sociosexual development would be more sensitive to early rearing conditions, there were no sex differences in the paths linking negative family relations to pubertal maturation, or negative family relations and father absence to timing of sexual debut. An interesting, yet tentative, finding is that more positive family relations predicted earlier pubertal maturation in males, but not females. This finding is in direct contrast to the BSD prediction that positive family relations should exert a delaying effect on pubertal maturation.

The model also provided support for the sexual selection model. Specifically, children who reported higher levels of self-perceived mate value initiated sexual relationships at earlier ages, which was itself predictive of greater sexual risk taking. In contrast to the prediction that male sociosexual development would be more sensitive to relative standing in domains related to status and mate attraction, there were no sex differences in the pathways linking self-perceived mate value to timing of sexual debut. However, the relationship between pubertal maturation and self-perceived mate value did differ across the sexes. Greater pubertal maturation was associated with higher levels of self-perceived mate value in males, but not females.

Latent Class Analysis

I now present an alternative approach – a latent class analysis (LCA) that focuses on groups of individuals with similar response patterns rather than relations among variables. LCA was conducted to identify groups of individuals with qualitatively distinct patterns of sexual behavior, and to validate these groups in relation to a diverse set of covariates and concurrent variables.

LCA is an exploratory, model based procedure, analogous to an exploratory factor analysis. Thus LCAs are often fit in a series of modeling steps starting with the specification of a one-class model (assumption: the sample is homogenous with response to sexual behavior). Subsequently, the number of classes is increased until there is no further improvement in the model. The next step involves including covariates, which can improve parameter coverage and classification accuracy (Lubke and Muthén, 2007). A critical assumption of the latent class model is that covariates represent antecedent variables that are posited to be causally related to group classification. Differences between the classes on covariates can be useful for further defining the nature of the groups. Concurrent or distal outcomes that are influenced by the grouping variables should not be directly included in the model, but can be added as auxiliary variables (e.g., Marsh, Ludtke, Trautwein, & Morin, 2009). Auxiliary variables can also be used to validate the latent classes by examining mean differences. The models for this study were run using Mplus 5.21. Missing data were imputed using Expectation Maximization (EM) prior to analysis.

Data Analytic Strategy

In the current study, LCA was conducted with the full sample and then within each sex to determine group (i.e., class) membership based on students' responses to four categorical items in the sexual behavior measure. LCA provides information about both item and class probabilities. Item probabilities correspond to the probability of an individual in a specific class endorsing an item. Item probabilities are similar to factor loadings in that they are used to define the nature of the groups. For example, an item

probability of .65 for item A means that a student in a class would have a 65% probability of endorsing that item. Class probabilities, on the other hand, describe the relative size of the classes (i.e., the percentage of the sample that a given class represents).

As with structural equation modeling, there is not a single statistical indicator of model fit. A combination of goodness of fit statistics (Log likelihood ratio) and fit indices that take into account parsimony, such as the Akaike Information Criterion (AIK; Akaike, 1987), Bayesian Information Criterion (BIC; Schwartz, 1978), and sample-size-adjusted BIC (SSA-BIC; Yang, 2006), are used to determine model fit. The model that yields the smallest values on these indices indicates the best-fitting model. To test nested LCA models, two methods are commonly used: the difference in the LMR statistic developed by Lo, Mendell, and Rubin (2001) and its alternative described by McLachlan & Peel (2000) the Bootstrap Likelihood Ratio test (BLRT), which provide *p* values that indicate which model fits best. Results are presented for multiple indicators, but the most weight was given to the BLRT and SSA-BIC. Recent simulation studies suggests that they are the most reliable indicators of the true number of classes (Nylund, Asparouhov, & Muthén, 2007; Tofighi & Enders, 2007).

To investigate differences in the LCA classes based on sex, positive and negative family relations, family structure, pubertal maturation, and self-perceived mate value, these variables were included as covariates. Logistic regression is used to relate covariates to the latent classes. Logistic regressions were run within the full sample and separately for each sex. This analysis provides information about the relationship between the antecedent variables and class membership. For instance, are individuals

from more positive family backgrounds more likely to be in a certain class than those from less positive family backgrounds?

Finally, to test the predictive validity of the latent classes, I examined mean differences across classes using a number of concurrent (auxiliary) variables. I specifically examined whether the groups differed in adult romantic attachment patterns and tactics of manipulation.

Latent Class Analysis: Full Sample

Number of groups and goodness of fit. LCA models were run by first testing a one-class model, and then exploring models with more classes. Table 6 includes fit information (i.e., log likelihood ratio, AIC, BIC, SSA-BIC, and p value for the BLRT) for LCA models with one through five classes. The AIC and BLRT indicate that a three-class model fits the best, while the SSA-BIC indicates a four-class model. Examination of the different models indicated that the three-class model provided the most interpretable results.

To investigate differences in the LCA classes based on sex, positive and negative family relations, family structure, pubertal timing, and self-perceived mate value, these variables were included as covariates in the next set of analyses. Model fit indices consistently pointed to the three-class solution. All of the models discussed from this point forward include covariates.

Structure of latent classes. The conditional probabilities for the three-class model are presented in Table 7. Similar to factor analysis, the item probabilities are used to differentiate and interpret the latent classes. Class 1 (middle debut, moderate risk taking)

includes 41.2% of the sample, and reflects males and females with a high probability of sexual debut between the ages of 16-18, a 92% probability of using contraception “always” or “most of the time”, and 11% probability of being involved in a teen pregnancy. Class 2 (late debut, low risk taking), which comprises 31.1% of the sample, reflects males and females with a high probability of sexual debut after the age of 18, a 97% probability of using contraception “always” or “most of the time”, and zero probability of being involved in a teen pregnancy. Class 3 (early debut, high risk taking) is the smallest class, including 27.7% of the sample. This class reflects males and females who have a high probability of early sexual debut (96%), use contraception inconsistently, and have a 53% probability of being involved in a teen pregnancy.

Covariates. To investigate the presence of differences among the LCA classes, sex, positive and negative family relations, family structure, pubertal maturation, and self-perceived mate value were included as covariates. Table 8 presents the associations between the covariates and the sexual behavior classifications.

The model yielded three classes with different profiles of developmental antecedents. Individuals from the middle sexual debut class (Class 1) and the late sexual debut class (Class 2) differed in family relations, family structure, pubertal maturation and sex from those in the early sexual debut class (Class 3). Specifically, members of the class with the highest probability of early sexual debut and sexual risk taking (Class 3) were more likely to be females who resided in father absent homes characterized by greater negativity. Members of this class also reported greater pubertal maturation than the other two classes. Class 1 (middle debut) differed from Class 2 (late debut) in that the

latter reported lower levels of family negativity, the presence of a biological father in the home, and lower levels of self-perceived mate value.

Auxiliary Variables. Table 9 presents the mean differences across the classes on concurrent assessments of adult romantic attachment and tactics of manipulation. The three sexual behavior classes differed significantly in their use of coercion, silent treatment, and regression as tactics of manipulation. All three sexual behavior classes differed from one another on use of coercion. Specifically, members from the class with the highest probability of early sexual debut and sexual risk taking (Class 3) had the highest scores on coercion followed by the middle sexual debut class (Class 1) and the late sexual debut class (Class 2). Furthermore, members from the early sexual debut, greater risk taking class (Class 3) had higher scores on silent treatment and regression than the members from the other two classes.

Summary. In sum, a three-class model best fit the data. These three classes differed in their profiles of timing of sexual debut (early, middle, late) and sexual risk taking (low, moderate, high). Members of the early sexual debut class engaged in greater levels of sexual risk taking, experienced earlier pubertal maturation, and were more likely to reside in father-absent homes characterized by higher levels of negativity. In accord with a sex-specific BSD model, female were more likely to populate this group than males. Members of this class were also more likely to use coercion, the silent treatment, and regression as ways to get what they wanted from their partners. Members from the middle sexual debut class engaged in low to moderate levels of sexual risk taking and were more likely to reside in father-absent homes characterized by higher levels of

negativity than members of the late sexual debut class. However, members of the middle sexual debut class possessed higher levels of self-perceived mate value than members of the late sexual debut class.

Given the presence of slight sex differences in class membership and the fact that the hypotheses under consideration are sex-specific, I conducted exploratory analyses within the male and female subsamples. Although this analysis will provide insight into the developmental processes at work in males and females, definitive statements about differences between the sexes cannot be made beyond this point.

Latent Class Analysis: Male Subsample

Number of groups and goodness of fit. Table 10 includes fit information for LCA models with one through five classes. The AIC, SSA-BIC and the BLRT indicate that a four-class model fits the best. However, there are discrepancies when the log likelihood ratio and BIC are taken into account. The log likelihood ratio indicates a five-class model, while the BIC indicates a two-class model. Given that the SSA-BIC and the BLRT have been shown to be the most reliable in simulation studies, greater weight was given to these measures of fit. Furthermore, examination of the different models indicated that the four-class model provided the most interpretable results.

To investigate differences in the LCA classes based on positive and negative family relations, family structure, pubertal timing, and self-perceived mate value, these variables were included as covariates in the next set of analyses. Model fit indices consistently pointed to the four-class solution for the male subsample. All of the models discussed from this point forward include covariates.

Structure of latent classes. The conditional probabilities for the four-class model are presented in Table 11. Class 1 (early debut, high risk) includes 23.5% of the males in the sample, and reflects those who have engaged in early sexual relations and greater levels of sexual risk taking. The males in this class had, on average, a 78% chance of having their first sexual experience prior to age 15, and an 86% chance of initiating sexual intercourse prior to the age of 16. The males in Class 1 also have a combined 29% probability of using contraception “sometimes”, “rarely” or “never,” and a 28% probability of being involved in a teen pregnancy. Class 2 (middle debut, high risk), which comprises 24.2% of the sample, reflects males with a high probability of sexual debut between the ages of 16-18, a 100% probability of “always” using contraception, and zero probability of being involved in a teen pregnancy. Class 3 (middle debut, low risk) also reflects males with a high probability of sexual debut between the ages of 16-18, but these males have a high probability of not using contraception consistently and a 23% probability of being involved in a teen pregnancy. Thus, class 2 and class 3 reflect males who both experience sexual activity and intercourse during the same time period, but who have different profiles of sexual risk taking. Class 4 (late debut, low risk) is the largest class, including 29.8% of the sample of males. This class reflects males who have a high probability of late sexual debut, a high probability of consistent use of contraception, and zero probability of being involved in a teen pregnancy.

Covariates. Table 12 presents the associations between the covariates and the males’ sexual behavior classification. The four-class model yielded two classes of males who have a high probability of engaging in sexual risk taking (Classes 1 and 3) and two

classes of males who have a low probability of engaging in sexual risk taking (Classes 2 and 4). The males in the two sexual risk taking classes differed only in levels of pubertal maturation. Specifically, the sexual risk taking class with a high probability of early sexual debut (Class 1) reported greater pubertal maturation at Time 3 than the sexual risk taking class with a high probability of a middle or on-time sexual debut (Class 3).

The two classes of males with a low probability of sexual risk taking differed on levels of positive and negative family relations at Time 1 and self-perceived mate value at Time 4. The class with a high probability of late sexual debut (Class 4) experienced less negative *and* positive relations during childhood, and reported lower levels on the combined self-perceived mate value scale.

The two sexual risk taking classes differed from the nonrisk taking classes in a number of ways. The sexual risk taking classes (Classes 1 and 3) differed from the middle sexual debut, low risk taking class (Class 2) on levels of positive family relations and self-perceived mate value. Specifically, both sexual risk taking classes experienced less positive family relations during childhood and reported lower levels of self-perceived mate value.

The sexual risk taking classes (Classes 1 and 3) differed from the late sexual debut, low risk taking class (Class 4) on levels of negative relations and self-perceived mate value. Both sexual risk taking classes experienced greater negative family relations during childhood compared to the late debut class. The early sexual debut, risk taking class (Class 1) reported higher self-perceived mate value than the late sexual debut, low risk taking class (Class 4).

Auxiliary Variables. Table 13 presents the mean differences across the classes on concurrent assessments of adult romantic attachment and tactics of manipulation. The four sexual behavior classes differed in levels of secure vs. avoidant attachment and anxious attachment. The two sexual risk taking classes (Class 1: early sexual debut and Class 3: middle sexual debut) reported more avoidant attachment patterns than the nonrisk taking classes (Class 2: middle sexual debut and Class 4: late sexual debut). Furthermore, the two middle sexual debut classes differed in terms of attachment anxiety. Of these two classes, males who engaged in higher levels of sexual risk taking (Class 3) reported higher levels of anxious attachment than those who engaged in lower levels of sexual risk taking (Class 2).

The sexual behavior classes also differed significantly in their mean levels of charm and reason as relationship manipulation tactics. The class of males characterized by middle sexual debut and low levels of risk taking (Class 2) reported greater use of charm than males who debuted at the same time, but engaged in sexual risk taking (Class 3) or debuted later (Class 4). Of the two sexual risk taking classes, those who debuted early also used charm to a greater extent. Furthermore, the non sexual risk taking classes (Class 2: middle sexual debut and Class 4: late sexual debut) reported greater use of reasoning tactics in romantic relationships than the sexual risk taking classes (Class 1: early sexual debut and Class 3: middle sexual debut). The four classes did not differ significantly in their use of coercion, silent treatment, or regression as tactics of manipulation in romantic relationships.

Summary. In sum, there were four classes of males that could be distinguished based upon their timing of sexual debut (early, middle, late) and patterns of sexual risk taking (high, low). Three classes of males were characterized by onset of sexual relationships before the age of 18. Two of the classes reported moderate to high levels of sexual risk taking. These two sexual risk taking classes differed in their timing of sexual debut, timing of pubertal maturation, and their use of charm as a manipulation tactic. Among the two classes, the earlier sexual debut group was more physically mature at Time 3 and was more likely to use charm as a manipulation tactic. The nonrisk taking class differed from the risk taking classes on reports of positive family relations and self-perceived mate value. Males in the nonrisk taking class experienced a history of more positive family relations and higher levels of mate value than the two sexual risk taking classes. Furthermore, these males reported more secure and less anxious attachment styles, and reported greater use of charm and reason as a tactic for getting what they wanted from their partners.

A fourth class of males characterized by late sexual debut (past the age of 18) and low levels of sexual risk taking also emerged. In general, this class was characterized by lower levels of mate value, a history of less negative and less positive family relations, and a more secure attachment style. These males also used charm and reason to a lesser extent than those who reported a middle or on-time sexual debut.

Latent Class Analysis: Female Subsample

Number of groups and goodness of fit. Table 14 includes fit information for LCA models with one through five classes in the female subsample. The AIC, BIC, SSA-BIC

and the BLRT indicate that a three-class model fits the best. Although the log likelihood ratio indicates a five-class model, examination of the different models indicated that the three-class model provided the most interpretable results.

To investigate differences in the LCA classes based on positive and negative family relations, family structure, pubertal timing, and self-perceived mate value, these variables were included as covariates in the next set of analyses. Model fit indices consistently pointed to the three-class solution for the female subsample. All of the models discussed from this point forward include covariates.

Structure of latent classes. The conditional probabilities for the three-class model are presented in Table 15. Class 1 includes 21% of the females in the sample. This class reflects females who have a high probability of late sexual debut, a high probability of consistent contraception use, and zero probability of being involved in a teen pregnancy. Class 2 includes 45.9% of the females in the sample and reflects those with a high probability of sexual debut between the ages of 16-18, a 71% probability of “always” using contraception, and a 7% probability of being involved in a teen pregnancy. Class 3 includes 33% of the sample. Females in this class had, on average, a 73% chance of having their first sexual experience prior to age 15, and a 94% chance of initiating sexual intercourse prior to the age of 16. The females in Class 3 had a combined 83% probability of using contraception “sometimes”, “rarely” or “never,” and a 65% probability of being involved in a teen pregnancy. Thus, Class 2 and Class 3 reflect females who both experience sexual activity and intercourse during high school, but who

have slightly different profiles of sexual risk taking, with Class 2 engaging in less risky behavior than Class 3.

Covariates. Table 16 presents the associations between the covariates and the females' sexual behavior classification. The model yielded three classes of females with different profiles of developmental antecedents. Females from the late sexual debut class (Class 1) and the middle or on-time sexual debut class (Class 2) differed in levels of family structure and pubertal maturation from the females in the early sexual debut class (Class 3). Specifically, females from the class with the highest probability of early sexual debut and sexual risk taking (Class 3) were more likely to reside in father absent homes and reported greater pubertal maturation at Time 1 than females from the other classes. The late sexual debut class reported lower levels of self-perceived mate value than females from the early and middle sexual debut classes.

Auxiliary Variables. Table 17 presents the mean differences across the classes on concurrent assessments of adult romantic attachment and tactics of manipulation. The three sexual behavior classes differed significantly in their use of coercion, silent treatment, and regression as tactics of manipulation. All three sexual behavior classes differed from one another on use of coercion. Specifically, females from the class with the highest probability of early sexual debut and sexual risk taking (Class 3) had the highest scores on coercion followed by the middle sexual debut class (Class 2) and the late sexual debut class (Class 1). Furthermore, females from the early sexual debut, greater risk taking class (Class 3) had higher scores on silent treatment and regression than the females from the other two classes.

Summary. In the female sample, a three class model best fit the data. These three classes differed in their profiles of timing of sexual debut (early, middle, late) and sexual risk taking (low, moderate, high). Females from the early sexual debut class engaged in greater levels of sexual risk taking, experienced earlier pubertal maturation, and were more likely to reside in father-absent homes. These females were also more likely to use coercion, the silent treatment, and regression as ways to get what they wanted from their partners. Females from the middle sexual debut class engaged in low to moderate levels of sexual risk taking and reported higher self-perceived mate value than females from the late sexual debut class.

CHAPTER 6: DISCUSSION

The Present Study

The present study is the first to examine multiple selection factors on key sociosexual outcomes, timing of sexual debut and sexual risk taking. The study extends the developmental literature by providing a full test of the BSD model, and extends the social/psychological literature by providing an examination of self-perceived mate value on adolescent sexual development. The study also contributes to our understanding of sex-specific and individual developmental trajectories.

Examination of the Belsky, Steinberg, and Draper Model

Early rearing conditions, pubertal maturation, and adolescent sexual behavior.

Using longitudinal data that spanned adolescence, I was able to examine the full causal model specified by Belsky, Steinberg, and Draper (BSD; 1991). This study specifically addressed the critical prediction that pubertal maturation links early rearing conditions to sexual behavior in an indirect chain of causation. Consistent with theoretical predictions, results showed that in females: (a) negative family relations predicted pubertal maturation, (b) pubertal maturation predicted greater sexual risk taking, and (c) rearing conditions exerted a significant indirect effect on sexual risk taking via pubertal maturation. This finding serves as an independent replication of the study conducted by Belsky et al. (2010). In the only other longitudinal analysis examining the critical prediction set forth by BSD, the researchers found that greater harsh maternal control predicted greater sexual risk taking, but not other forms of risk taking, via a significant indirect effect on age of menarche.

Differential effects of family relations and family structure. The BSD model gave rise to the prediction that both positive and negative family relations would predict pubertal maturation and subsequent sexual behavior. Specifically, positive aspects of the family environment should exert a delaying effect on pubertal maturation and onset of sexual behavior, whereas negative aspects of the family environment should exert an accelerating effect on pubertal maturation and onset of sexual relationships. Paternal investment theory (Draper & Harpending, 1982; Ellis, 2004) highlights the unique influence exerted by fathers on timing of pubertal maturation, such that daughters reared in father absent homes are predicted to mature sexually and initiate sexual relationships at younger ages.

In the current study, I examined the differential effects of positive and negative family relations and father presence-absence. Results indicated that: (a) more negative family relations predicted greater pubertal maturation in both males and females; (b) more positive family relations predicted greater pubertal maturation in males, but not females; (c) more negative family relations and father-absence predicted earlier timing of sexual debut and greater sexual risk taking (via an indirect effect through sexual debut) in both males and females.

Three intriguing results emerged concerning the relationship between measures of early rearing conditions and pubertal maturation. First, negative family relations predicted pubertal maturation in a manner predicted by BSD in both male and female samples. Previous research has not detected significant main effects of rearing condition on pubertal onset in males. In fact, this lack of empirical evidence in the literature,

coupled with ideas regarding sex-specific developmental trajectories, prompted the prediction in the current study that male sexual development would be less sensitive to the early environment. Thus, this is an interesting finding that, while in accord with the original BSD prediction, contradicts the sex-specific developmental trajectories predicted from an integrative theoretical approach.

Second, positive family relations predicted pubertal maturation in males in a manner opposite that predicted by BSD. Specifically, more positive family relations predicted greater pubertal maturation in males. It appears that by controlling for negative family relations, thus suppressing variance in the positive family relations variable that reflects negativity, the magnitude of the relationship between positive family relations and puberty increased. This is an intriguing finding that should be considered tentative until replicated in an independent sample. However, it is interesting to note that there could be two possible pathways to early pubertal maturation in males, one involving positive familial processes and one involving negative familial processes.

And finally, the fact that family structure, as operationalized in this inquiry (i.e., father presence/absence), did not uniquely predict female pubertal maturation was somewhat unexpected. It is assumed that the information captured by the family structure variable was accounted for in the model by the variance it shared with both positive and negative family relations. Although previous research has demonstrated an accelerating effect of father absence on female pubertal maturation, in this particular study it did not predict pubertal maturation above and beyond family process variables. Very little research to date has examined the differential impact of family process and family

structure variables on pubertal maturation. Thus, more research is needed in this area before strong conclusions can be drawn.

The current study also examined the direct effects of family relations and family structure variables on timing of sexual debut and sexual risk taking. Previous research has shown that positive family relations are associated with later timing of sexual debut, whereas negative family relationships are associated with greater sexual risk taking (Zimmer-Gembeck & Helfand, 2008). In addition, adolescents who live with both biological parents are less likely to initiate sexual relationships, have fewer sexual partners, and are less likely to experience a teen pregnancy (Kirby, Lepor, & Ryan, 2005; Kotchick, Shaffer, & Forehand, 2001). Consistent with prior research, both negative family relations and father presence-absence were directly associated with timing of sexual debut and indirectly associated with sexual risk taking in the current study. Specifically, males and female who resided in father-absent homes characterized by greater levels of negativity were more likely to initiate sexual relationships at an earlier age and engage in greater sexual risk taking.

Examination of the Sexual Selection Model

Self-perceived mate value and adolescent sexual behavior. A sexual selection model suggests that it is relative standing on dimensions such as status/mate value and attractiveness that guide the adoption of alternative reproductive strategies. Individuals who have higher status or mate value compared to their peers are more likely to encounter a variety of mating opportunities, facilitating the development of sexual relationships. A review of the adolescent peer status literature suggested that social

competence, athletic ability, and physical attractiveness are important determinants of status. These traits are also important with regard to desirability as a romantic partner among adolescents. As such, it was predicted that individuals who perceived themselves as higher in social competence, athletic competence, and physical appearance, collectively referred to as self-perceived mate value in this study, would initiate sexual relationships earlier. Consistent with this prediction, both males and females who reported higher self-perceived mate value experienced earlier timing of sexual debut. Furthermore, self-perceived mate value exerted a significant indirect effect on sexual risk taking via timing of sexual debut.

Previous research on self-esteem, self-concept and the onset of sexual behavior has produced mixed results, with the majority of studies demonstrating that high self-esteem serves as a protective factor against early sexual debut or exerts no effect at all. There is some evidence to suggest that the global measures of self-esteem used in prior research mask more precise relationships that exist between particular domains of self-esteem and adolescent sexual behavior (e.g., Waller & Dubois, 2004). The current study made use of three domains that have been shown to be important for adolescent attraction and romantic relationships. Thus, it is not surprising that the results of the current study differ from the extant body of literature on global self-esteem and sexual initiation.

Sex Differences in Developmental Trajectories

A sexual selection approach highlights the fact that males and females have had to solve qualitatively different adaptive problems when negotiating life history trade-offs across evolutionary history. Female reproductive success is ultimately tied to the

resources that can be garnered from the environment and invested in current or future offspring. Male reproductive success, on the other hand, is primarily tied to ability to succeed in intrasexual competition. Based on this logic, it was predicted that female pubertal maturation and sexual behavior would be strongly tied to levels of support in and around the home, per the BSD model. It was predicted that male sexual behavior would be strongly tied to levels of self-perceived mate value. A series of nested model comparisons tested for sex differences in developmental trajectories. Overall, the hypothesis that males and females are tracking different environmental cues was not supported, as the more general path model fit the data as well as the sex-specific models.

However, there were three pathways that differed significantly across the sexes: (a) a positive path linking positive family relations and pubertal maturation was present in males, but not females, (b) a positive path linking pubertal maturation and sexual risk taking was present in females, but not males, and (c) a positive path linking pubertal maturation and self-perceived mate value was present in males, but not females. The first two pathways have been addressed in previous sections. Thus, here I focus on the sex difference in the relationship between pubertal maturation and self-perceived mate value.

Previous research indicates that the psychological effects of early maturation differ for males and females, with early pubertal maturation resulting in more positive psychological outcomes for boys. For instance, early pubertal maturation is associated with higher levels of popularity and self-image (Petersen, 1988; Williams & Dunlop, 1999; Wiesner & Ittel, 2002), whereas late maturation is associated with lower levels of self-esteem among males. In females, early pubertal maturation has been repeatedly

linked to depression (e.g., Angold, Costello, Erkanli, & Worthman, 1999; Ge, Conger, & Elder, 2001) and early substance use (e.g., Dick, Rose, Viken, & Kaprio, 2000; Stattin & Magnusson, 1990).

Differences in reproductive roles could underlie differences in the psychological reaction to pubertal maturation in males and females. According to parental investment theory, the female strategy is biased more toward selective mate choice and parental effort, whereas the male strategy is biased more toward intrasexual competition and mating effort (Clutton-Brock, 1989). Thus, pubertal maturation, as an indicator to others of reproductive readiness, alters the social context for males and females in different ways. For instance, females might suddenly experience attention from members of the opposite sex, and this attention might not always be welcomed. Among males, pubertal maturation not only advertises to others that one can reproduce; it also gives rise to the sexually-selected traits that are closely tied to social and sexual competitiveness, such as male social dominance, physical attractiveness, and physicality. In the current study, pubertal maturation exerted an indirect effect on timing of sexual debut via its effect on self-perceived mate value ($p < .10$) in males.

Individual, Within-Sex Differences in Developmental Trajectories

Theoretical integration brings to light the possibility of more than one developmental pathway to early sexual experience in males. According to the BSD model, males who experience less positive and more negative parenting practice will develop an opportunistic reproductive strategy characterized by insecure attachment patterns, earlier pubertal maturation, earlier onset of sexual relationships, greater sexual

risk taking, and less prosocial, more coercive mating tactics. The sexual selection perspective suggests that socially competitive or high mate value males might also experience earlier pubertal maturation and earlier onset of sexual relations. However, these two strategies diverge in important ways. In contrast to the strategy proposed by BSD, the highly competitive male strategy is likely characterized by more secure romantic attachment patterns, less sexual risk taking, and use of less coercive, more prosocial mating tactics.

The presence of multiple developmental trajectories was explored using latent class analysis. Among the full samples of males and females, a three-class model emerged reflecting differing levels of sexual debut (early, middle, late) and sexual risk taking (low, moderate, high). Overall, individuals who reported early sexual debut and higher levels of sexual risk taking were more likely to be females from father-absent homes characterized by higher levels of negativity. These individuals also reported greater sexual maturation than members from the other classes. Members from the middle sexual debut, moderate sexual risk taking class reported higher self-perceived mate value than the late sexual debut class.

Within the male subsample, four classes emerged that presented different patterns of timing of sexual debut and sexual risk taking. Consistent with the BSD prediction, two classes emerged that were characterized by onset of sexual relationships during the early to middle teens, greater sexual risk taking, more insecure attachment patterns, and less use of prosocial mating tactics, such as charm and reason. Males from these two classes were also more likely to reside in homes characterized by less positivity and greater

negativity. Consistent with the sexual selection prediction, a class of males emerged that could be characterized by onset of sexual activity during the middle teenage years, less sexual risk taking, higher self-perceived mate value, more secure attachment patterns, and greater use of prosocial mating tactics. These males did not differ significantly from the other classes on measures of pubertal maturation.

Within the female subsample, three classes emerged that represented girls who initiated sexual relationships during early, middle, and late adolescence. These three classes resembled the analysis in the full sample. Consistent with the BSD model, girls from the early sexual debut, risk taking class experienced earlier pubertal maturation and were more likely to reside in father-absent homes. Furthermore, these girls used more coercive, less prosocial mating tactics to a greater extent. The three classes did not differ on positive family relations, negative family relations, or attachment patterns. Although not explicitly outlined by the sexual selection model, a class of females characterized by higher self-perceived mate value also emerged. These girls were more likely to initiate sexual relationships in their mid teens.

Thus, it appears that a variable-centered approach to analysis might confound some of important differences in the developmental pathways leading to timing of sexual debut, particularly in males. The discovery of multiple developmental trajectories is consistent with current theorizing and empirical research in the literature examining antecedents of sexual initiation and risky sexual behavior. In their comprehensive review of the longitudinal studies that have been conducted on antecedents of sexual initiation, Zimmer-Gembeck and Helfand (2008) suggest that patterns of correlates associated with

early, middle, and late onset of sexual intercourse signify multiple developmental trajectories. They contend that two developmental pathways associated with sexual intercourse before the age 18 are possible. One includes dispositional traits marked by unconventionality, problem behaviors, and a lack of bonds to family, school, and other social institutions. The second pathway includes certain biological characteristics (e.g., earlier pubertal maturation), moderate levels of problem behavior, and peer group success. While not cast in the same framework, these pathways resemble those arrived at by evolutionary thinking.

Limitations

Two important limitations must be taken into account when evaluating the contribution of the current study. First, one of the primary strengths of the study was the use of longitudinal data to model the associations hypothesized by evolutionary theory. One of the crucial hypotheses under investigation was that rearing conditions during childhood would exert an indirect effect on timing of sexual behavior via pubertal maturation. A significant indirect relationship was in fact observed between negative family relations and sexual risk taking in the female sample, offering support for the critical prediction made by Belsky, Steinberg, and Draper (1991). However, it must be noted that this was not one of the longitudinal pathways in the model. A limitation of the current dataset was that the timing of data collection occurred while pubertal maturation was already well under way for many of the female participants. The pubertal maturation measure was most reliable at Time 1, which is when the measures of rearing conditions were also gathered.

Another important limitation is that the sample used in the current study presented several limitations. First, with only 240 families participating in the study, the sample size was relatively small, which likely limited the power of the statistical tests conducted. Furthermore, path modeling with manifest variables was possible with this sample size, but latent variable modeling was untenable given the number of estimated pathways. Causal modeling with latent variables poses several advantages. For instance, latent variable modeling allows researchers to first examine the convergent and discriminant validity of their measures. Researchers can have more confidence that the measures used in the study actually reflect the hypothetical construct of interest. Furthermore, latent variable modeling allows researchers to model error variance separately from the construct of interest, providing a more accurate estimate of the relation between two constructs. It is this last advantage of latent variable modeling that would have been particularly beneficial in the current study. In an attempt to reduce measurement error and increase construct validity, composites were created from multiple measure when possible. However, these variables were not perfectly reliable and some possessed substantial measurement error. Thus, the path coefficients derived in this study are biased and the absence of prediction among variables could be inconclusive. Clearly, replication with a larger sample is needed before strong conclusions can be drawn.

A second limitation is that the sample used in the current study was derived from a longitudinal study on maternal depression and adolescent development. By design, the sample possessed a high proportion of mothers with depression disorders, making the study findings less generalizable to the general population. Overall, maternal depression

is related to many of the ecological and psychosocial stressors hypothesized by Belsky, Steinberg, and Draper (e.g., marital discord, divorce, and conflictual family relations) to alter developmental trajectories (Beach & Nelson, 1990; Cummings & Davies, 1994; Downey & Coyne, 1990). Ellis and Garber (2000) used a subset of the sample used in the current study and found that maternal depression predicted earlier pubertal timing in daughters, and that this finding was fully mediated by dyadic stress in the home and father absence. However, the sample may have presented limitations for testing the sexual selection model, as adolescent children of depressed mothers have been found to function more poorly than other adolescents in a number of areas. For instance, they tend to report poor peer relationships, lower levels of self-esteem, more behavior problems, and are themselves at risk for a variety of depressive and anxiety disorders (e.g., Downey & Coyne, 1990; Gelfand & Teti, 1990). Again, future replication using an independent sample needed.

Broader Issues in Need of Additional Research

In the following section, I highlight several areas for future research in the area of life history theory, sexual selection, and their integration.

Are Sex Differences in Sociosexual Development of a Qualitative or Quantitative Nature?

In the current study, I predicted that female sexual behavior would be more closely tied to early family relations, whereas male sexual behavior would be more closely tied to self-perceived mate value. This prediction concerning sex differences in environmental tracking was not well supported in the current analysis. Measures of the early family environment and self-perceived mate value during adolescence predicted

timing of sexual debut and sexual risk taking (albeit indirectly) in both males and females. The absence of sex moderation in the multisample path analysis suggests that the antecedents of sociosexual development are not sex-specific and that the developmental processes operate in a similar fashion. This fact, in and of itself, does not argue against central tenets of either life history theory or sexual selection.

However, at least one finding, the pattern of the relations between self-perceived mate value and timing of sexual debut, was particularly perplexing from a theoretical standpoint. From a sexual selection perspective, self-perceived mate value is important for both males and females. However, high mate value is thought to allow males and females to enact their sex-preferred strategy (Buss & Schmitt, 1993). Given the high costs associated with short-term, sexual relationships, females should be oriented toward a long-term, investing strategy, characterized by delayed sexual debut and less sexual risk taking. In the current study, the opposite pattern was found. Similar to males, higher self-perceived mate value was associated with earlier sexual debut and greater sexual risk taking in females. There are several possible explanations for this finding that will need to be explored in future research.

One possible explanation is that males and females are in fact reacting in a similar manner to the opportunities and constraints associated with their mate value status. For instance, high mate value females might pursue a precocious and/ or short-term reproductive strategy for the same reasons that males do; because the opportunity exists. In fact, there is empirical evidence demonstrating a positive correlation between self-perceived mate value in females and increased sexual activity (e.g., sociosexual

orientation) (Lalumiere, Seto, & Quinsey, 1995; Mikach & Bailey, 1998). Sociosexuality refers to individual differences in willingness to engage in sexual relations without closeness or commitment; its existing measure, the Sociosexual Orientation Inventory (SOI; Simpson & Gangestad, 1991), has become the leading measure of individual differences in long-term vs. short-term mating strategy. *Restricted* individuals require greater closeness and commitment prior to having sex with a romantic partner, whereas *unrestricted* individuals are comfortable with engaging in casual, short-term sexual relationships. In accord with the hypothesis that high mate value females pursue a more precocious, short-term reproductive strategy in a manner similar to high mate value males, research has shown that measures of self-perceived attractiveness and mate value are associated with a more unrestricted sociosexual orientation in college-age females (e.g., Clark, 2004; Jackson & Kirkpatrick, 2007, but see Mikach & Bailey 1998 for an exception).

Although the pattern of the relationship between self-perceived mate value and sexual behavior is similar across the sexes, research that examines sexual *psychology* separate from sexual *behavior* suggests that the experience of unrestricted sexual behavior is qualitatively distinct for males and females. For instance, Jackson & Kirkpatrick (2007) found that males of relatively high mate value are more psychologically and behaviorally oriented toward short-term, casual sex than males of relatively lower mate value. Among females, however, self-perceived mate value was unrelated to psychological orientation toward long-term vs. short-term sexual relationships, but was moderately related to previous sexual behavior. This suggests that

high mate value females differ from low mate value females in the number of mating opportunities they encounter, but not in their mating psychology. Research by Townsend (1993) supports this notion. In a study of 400 college students, Townsend found that restricted and unrestricted females equally desired a long-term committed relationship in the near future. This was not true for restricted and unrestricted males. Unrestricted males expressed a desire to delay the pursuit of a long-term relationship. Townsend concluded that unrestricted sexual activity may represent a mating stage rather than a lifetime strategy for females. In fact, young females who voluntarily engage in unrestricted sexual behavior typically report that they feel emotionally vulnerable and experience high levels of anxiety about their partner's willingness to invest, despite endorsing more liberal ideas regarding female sexuality (Townsend, 1995).

When perceived investment is not forthcoming or sufficient, unrestricted females report that sexual relations become less desirable. The same is not true for males. Townsend, Kline, and Wasserman (1995) found that unrestricted males and females differ in their emotional response to sexual relationships. Unrestricted females report testing their partners for ability and willingness to invest, whereas unrestricted males report testing for opportunities to reduce investment and pursue other women. Thus, when sexual attitudes and motivations are examined separately from sexual behavior, it does appear that the nature of unrestricted sexual behavior is qualitatively different for males and females, per the sexual selection model. It is important to note that in the present study, sexual behavior was the dependent measure. Given the empirical evidence

just cited, early timing of sexual debut among females might not be indicative of desire for and pursuit of a short-term reproductive strategy.

Future research is needed to address the issue of self-perceive mate value and timing of sexual debut. An important factor to consider in future research is differential mate selection among high and low mate value females. For instance, high mate value females might assortatively mate with high mate value males. For instance, Little, Penton-Voak, Burt, and Perrett (2002) have shown that self-rated attractiveness among females is associated with attraction to indicator of good genes in males, such as masculine and symmetrical facial features. In the case of a high mate male female mated to a high mate value male, the female might find it particularly difficult to retain her partner over the course of the relationship. This is because high mate value males might be especially likely to pursue the multiple short-term opportunities that their desirability makes possible. Thus, increased sexual behavior for high mate value females might be the result of inability to retain a long-term partner rather than a direct indicator of proclivity toward precocious and short-term romantic relationships.

Is Adolescence a Sensitive Period for the Development of Alternative Reproductive Strategies?

Researchers have theorized that self-perceive mate value guides the development and adoption of alternative reproductive strategies (e.g. Harris, 2005; 2006; Kirkpatrick & Ellis, 2001; Figueredo & Jacobs, 2000; Gangestad & Simpson, 2000). Based on the extant research, I proposed in Chapter 2 that adolescence is a particularly important time for the development of such self-assessments. However, does adolescence reflect a

sensitive period for self-perceptions of mate value and the development of a stable orientation toward long-term investing relationships vs. short-term, sexual relationships?

Adolescence is undeniably an important time for competition for dating partners and the initiation of romantic and sexual relationships. Hormonal changes during adolescence as well as societal stress on heterosexual relationships result in increased interest in the opposite sex (Collins & Sroufe, 1999; Furman, 1999). And, as argued above, it is during this time that status might play a decisive role in the development of alternative reproductive strategies. However, does adolescence represent a critical period in the development of status and specialization of reproductive strategies? Several lines of thinking and empirical study suggest that it might.

One line of thinking comes from within the field of evolutionary biology and concerns the adaptive benefits of niche specialization vs. generalization. Evolutionary biologists have demonstrated that, all else being equal, the presence of multiple competitive niches in a single environment will favor developmental specialists (i.e., narrow genetic reaction norms in which phenotypic development is minimally condition-dependent) over developmental generalists (i.e., broad genetic reaction norms in which phenotypic development is highly condition-dependent) when individuals can evaluate and select niches. This is because specialists are always able to out-compete generalists in their preferred niche (Wilson, 1994; Wilson & Yoshimura, 1994; see also Ellis, Jackson, & Boyce, 2006 for a review). With a little revision, the same argument could be applied to the adoption of environmentally-contingent reproductive tactics within developmental time.

While at first glance it might appear beneficial for individuals to possess the capability to facultatively adjust their strategies across the lifespan, this ability would come at the cost of specialization. As reviewed in Chapter 2, alternative reproductive strategies reflect coordinated suites of physiological, psychological, and behavioral mechanisms that guide reproductive behavior. In order to successfully execute a strategy, an amount of developmental coherence among various systems is required, and development of one strategy might preclude the development of another strategy. For instance, the two developmental pathways proposed by Belsky, Steinberg, and Draper (1991) necessitate two opposing worldviews (prosocial vs. opportunistic).

As previously suggested, a period of learning about oneself would help individuals determine the particular niche that they are best equipped to compete in and allow them to refine the sociocompetitive competencies required for successful competition. Commensurate with the ideas presented on the development of the self, extended childhood and adolescence represents a time when individuals can acquire important knowledge about themselves relative to their competitors as well as safely test different behavioral strategies (Harris, 2005; 2006). Indeed, the social brain hypothesis argues that selection pressure shaping extended childhood and adolescence was increased social competition with conspecifics (e.g., Flinn, Geary, & Ward, 2005; Flinn & Ward, 2005; Joffe, 1997).

In support of the specialization hypothesis, two empirical studies suggest that adolescence is a sensitive period for certain aspects of personality development. Jones (1957) examined personality differences among fast- and slow-maturing adolescent boys.

The fast-maturing boys, who were stronger and taller than most of their peers during adolescence, were more socially poised and less anxious. Though the two groups were approximately equal in height during adulthood, the fast-maturing boys remained significantly more self-assured in adulthood. They also scored higher on personality characteristics associated with dominance and were more likely to attain executive positions in their careers. Persico, Postlewaite, and Silverman (2004) found an interesting relationship between height and income in adult males. Longitudinal data of more than 4,000 males demonstrated that income was predicted by how tall the men were during adolescence relative to their peers, rather than their adult height. These two studies suggest that variables related to male peer status during adolescence have long-term developmental consequences for social and personality development. However, future research is needed to directly test the idea that adolescence is, in fact, a sensitive period.

How Does an Organism Attend to and Respond to Multiple Cues?

In the current study, I have proposed that both early family relationships and self-perceptions of mate value should influence the adoption of alternative reproductive strategies. However, how might an individual weigh or balance these two important selection factors during development? One way to think about such an integrated developmental model of reproductive strategies is using Brunswik's (1952, 1955, 1956) probabilistic functionalism theory of cognitive processing, which was developed to explain how humans make use of a wide array of uncertain and interdependent environmental cues that indicate a given distal event. His theory argues that the environment offers a wide variety of interdependent, fallible, or probabilistic indicators

that are not directly observable, and that the best cognitive mechanism for coping with such a condition would resemble a multiple regression model. Thus, humans have evolved psychological mechanisms that can deal with the following: (a) cues that have imperfect relations with the distal criterion or environment in question, (b) cues that have imperfect and redundant relationships among one another, (c) cues that have a functional relationship with the criterion, and (d) cues that together provide an overall measure of predictability (much like in a multiple regression equation). While not originally cast in the terms of adaptive phenotypic plasticity, Figueredo, Hammond, and McKiernan (2006) elaborate on Brunswick's Lens Model to form an evolutionary developmental theory of preparedness and plasticity. Such a model will be useful for thinking about how individuals may process multiple cues signaling distal reproductive opportunities and constraints.

Developmental Links between Life History Traits and Sexually-Selected Traits

While I have attempted to devise a more comprehensive model of the development of reproductive strategies, the integration of ideas for life history theory and sexual selection is still in an early stage of development (see also Geary, 2002 for a review). I believe that two interesting avenues for future research are; (1) how the intergenerational transmission of social and economic status determines the extent of the influence of the ecology on the development of human reproductive strategies, and (2) how parental provisioning influences the development of and the preference for sexually-selected traits, above and beyond genetic parental effects. I describe each of these in turn.

Environmentally-contingent life history patterns are conceived in terms of nonsocial factors, such as predation, food availability, or rainfall. However, life history traits shaped by social and sexual selection are also likely to show adaptive plasticity, but the ontogenetic expression of these traits should be more strongly influenced by social competition and dynamics than nonsocial conditions (Rohwer, Fretwell, & Niles, 1980; Selander, 1965). In fact, the relation between many ecological variables, such as food availability, and the environmentally-contingent expression of life history traits may be moderated by social competition.

Female strategies are attuned to the resources that exist in the local environment. Between-population variance in life histories is likely the result of inhabiting different ecologies, and thus, variation in female reproductive strategies may be best explained based on the potential return on parental investment under specific ecological conditions, per life history theory. However, within-population variance may be best explained based on differential access to resources that exist within the local ecology. As pointed out by Gangestad and Simpson (2000), those females who have access to highly competitive males or are able to secure resources on their own or through their social networks are likely to be less constrained by the physical environment. Less socially dominant and/or low mate value females may be forced to trade somatic effort for reproductive effort based on conditions of the local ecology. Under such conditions, female social competitiveness and that of their offspring will be diminished. This cycle of events would serve to reinforce the intergenerational transmission of status and life history patterns.

Male reproductive success is constrained to a lesser extent by the nature of the local ecology and more by relative standing in male hierarchies and/ attractiveness relative to other males. Thus, the early environment may influence the adoption of male alternative strategies to the extent that provisioning by parents influences phenotypic condition or the performance of sexually-selected social behaviors. Parents can influence the condition and decisions of their offspring through genetic effects and through resource provisioning. Nongenetic parental effects on the expression of sexually-selected traits are just now receiving empirical attention (e.g., Qvarnstrom & Price, 2001). Nongenetic parental effects can be condition-mediated or socially-mediated. In condition-mediated parental effects, the provisioning of offspring results in the expression or better expression of a particular sexually-selected trait (e.g., size, body mass, odor, physical attractiveness). Socially-mediated parental effects occur when the provisioning of offspring results in the social learning of the performance of a sexually-selected behavior (e.g., bird song).

The effects of parental provisioning on offspring performance, attractiveness, and mating success have been demonstrated in a number of species (see Qvarnstrom & Price, 2001 for a review). For instance, variation in maternal investment during pregnancy and lactation has been shown to influence both male body size and odor in mammals. In house mice (*Mus musculus*), for instance, females prefer the odor of males that were well-nourished by mothers than the odor of males that were reared by undernourished mothers (Meikle, Kruper, & Browning, 1995). Strong paternal effects have also been demonstrated in some species. Researchers have found that in house sparrows (*Passer*

domesticus) sexually-selected traits (i.e., badge size) resemble those of foster fathers rather than genetic fathers (Griffith, Owens, & Burke, 1999).

Parents can also exert a nongenetic influence on the expression of sexually-selected traits in their offspring by other means than through effects on condition. Some sexually-selected traits are mainly socially learned. For instance, in bower birds (*Ptilonorhynchus violaceus*), males must learn how to successfully construct bowers that are attractive to females in order to reproduce. This sexually-selected trait is learned through watching and imitating adult males (Collis & Borgia, 1992). An example of a socially-mediated parental effect can be found in Darwin's medium ground finches (*Geospiza fortis*). In these birds, males learn their song from their fathers, and there is apparently no measurable genetic variation in the expression of this trait (Grant & Grant, 1996). These animal examples of nongenetic parental effects suggest a way to think about how the effects of the early environment, as mediated by parental provisioning, can influence the social and sexual competitiveness of offspring in a manner that would influence the adoption of alternative reproductive strategies.

General Conclusion

Life history theory and sexual selection theory are two expansive evolutionary theories have been used by developmental scientists and social/personality psychologists to explain the variation observed in human reproduction, including the timing of reproductive events and orientation toward sexual relationships. Part I of this paper was dedicated to reviewing existing research related to these two theories. It was suggested that a synthesis between the principles of sexual selection with life history models of

human reproductive strategies could potentially address existing empirical limitations and lead to a more comprehensive developmental model of reproductive variation. Part II was dedicated to testing several of the empirical ideas highlighted by theoretical integration. Specifically, the role of early psychosocial stress within the home, as specified by BSD, and sociosexual competencies, as highlighted by a sexual selection perspective, on timing of sexual debut and sexual risk taking were examined. Variable-centered and person-centered models provided alternative means for examining sex-specific and individual developmental trajectories.

APPENDIX A: FIGURES

Figure 1. Diagram of the main components of life history theory.

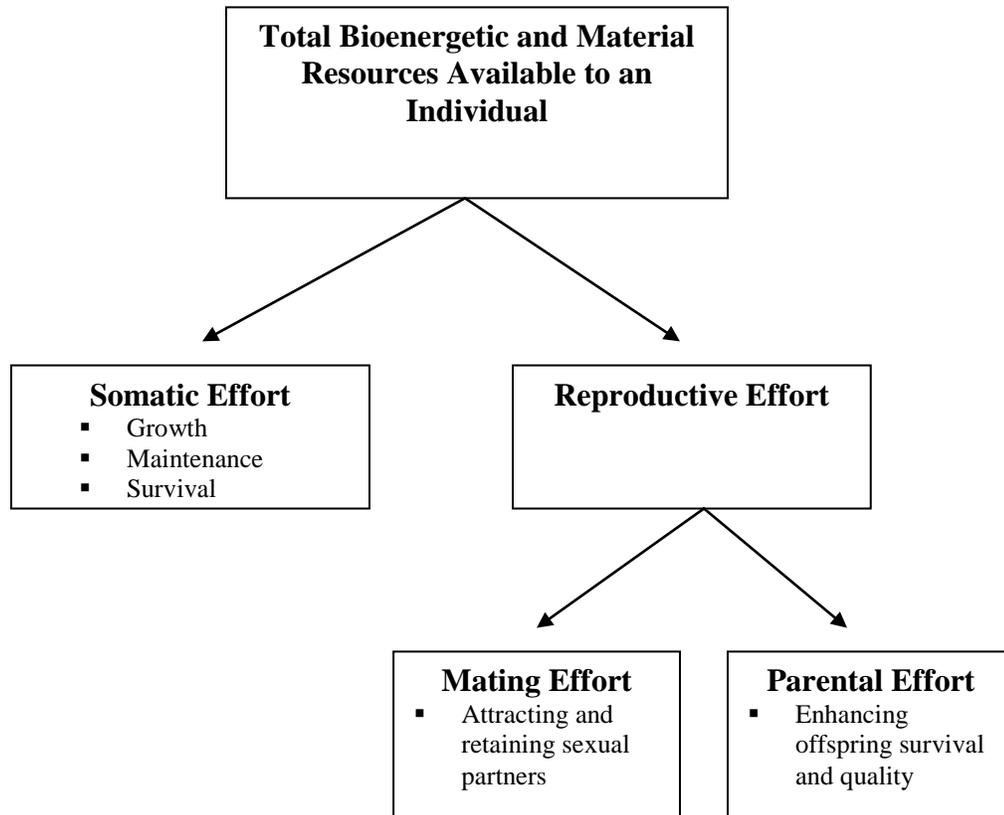


Figure 2. Diagram of major components of the Belsky, Steinberg, and Draper (1991) model.

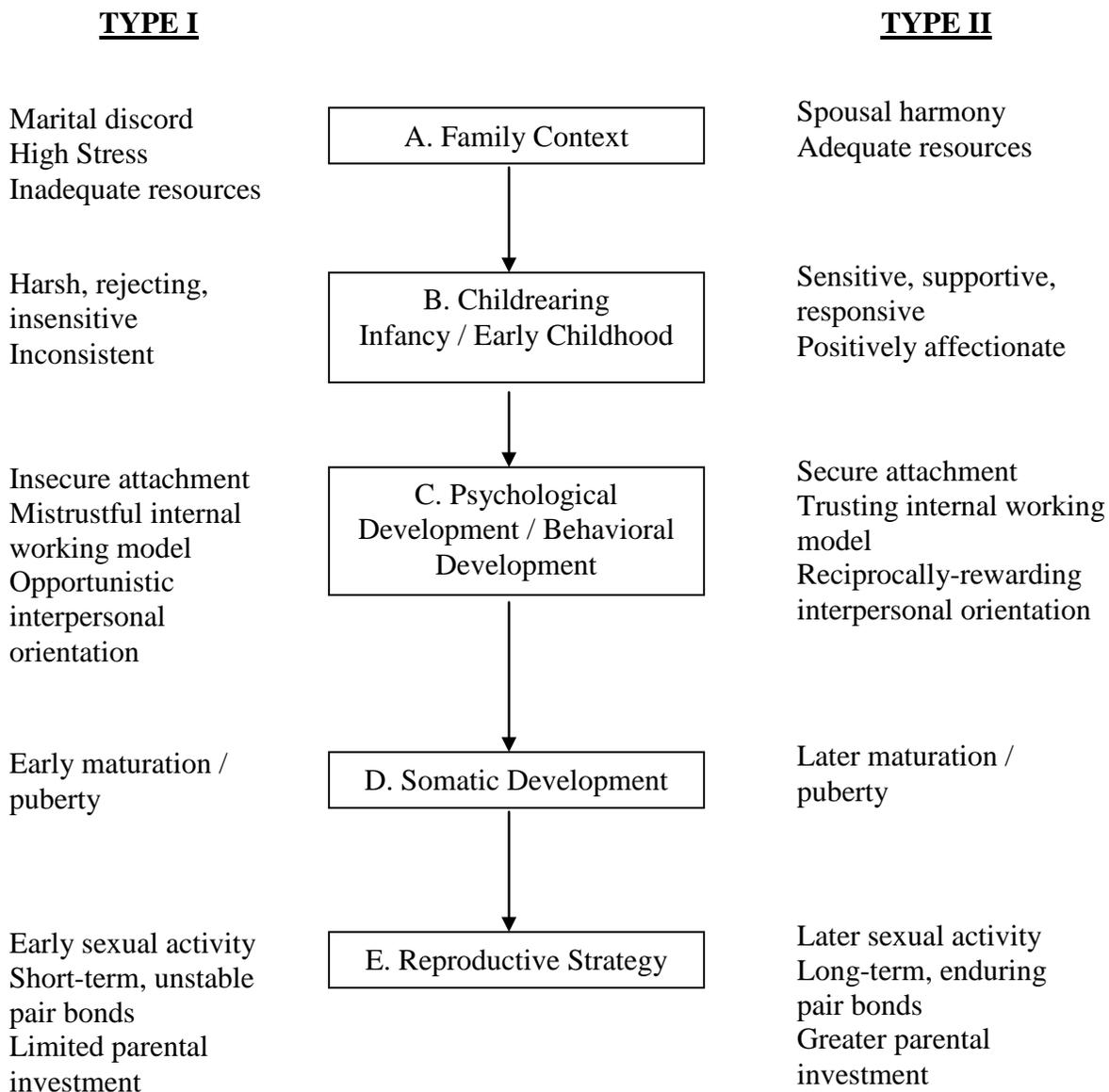
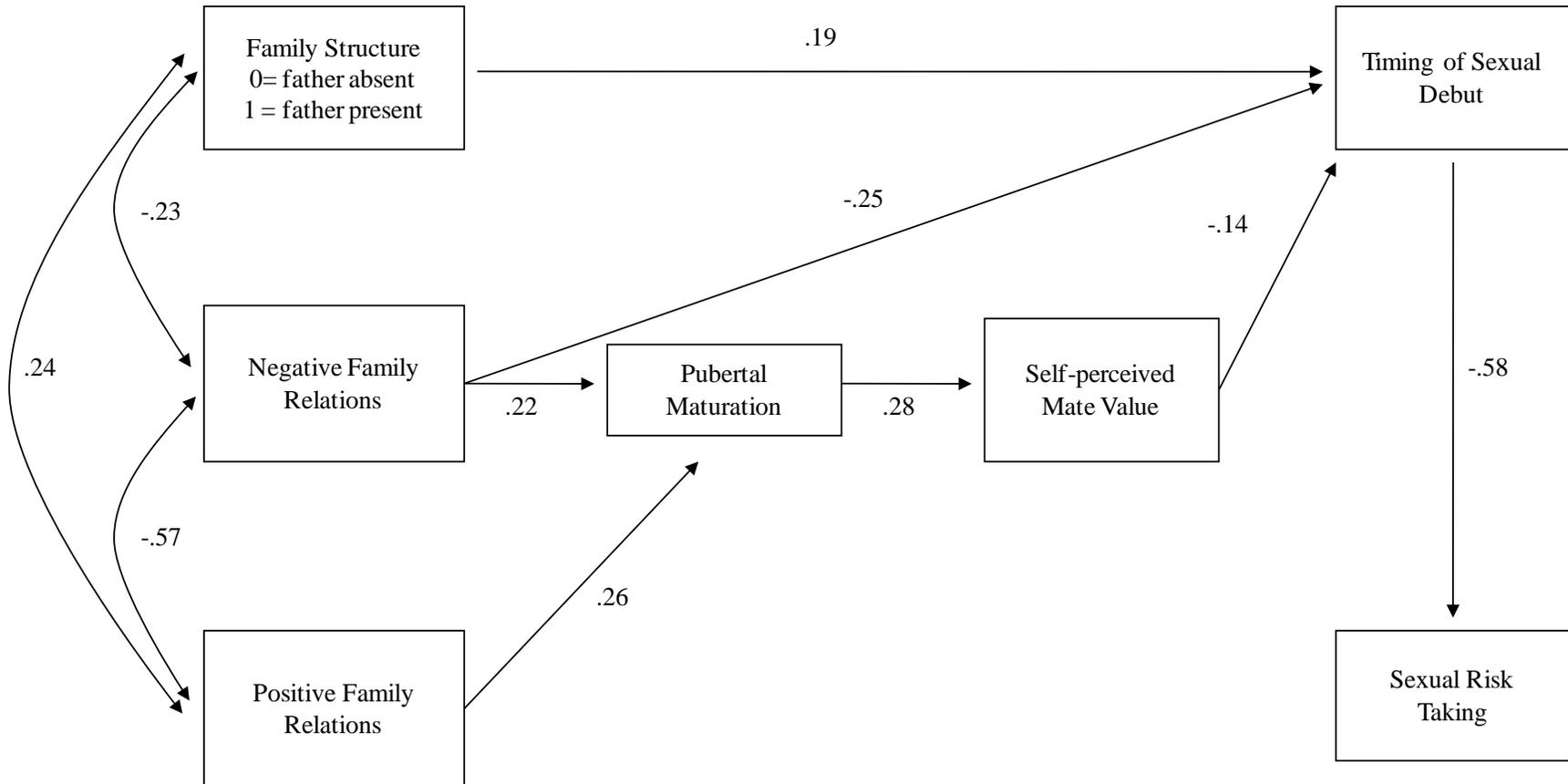
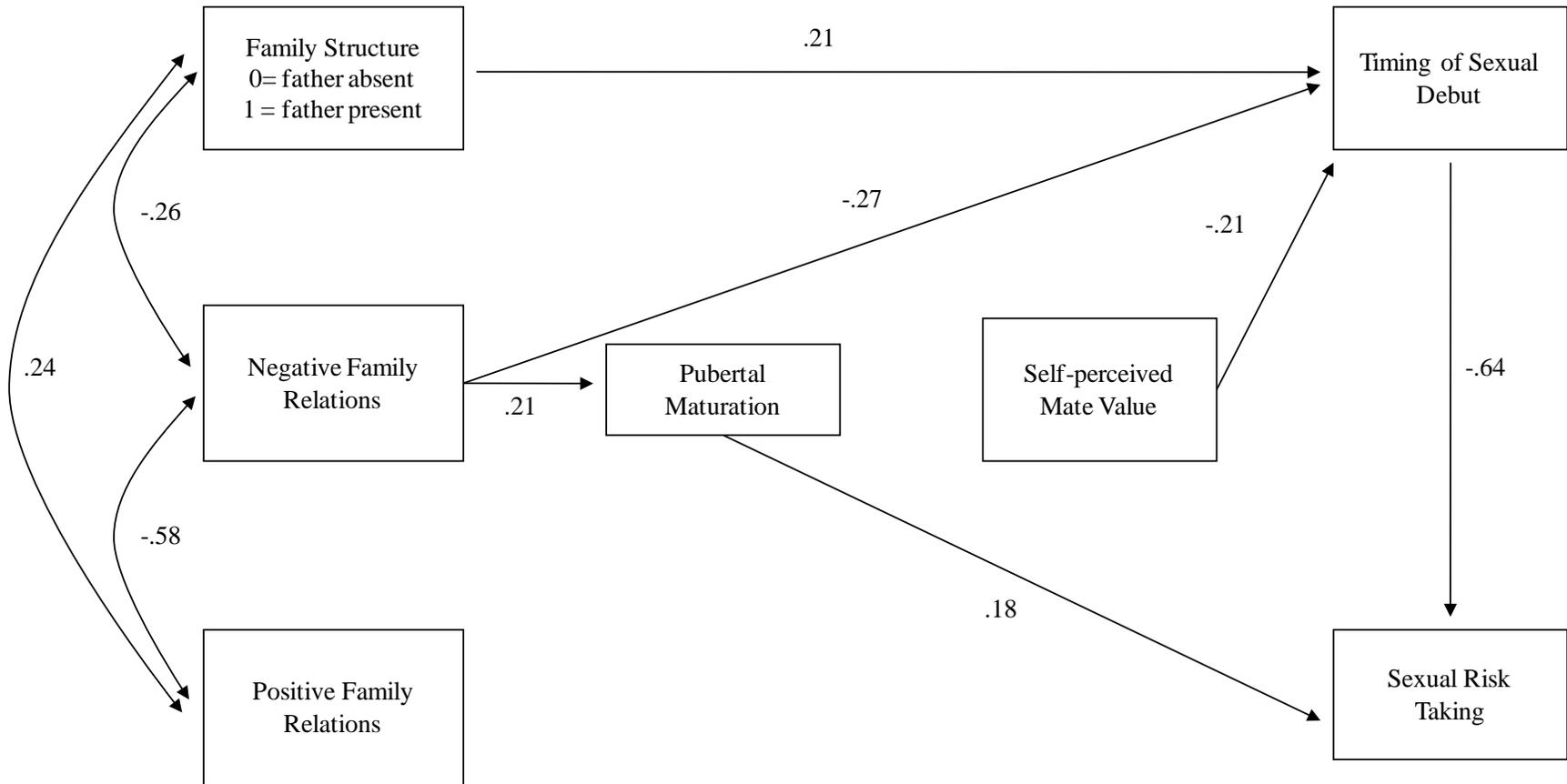


Figure 3. Standardized path coefficients obtained for the final model: Male subsample.



Note. Only significant pathways are shown.

Figure 4. Standardized path coefficients obtained for the final model: Female subsample.



Note. Only significant pathways are shown.

APPENDIX B: TABLES

Table 1. List of Composite Measures

<i>Construct of Interest</i>	<i>Time of Measurement</i>	<i>Reporter</i>	<i>Questionnaires</i>
Positive Family Relations	Time 1	Mother-report	<ul style="list-style-type: none"> • FES: Cohesion & Expressiveness Subscales • CRPBI: Acceptance-Rejection • CRT: Observed Positive Relations • Expressed Emotions: Number of Positive Remarks
Negative Family Relations	Time 1	Mother-report	<ul style="list-style-type: none"> • FES: Conflict Subscale • FAD: General Functioning • Child Behavior Questionnaire • CRT: Observed Negativity • Expressed Emotions: Number of Criticisms
Family Structure	Time 1	Mother-report	<ul style="list-style-type: none"> • Biological father presence-absence
Pubertal Maturation			
Female Participants	Time 1	Child-report	<ul style="list-style-type: none"> • PDS: Growth Spurt, Breast Change, Body Hair, and Menarche Items • IAD: Breast Change, Body Hair, Overall Development Items
Male Participants	Time 3	Child-report	<ul style="list-style-type: none"> • PDS: Growth Spurt, Body Hair, Facial Hair, and Voice Change Items • IAD: Body Hair, Facial Hair, and Voice Change Items
Self-Perceived Mate Value	Time 4	Child-report	<ul style="list-style-type: none"> • SPPC: Appearance, Social Competence, and Athletic

Competence Subscales

Timing of Sexual Debut	Time 7	Child-report	<ul style="list-style-type: none">• Romantic Relations: Age of first sexual experience and Age of first sexual intercourse items
Sexual Risk Taking	Time 7	Child-report	<ul style="list-style-type: none">• Romantic Relations: Involvement in teen pregnancy and use of contraception items

Table 2. Descriptive Statistics and Zero-Order Correlations.

		1	2	3	4	5	6	7
	Mean (SD)	-0.03 (0.62)	0.11 (0.52)	0.48 (0.50)	0.00 (0.99)	0.20 (0.67)	0.14 (0.97)	-0.24 (0.68)
1. Positive Family Relations	0.05 (0.69)	1.00	-.52** (109)	.21* (109)	.11 (86)	.04 (74)	.27* (68)	-.24* (68)
2. Negative Family Relations	-0.01 (0.53)	-.61** (129)	1.00	-.15 (109)	.08 (86)	-.25* (74)	-.20 (68)	.05 (68)
3. Family Structure	0.43 (0.49)	.26** (129)	-.31** (129)	1.00	-.09 (86)	-.01 (74)	.12 (68)	-.06 (68)
4. Pubertal Maturation	0.01 (0.99)	-.16 [†] (128)	.28** (128)	-.18* (128)	1.00	.24* (69)	-.10 (57)	-.06 (57)
5. Self-Perceived Mate Value	-0.14 (0.84)	.12 (96)	-.03 (96)	.12 (96)	-.07 (96)	1.00	-.25 [†] (56)	.01 (56)
6. Timing of Sexual Debut	-0.10 (0.93)	.20* (102)	-.40** (102)	.38** (102)	-.30** (101)	-.08 (86)	1.00	-.59** (68)
7. Sexual Risk Taking	-0.02 (0.76)	-.29** (102)	.37** (102)	-.41** (102)	.38** (101)	.01 (86)	-.69** (102)	1.00

Note. Male data displayed above the diagonal. Female data displayed below the diagonal. Pairwise *n* in parentheses below correlations.

[†] <.10; * $p < .05$; ** $p < .01$

Table 3. Fit Indices for Nested Models

Model	χ^2	<i>df</i>	CFI	RMSEA	$\Delta\chi^2$	Δdf
1. Fully Constrained Model	34.88*	21	.91	.08	157.41**	
2. Partially Constrained Model 1: Paths freely estimated across sexes Family Structure → Pubertal Maturation Negative Family Relations → Pubertal Maturation Positive Family Relations → Pubertal Maturation	31.13	18	.92	.08	3.75	3
3. Partially Constrained Model 2: Paths freely estimated across the sexes Self-Perceived Mate Value → Sexual Debut Self-Perceived Mate Value → Sexual Risk Taking	30.39	19	.93	.08	4.49	2
4. Partially Constrained Model 3: Paths freely estimated across sexes Positive Family Relations → Pubertal Maturation Pubertal Maturation → Mate Value Pubertal Maturation → Sexual Risk Taking	22.51	18	.97	.05	12.28*	3

* $p < .05$. ** $p < .01$.

Table 4. Indirect Paths to Timing of Sexual Debut.

Predictor		Male Subsample	Female Subsample
		Estimate Effect	Estimate Effect
Family Structure	Total effect	0.20**	0.22**
	Direct effect	0.19**	0.21**
	Indirect effect	0.01	0.01
Negative Family Relations	Total effect	-0.26**	-0.27**
	Direct effect	-0.25**	-0.27
	Indirect effect	-0.01	-0.00
Positive Family Relations	Total effect	-0.02	0.03
	Direct effect	0.02	0.02
	Indirect effect	-0.04	0.01
Pubertal Maturation	Total effect	-0.17 [†]	-0.14 [†]
	Direct effect	-0.13 [†]	-0.14 [†]
	Indirect effect	-0.04 [†]	0.00
	Pubertal Maturation → Self-Perceived Mate Value	-0.04 [†]	0.00

[†] <.10; * $p < .05$; ** $p < .01$

Table 5. Indirect Paths to Sexual Risk Taking.

Predictor		Male Subsample	Female Subsample
		Estimate Effect	Estimate Effect
Family Structure	Total effect	-0.19**	-0.23**
	Direct effect	-0.08	-0.08
	Indirect effect	-0.12*	-0.15**
	Family Structure → Sexual Debut	-0.12*	-0.12**
Negative Family Relations	Total effect	0.09	0.15 [†]
	Direct effect	-0.05	-0.05
	Indirect effect	0.14*	0.20**
	Negative Relations → Sexual Debut	0.16*	0.16**
	Negative Relations → Pubertal Maturation	-0.03	0.04 [†]
Positive Family Relations	Total effect	-0.15 [†]	-0.14
	Direct effect	-0.12 [†]	-0.13 [†]
	Indirect effect	-0.03	-0.02
Pubertal Maturation	Total effect	-0.04	0.26**
	Direct effect	-0.14	0.18*

	Indirect effect	0.10*	0.08 [†]
	Pubertal Maturation → Sexual Debut	0.08 [†]	0.08 [†]
Self-Perceived Mate Value			
	Total effect	0.06	0.08
	Direct effect	-0.03	-0.05
	Indirect effect		
	Self-Perceived Mate Value → Sexual Debut	0.09*	0.12*

[†] <.10; * $p < .05$; ** $p < .01$

Table 6. Goodness of Fit for LC Models Based on Number of Groups: Full Sample

No. Groups	No. Parameters	Log likelihood	AIC	BIC	SSA-BIC	<i>p</i> BLRT
1	9	-868.65	1755.29	1786.54	1758.01	-
2	19	-748.93	1535.87	1601.84	1541.61	0.00
3	29	-698.69	1455.37	1556.07	1464.15	0.00
4	39	-688.65	1455.29	1590.71	1467.09	0.29
5	49	-686.48	1470.99	1641.14	1485.82	0.92
2 + covariates	25	-725.23	1500.45	1587.26	1508.02	0.00
3 + covariates	41	-661.90	1405.79	1548.16	1418.20	0.02
4 + covariates	57	-636.27	1386.54	1584.46	1403.79	0.87
5+ covariates	73	Not Identified	-	-	-	-

Table 7. Parameters for the Three-Class Model with Covariates: Full Sample

	Class 1 <i>Middle Debut with Some Risk Taking</i>	Class 2 <i>Late Debut with Low Risk Taking</i>	Class 3 <i>Early Debut with High Risk Taking</i>
Class probabilities	41.2%	31.1%	27.7%
Item Probabilities			
<u>Use of Birth Control</u>			
Never	0.04	0.01	0.09
Rarely	0.00	0.00	0.05
Sometimes	0.05	0.01	0.17
Most of the time	0.34	0.16	0.24
Always	0.58	0.81	0.45
<u>Teen Pregnancy</u>			
No	0.89	1.00	0.48
Yes	0.11	0.00	0.53
<u>Age of First Sexual Experience</u>			
Early (14 or younger)	0.07	0.00	0.75
Middle (15-17)	0.84	0.20	0.25
Late (18 and older)	0.09	0.80	0.00
<u>Age of First Sexual Intercourse</u>			
Early (15 or younger)	0.03	0.00	0.96
Middle (16-18)	0.98	0.00	0.04
Late (19 and older)	0.00	1.00	0.00

Table 8. Log Odds Coefficients and Odds Ratio for Three-Class Model with Covariates: Full Sample

Class	Effect	Logit	SE	<i>t</i>	Odds ratio
<u>Class 1: Middle Debut, Some Risk in Comparison to:</u>					
Class 2: Late Debut, Low Risk					
	Sex	-0.26	0.36	-0.73	0.77
	Negative Family Relations	-1.46**	0.50	-2.92	0.23
	Positive Family Relations	-0.24	0.36	-0.68	0.79
	Family Structure	1.15**	0.35	3.25	3.15
	Pubertal Maturation	0.30	0.20	1.49	1.36
	Self-Perceived Mate Value	-0.92**	0.28	-3.25	0.40
Class 3: Early Debut, High Risk					
	Sex	0.89*	0.39	2.29	2.43
	Negative Family Relations	0.19	0.46	0.42	1.22
	Positive Family Relations	-0.26	0.41	-0.64	0.77
	Family Structure	-0.21	0.44	-0.49	0.81
	Pubertal Maturation	0.77*	0.21	3.60	2.16
	Self-Perceived Mate Value	0.07	0.28	0.23	1.07
<u>Class 2: Late Debut, Low Risk in Comparison to:</u>					
Class 3: Early Debut, High Risk					

Sex	1.15*	0.45	2.55	3.15
Negative Family Relations	1.66*	0.58	2.84	5.25
Positive Family Relations	-0.02	0.42	-0.05	0.98
Family Structure	-1.36*	0.42	-3.24	0.26
Pubertal Maturation	0.47*	0.22	2.05	1.59
Self-Perceived Mate Value	0.98*	0.32	3.06	2.67

Note. Biological sex was coded as follows: 0 = male, 1 = female.

† <.10; * $p < .05$; ** $p < .01$

Table 9. Test of Mean Differences across Classes: Full Sample

Variable	Omnibus χ^2	Class 1 <i>Middle Debut with Some Risk Taking</i>	Class 2 <i>Late Debut with Low Risk Taking</i>	Class 3 <i>Early Debut with High Risk Taking</i>
<u>Romantic Attachment</u>				
Secure-Avoidant	2.19	18.95	18.50	19.95
Anxious	1.39	11.95	11.33	11.78
<u>Tactics of Manipulation</u>				
Charm	0.05	3.12	3.13	3.16
Reason	0.20	4.11	4.20	4.18
Coercion	24.00**	1.47 ^{abc}	1.27 ^{abc}	1.97 ^{abc}
Silent Treatment	15.96**	1.67 ^a	1.51 ^b	2.13 ^{ab}
Regression	14.78**	1.77 ^a	1.72 ^b	2.46 ^{ab}

† <.10; * $p < .05$; ** $p < .01$

Table 10. Goodness of Fit for LC Models Based on Number of Groups: Male Subsample

No. Groups	No. Parameters	Log likelihood	AIC	BIC	SSA-BIC	<i>p</i> BLRT
1	9	-379.65	777.30	801.53	773.09	-
2	19	-332.03	702.06	753.19	693.16	.00
3	29	-308.64	675.27	753.32	661.69	.00
4	39	-298.50	674.99	779.96	656.72	.00
5	49	-293.12	684.24	816.12	661.28	.07
2 + covariates	24	-319.27	686.55	751.14	675.30	.00
3 + covariates	39	-289.52	657.04	762.01	638.77	.00
4 + covariates	54	-270.51	649.01	794.34	623.71	.20
5+ covariates	69	Not Identified	-	-	-	-

Table 11. Parameters for the Four-Class Model with Covariates: Male Subsample

	Class 1 <i>Early Debut, High Risk</i>	Class 2 <i>Middle Debut, Low Risk</i>	Class 3 <i>Middle Debut, High Risk</i>	Class 4 <i>Late Debut, Low Risk</i>
Class probabilities	23.5%	24.2%	22.5%	29.8%
Item Probabilities				
<u>Use of Birth Control</u>				
Never	0.08	0.00	0.04	0.00
Rarely	0.04	0.00	0.00	0.00
Sometimes	0.17	0.00	0.15	0.03
Most of the time	0.28	0.00	0.81	0.28
Always	0.44	1.00	0.00	0.69
<u>Teen Pregnancy</u>				
No	0.72	1.00	0.77	1.00
Yes	0.28	0.00	0.23	0.00
<u>Age of First Sexual Experience</u>				
Early (14 or younger)	0.78	0.00	0.00	0.00
Middle (15-17)	0.22	0.85	0.88	0.07
Late (18 and older)	0.00	0.15	0.12	0.93
<u>Age of First Sexual Intercourse</u>				
Early (15 or younger)	0.86	0.00	0.00	0.00
Middle (16-18)	0.14	0.87	1.00	0.00
Late (19 and older)	0.00	0.13	0.00	1.00

Table 12. Log Odds Coefficients and Odds Ratio for Four-Class Model with Covariates: Male Sample

Class	Effect	Logit	SE	<i>t</i>	Odds ratio
<u>Class 2: Middle Debut, Low Risk in Comparison to:</u>					
Class 1: <i>Early Debut, High Risk</i>					
	Negative Family Relations	-1.43	0.81	-1.76	0.24
	Positive Family Relations	-2.69**	0.86	-3.15	0.07
	Family Structure	0.21	0.66	0.32	1.23
	Pubertal Maturation	0.19	0.37	0.52	1.21
	Self-Perceived Mate Value	-1.29 [†]	0.68	-1.89	0.28
Class 3: <i>Middle Debut, High Risk</i>					
	Negative Family Relations	-1.29	0.88	-1.47	0.28
	Positive Family Relations	-3.49**	0.91	-3.85	0.03
	Family Structure	-0.09	0.78	-0.12	0.91
	Pubertal Maturation	-0.58	0.40	-1.47	0.56
	Self-Perceived Mate Value	-2.14**	0.78	-2.76	0.12
Class 4: <i>Late Debut, Low Risk</i>					
	Negative Family Relations	-2.98**	0.96	-3.09	0.05
	Positive Family Relations	-2.28*	1.03	-2.21	0.10
	Family Structure	1.23	0.72	1.70	3.41
	Pubertal Maturation	0.03	0.46	0.07	1.03
	Self-Perceived Mate Value	-3.23**	1.05	-3.07	0.04

Class 1: Early Debut, High Risk in Comparison to:Class 3: Middle Debut, High
Risk

Negative Family Relations	0.13	0.72	0.19	1.14
Positive Family Relations	-0.80	0.67	-1.18	0.45
Family Structure	-0.30	0.75	-0.40	0.74
Pubertal Maturation	-0.77**	0.29	-2.65	0.46
Self-Perceived Mate Value	-0.86	0.54	-1.58	0.43

Class 4: Late Debut, Low
Risk

Negative Family Relations	-1.55*	0.79	-1.96	0.21
Positive Family Relations	0.41	0.79	0.52	1.50
Family Structure	1.02	0.64	1.59	2.77
Pubertal Maturation	-0.16	0.36	-0.44	0.85
Self-Perceived Mate Value	-1.94*	0.84	-2.30	0.14

Class 3: Middle Debut, High Risk in Comparison to:Class 4: Late Debut, Low
Risk

Negative Family Relations	-1.68*	0.85	-1.97	0.19
Positive Family Relations	1.21	0.81	1.49	3.34
Family Structure	1.32 [†]	0.70	1.89	3.75
Pubertal Maturation	0.61	0.39	1.57	1.84
Self-Perceived Mate Value	-1.08	0.76	-1.42	0.34

[†] <.10; * $p < .05$; ** $p < .01$

Table 13. Test of Mean Differences across Classes: Male Subsample

Variable	Omnibus χ^2	Class 1 <i>Early Debut with High Risk Taking</i>	Class 2 <i>Middle Debut with Low Risk Taking</i>	Class 3 <i>Middle Debut with High Risk Taking</i>	Class 4 <i>Late Debut with Low Risk Taking</i>
<u>Romantic Attachment</u>					
Secure-Avoidant	19.31**	20.30 ^c	17.70 ^{ac}	21.72 ^{ab}	18.78 ^b
Anxious	12.05*	12.05	11.39 ^a	12.95 ^a	11.96
<u>Tactics of Manipulation</u>					
Charm	15.94**	3.24	3.71	2.66	3.39
Reason	13.83*	3.87 [†]	4.25 ^a	3.31 ^{†ab}	4.21 ^b
Coercion	4.66	1.49	1.32	1.44	1.24
Silent Treatment	0.34	1.64	1.59	1.55	1.54
Regression	3.42	1.89	1.63	1.60	1.81

[†] <.10; * $p < .05$; ** $p < .01$

Table 14. Goodness of Fit for LC Models Based on Number of Groups: Female Subsample

No. Groups	No. Parameters	Log likelihood	AIC	BIC	SSA-BIC	<i>p</i> BLRT
1	9	-477.12	972.25	997.99	969.52	-
2	19	-400.29	838.58	892.91	832.82	0.00
3	29	-375.25	808.51	891.44	799.73	0.00
4	39	-369.91	817.81	929.34	806.00	0.24
5	49	-368.55	835.09	975.22	820.25	1.00
2 + covariates	24	-380.19	808.19	876.83	800.93	0.00
3 + covariates	39	-351.52	781.05	892.58	769.24	0.00
4 + covariates	54	Not Identified	-	-	-	-

Table 15. Parameters for the Three-Class Model with Covariates: Female Subsample

	Class 1 <i>Late Debut with Low Risk Taking</i>	Class 2 <i>Middle Debut with Moderate Risk Taking</i>	Class 3 <i>Early Debut with High Risk Taking</i>
Class probabilities	21.0%	45.9%	33.1%
Item Probabilities			
<u>Use of Birth Control</u>			
Never	0.04	0.03	0.12
Rarely	0.00	0.00	0.05
Sometimes	0.00	0.02	0.16
Most of the time	0.03	0.24	0.23
Always	0.93	0.71	0.44
<u>Teen Pregnancy</u>			
No	1.00	0.93	0.35
Yes	0.00	0.07	0.65
<u>Age of First Sexual Experience</u>			
Early (14 or younger)	0.00	0.05	0.73
Middle (15-17)	0.00	0.77	0.27
Late (18 and older)	1.00	0.18	0.00
<u>Age of First Sexual Intercourse</u>			
Early (15 or younger)	0.00	0.05	0.94
Middle (16-18)	0.00	0.77	0.06
Late (19 and older)	1.00	0.18	0.00

Table 16. Log Odds Coefficients and Odds Ratio for Three-Class Model with Covariates: Female Subsample

Class	Effect	Logit	SE	<i>t</i>	Odds ratio
<u>Class 2: Middle Debut, Some Risk in Comparison to:</u>					
Class 3: <i>Early Debut, High Risk</i>					
	Negative Family Relations	1.19	0.73	1.63	3.30
	Positive Family Relations	0.24	0.49	0.49	1.28
	Family Structure	-1.20*	0.59	-2.02	0.30
	Pubertal Maturation	0.76*	0.32	2.39	2.14
	Self-Perceived Mate Value	0.04	0.39	0.10	1.04
Class 1: <i>Late Debut, Low Risk</i>					
	Negative Family Relations	-1.35	1.28	-1.05	0.26
	Positive Family Relations	0.44	0.44	0.99	1.55
	Family Structure	1.09 [†]	0.60	1.82	2.97
	Pubertal Maturation	-0.11	0.33	-0.34	0.89
	Self-Perceived Mate Value	-.95**	0.33	-2.86	0.39
<u>Class 3: Early Debut, High Risk in Comparison to:</u>					
Class 1: <i>Late Debut, Low Risk</i>					
	Negative Family Relations	2.54	1.48	1.72	12.73
	Positive Family Relations	-0.19	0.57	-0.34	0.83

Family Structure	-2.29**	0.73	-3.14	0.10
Pubertal Maturation	0.88*	0.38	2.32	2.40
Self-Perceived Mate Value	0.99*	0.43	2.32	2.68

[†] <.10; * $p < .05$; ** $p < .01$

Table 17. Test of Mean Differences across Classes: Female Subsample

Variable	Omnibus χ^2	Class 1 <i>Late Debut with Low Risk Taking</i>	Class 2 <i>Middle Debut with Moderate Risk Taking</i>	Class 3 <i>Early Debut with High Risk Taking</i>
<u>Romantic Attachment</u>				
Secure-Avoidant	4.32	18.44	17.83	20.07
Anxious	10.99	10.99	11.23	11.91
<u>Tactics of Manipulation</u>				
Charm	0.73	2.85	3.06	3.06
Reason	0.60	4.26	4.44	4.27
Coercion	20.31**	1.23 ^{ab}	1.55 ^{ac}	2.21 ^{bc}
Silent Treatment	13.41**	1.50 ^a	1.73 ^b	2.34 ^{ab}
Regression	14.86**	1.66 ^a	1.89 ^b	2.71 ^{ab}

† <.10; * $p < .05$; ** $p < .01$

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