Adapting to Parental Investment Uncertainty? The Role of Personality and Puberty

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Abstract

Early childhood experiences of parental investment uncertainty appear to influence later dating and sexuality in girls. Research has suggested that this relationship is mediated by the timing of pubertal development. This thesis investigated whether personality traits also mediated this relationship. A path model was tested with paths from indices of early parental investment uncertainty to dating and sexuality through pubertal development and personality. Results suggested that pubertal development did not mediate the relationship between early experiences of parental investment. However, there was some evidence that personality, specifically the trait Honesty-Humility, was associated with early experiences of parental investment uncertainty and dating and sexuality in girls.

Keywords: Puberty, personality, evolution, life history theory, attachment, development
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# Table of Contents

Abstract .................................................................................................................. ii

Acknowledgements ............................................................................................... iii

Introduction ........................................................................................................... 1

  Life History Theory ........................................................................................... 2

  Bet - Hedging ................................................................................................... 4

  Phenotypic Plasticity in Humans ....................................................................... 5

  Draper and Harpending’s Theory of Father Absence ......................................... 6

  Attachment and Psychosocial Acceleration Theory ........................................... 7

  Other Theories of Accelerated Pubertal Development ...................................... 14

  Why study girls (and not boys)? ....................................................................... 23

  Personality ......................................................................................................... 24

The Current Study .................................................................................................. 29

Methodology .......................................................................................................... 32

  Participants ....................................................................................................... 32

  Procedure ......................................................................................................... 32

  Measures .......................................................................................................... 32

Statistical Analysis .................................................................................................. 36

Results .................................................................................................................... 37

Discussion ............................................................................................................... 51

Limitations .............................................................................................................. 58

Future Directions ................................................................................................... 61

Conclusion .............................................................................................................. 62
References ........................................................................................................... 64

Appendix A – Testing of Statistical Assumptions ........................................ 82

Appendix B ....................................................................................................... 90
Adapting to Parental Investment Uncertainty? The Role of Personality and Puberty

It has been suggested that earlier pubertal development in girls may be part of an evolved reproductive strategy that enhances fertility, and consequently genetic fitness, under precarious or harsh environmental conditions (e.g., Draper & Harpending, 1982; Belsky, Steinberg & Draper, 1991; Chisholm, 1993). Specifically, early constructions of internal working models (IWMs) based on low-quality attachment between a child and their primary caregiver have been suggested to be a cue to a developing child that relationships with others are unpredictable, that support and care is unreliable, and parental investment will be limited or non-existent. Such individuals go on to develop a mistrust of the world in general, and manipulative and exploitative orientations towards others (Belsky, Steinberg & Draper, 1991). When girls experience such parental investment uncertainty, is hypothesized to then calibrate development such that they begin to mature and reproduce earlier as a way to “hedge their bets” of raising a viable offspring and propagating their genetic material (Chisholm, 1993).

The overarching premise of my study is that certain developmental traits which have been traditionally viewed in a pejorative manner ought to be considered in a new light as useful, rational and adaptive strategies. If accelerated pubertal development is indeed part of a co-evolved suite of adaptations, it may be reasonable to expect associated differences in personality. For example, if the resulting manipulative and exploitative orientation towards others is part of an adaptive strategy, we might expect to observe differences in personality which reflect this orientation. Furthermore, previous research has demonstrated personality differences between individuals who partake in relationships with differing degrees of commitment and seriousness (e.g., Jonason,
Hatfield & Boler, 2014). As such, it may be reasonable to suggest that personality is related to pubertal development and dating and sexuality in girls if personality is indeed part of this co-evolved suite of adaptive traits.

It has been established that attachment security is related to various attributes of adult relationships in girls, including accelerated dating and sexual behaviour. Furthermore, it has been proposed that accelerated pubertal development is a mechanism that facilitates this relationship (e.g., Belsky et al., 1991; Chisholm et al., 1993). The purpose of my study was to test the conceptual model presented in Figure 1. Specifically, I tested whether early experiences of parental investment uncertainty were related to dating and sexuality in girls, and whether these associations were mediated by pubertal development (i.e., biologically-oriented and psychosocially-oriented) and personality (i.e., Honesty-Humility and Conscientiousness).

**Life History Theory**

Life history theory is an evolutionary metatheory that describes variability in individual differences as reflective of a series of coordinated adaptive trade-offs that organisms must make to maximize the somatic and reproductive resources available to them in their local ecologies (e.g., Wilson & MacArthur, 1967). Life history theory resolves, in part, the tension between adaptationist and mechanistic perspectives in evolutionary psychology as it is concerned with both how natural selection has shaped certain adaptations, as well as how the phenotypic expression of these adaptations has been shaped by the environment (e.g., Boyce, 1988; Promislow & Harvey, 1990; 1991). Across evolutionary disciplines it is agreed that the ability to solve adaptive problems is associated with increasing one’s genetic fitness (i.e., passing on one’s genes) (Chisholm,
These functions fall into two categories: (1) somatic effort (i.e., having to do with growth and maintenance) and (2) reproductive effort. Reproductive effort can be further broken down into two subcategories: (1) mating effort (i.e., seeking out a mate, establishing pair-bonds) and (2) parental effort (i.e., gestation, childbirth, breastfeeding, provisioning of resources towards kin) (e.g., Clutton-Brock, 1991). Due to the finite nature of expending such efforts, organisms are often forced to make trade-offs to allocate their resources in the most optimal way in the current socioecology, leading to “suites of co-evolved traits” (Chisholm, 1993, p. 3). Indeed, comparative research has suggested that mammals typically fall along a continuum of emphasizing mating effort or parenting effort (e.g., Boyce, 1988; Promislow & Harvey, 1990; 1991).

As delineated by the biological sciences, life history theory categorizes organisms into two categories: \( r \)-selected and \( K \)-selected (e.g., Pianka, 1970, West-Eberhand, 2003). \( r \)-selected strategies entail coming to reproductive age earlier, living a shorter lifespan and bearing many offspring with little parental investment. These strategies are typically correlated with unpredictable and variable environments, density-independent (and often catastrophic) mortality rates, large broods, and small body size (Pianka, 1970). Conversely, \( K \)-selected strategies entail a longer lifespan with slower development, delayed maturity and reproduction, and greater parental investment in fewer offspring (West-Eberhard, 2003). These strategies are correlated with fairly predictable environments, density-dependent mortality rates, variable juvenile mortality rates and larger body size (Pianka, 1970; Stearns, 1977). In sum, the theory would predict that \( r \)-selected organisms will favor allocating resources towards reproductive effort, while \( K \)-
selected organisms will favor allocating resources towards somatic effort (i.e., continued growth and maintenance).

Perhaps the most notable criticism of Pianka’s (1970) theory of \( r \)- and \( K \)-selection was that variation in life history strategy was centered around the body size of the organism, whereas the other factors (i.e., timing of development, parental investment, mortality rates) appeared to only be significant in terms of relative body size (Promislow & Harvey, 1990). This criticism is central to bet-hedging theory, that was developed to refine and redevelop Pianka’s (1970) original theory of \( r \)- and \( K \)-selection (Promislow & Harvey, 1990; 1991).

**Bet-Hedging**

Upon examining the life history traits of 48 mammal species, Promislow and Harvey (1990) concluded that local mortality, after controlling for body size, was the driving force behind life history strategy. Following these results, bet-hedging theory predicts that when mortality rates are high, the short-term strategy of maximizing fertility will be the most reproductively successful due to a reduced likelihood of the parent and/or the offspring surviving. Conversely, when mortality rates are low, the long-term strategy of minimizing variance in the number of offspring and maximizing said offspring’s reproductive value is likely to be most successful. In such cases, mothers are able to “hedge their bets” and produce a large and highly competitive neonate. However, when the likelihood of survival is unpredictable, a mother can increase the likelihood of fitness should the environment improve, by “cutting her losses” should the environment remain adverse, by increasing her fertility (Promislow & Harvey, 1990). However, in
accordance with parental investment theory, individual characteristics of an offspring may also contribute to decisions about whether to invest parentally or not (Trivers, 1972).

**Phenotypic Plasticity in Humans**

Due to the limited and finite nature of these resources, organisms must make strategic decisions about how and when these resources will be allocated. These decisions are likely calibrated by factors in the organisms’ local ecology such as mortality rate and environmental unpredictability. Phenotypes that allowed for this type of plasticity would have been favoured by natural selection, such that organisms that adapted by maximizing their fecundity and enhancing their reproductive status would have increased their chances of propagating their genetic material (Chisholm, 1993). However, the fundamental trade-off exists between prioritizing productivity and longevity – organisms may invest all their resources in reproduction, but will sacrifice important somatic and health-related resources in the process, resulting in shorter lifespans (Stearns, 1989; Williams, 1966).

Human life history strategy is distinct from other mammals, including other non-human primates (Hawkes et al., 1998). Human lifespan development is characterized by a slow childhood, long periods of dependence, shorter interbirth intervals, and a mortality rate that peaks at birth (Hill, 1993; Hill & Kaplan, 1999; Robson, van Schaik & Hawkes, 2006; Volk & Atkinson, 2008). Human growth takes precedence in the allocation of somatic and energetic resources during childhood. At pubertal maturation, these resources are increasingly reallocated to reproductive endeavours, including gestation and breastfeeding in women, and the maintenance of energetically-costly dimorphic features in men (Charnov, 1993; Kuzawa, 2007).
While life history strategy was originally meant to describe between-species patterns of development, there appear to be salient human within-species differences in important life history domains, such as growth rate, body size, and reproductive timing (Kurzawa & Bragg, 2012). Researchers in this area attribute much of this variance in human development to the influence of social, nutritional, demographic and ecological conditions (Chisholm, 1993; Ellis et al., 2009). Consistent with the early postulations of Stearns (1977), a direct application of life history theory would predict that life history traits should be plastic between and within populations.

**Draper and Harpending’s (1982) Theory of Father Absence**

Building on life history theory, Draper and Harpending (1982) presented ground-breaking work that suggested that development was influenced very specifically by whether children were reared in father-absent or father-present homes. The results of their research suggested that girls reared in a father-absent home differed most substantially from girls reared in father-present homes in terms of sexual behaviour. Girls reared in father-absent homes tended to display more “precocious sexual interest”, denigration of masculinity and masculine behaviour, and less intimate and stable relationships with men compared to girls reared in father-present homes (Draper & Harpending, 1982). This pattern of increased promiscuity was attributed to the expectation that interpersonal relationships would not be stable and enduring, and that paternal investment in future offspring would be limited or non-existent. The contrary was suggested among girls reared in father-present homes. That is, girls in father-present homes would be prone to delaying their sexual debut, and would seek out and expect long-lasting interpersonal relationships, characterized by intimacy and security (Draper & Harpending, 1982).
Attachment and Psychosocial Acceleration Theory

Belsky, Steinberg and Draper (1991) extended the work of Draper and Harpending (1982) by suggesting that the effects of early stress preceded, in part, the development of later reproductive strategies. Specifically, the attachment relationship between a child and their primary caregiver would give rise to a pattern of development that emphasizes either mating effort or parenting effort. Bowlby’s (1969) attachment theory highlights the adaptive origins of love and security throughout the lifespan (e.g., Parkes, Stevenson-Hinde & Marris, 1991). Attachment theory posits that children develop internal working models (IWMs) about themselves and others throughout the first seven years of life based on the quality of the social-emotional relationship between themselves and their primary caregivers (Bowlby, 1969). These IWMs are the neuroendocrine basis for how children respond to stress, as well as the perceptual basis of how children expect to be welcomed and cared for by others (Kraemer, 1992; Bowlby, 1973).

In the case of a secure attachment, feelings of security between the child and the caretaker will motivate the child to explore and play, thus increasing the literal and metaphorical distance between the child and their caregiver. This distance contributes to feelings of separation anxiety that, in turn, motivates a child to return to their caregiver. If the child is consistently met with warmth and responsiveness upon their return, a secure attachment relationship will be fostered, and child will develop an IWM of others as safe and trustworthy (Bowlby, 1969). When caregivers are insensitive and unresponsive, the child is likely to experience negative feelings, such as fear, anxiety and grief, that constitute the early experience of stress. These experiences foster an insecure attachment
to a caregiver, and the child is likely to establish IWMs of others as rejecting and insensitive (Bowlby, 1969). These low expectations of others may contribute to behaving in an “aloof and detached” manner, akin to Ainsworth’s (1979) avoidant-attachment style, or in a “clingy and dependent” manner, akin to Ainsworth’s (1979) anxious-attachment style (Skolnick, 1981, p. 181). IWMs may be somewhat plastic, but they are generally resistant to modification. Main (1990) suggested that insecure attachment styles may represent adaptive strategies for maintaining parental investment from parents who are otherwise disinterested or rejecting of their offspring. Likewise, corresponding parenting strategies, from a life history perspective, may have evolved as “cues” to offspring that the current local ecology is harsh and precarious, that would inform how the cascade of developmental events should proceed to account for such variability (Chisholm, 1993). However, since children will not directly perceive these events as cues, life history theory provides an explanation of how parental insensitivity or indifference may be an index of local mortality rates for a developing child. Furthermore, if reproductive strategies are indeed calibrated by local mortality rates, and early stress is a correlate of high local mortality rates, it should follow that early childhood stress should, in part, regulate the development of reproductive strategy. Specifically, high early childhood stress should be associated with a reproductive strategy that emphasizes mating effort and/or parenting effort (Chisholm, 1993).

This theorizing gave rise to psychosocial acceleration theory, which posited that if a child experienced chronic familial stress during the first five to seven years of life, their development would be calibrated as though parental investment and stability in relationships could not be reliably predicted (Belsky, Steinberg & Draper, 1991). This
model, which emerges from the assumptions of life history theory, suggests that the transition from childhood to adolescence is a sensitive period for developing a reproductive strategy (Belsky, Steinberg & Draper, 1991). While Draper and Harpending’s (1982) initial work in this area was ground-breaking, there were some notable limitations that were later addressed by Belsky, Steinberg and Draper (1991). First, an explanation of the developmental mechanism facilitating the proposed relationship between father-absence and later promiscuity was lacking. Second, the predictions made by Draper and Harpending (1982) required empirical investigation.

Belsky and colleagues (1991) extended the initial work done by Draper and Harpending (1982) by focusing on the identification of proximate mechanisms that mediate the relationship between early rearing environments (i.e., the extent to which they were stressful or supportive) and later sexual behaviour. Psychosocial acceleration theory posits that the extent to which the extrafamilial environment is stressful or supportive influences the familial dynamics that, in turn, influence a child’s social, emotional and behavioural development (Belsky et al., 1991). At the level of parent-child relationships, the nature of the attachment relationship and the quality of parent-child interactions (i.e., characterized by conflict vs. cooperation), mediate the impact of extrafamilial influences. As such, psychosocial acceleration theory predicts that children reared in stressful environments with insecure attachment relationships will develop a general worldview characterized by mistrust, and interpersonal relationships characterized by opportunism and exploitation (Belsky, 2012).

Consistent with evolutionary theory, natural selection would have favoured organisms that, under precarious conditions, would have adapted by accelerating
development to facilitate earlier and increased reproduction (Belsky, Steinberg, Houts, Halpern-Felsher & the NICHD, 2010). This adaption would confer two specific advantages to such organisms. First, the chance of an organism dying before reaching a viable reproductive age increases under unpredictable conditions. Second, any offspring that an organism does have are also unlikely to reach a viable age to reproduce due to similar ecological constraints. As such, organisms that matured quickly, invested more in mating, and invested less in parenting would have enhanced their genetic fitness (Belsky, Steinberg, Houts, Halpern-Felsher & the NICHD, 2010). Indeed, the relationship between earlier pubertal development and increased sexual risk taking in girls is well-established (e.g., Ellis, 2004; Steinberg, 2008).

Belsky and colleagues (1991) have proposed that insecure attachment may be an adaptive mechanism for adopting alternative reproductive strategies. Several studies have found that in modern environments, low subjective life expectancy is associated with earlier and less selective reproductive strategies. Whereas traditional approaches to developmental science may brand these qualities as “non-optimal” or “maladaptive”, a grounding in evolutionary theory illuminates the adaptive utility of developing in this manner. Akin to the propositions of life history theory, individuals who are reared in a stressful environment would incur reproductive benefits by cultivating a “quantity-oriented reproductive strategy” (Belsky, 2012). Due to the constraints of mammalian physiology, female parental investment is an absolute requirement for offspring viability, while men are able to invest nothing. This parental investment asymmetry is another calibrating factor of reproductive strategy, which may make women more sensitive to the presence or absence of paternal investment (Draper & Harpending, 1982). Furthermore, it
would appear that male reproductive strategy calibration is most sensitive to peer relationships, whereas female reproductive strategy calibration in women is most sensitive to ecological and familial conditions (Del Giudice, Ellis & Shirtcliff, 2011; James, Ellis, Schlomer & Garber, 2012). Whereas men can increase their genetic fitness by mating and reproducing as much as possible, women’s reproductive strategy is limited by the somatic resources necessary for ovulation and successful parturition, as well as the parental resources necessary to raise a viable offspring once a mother delivers (Draper & Harpending, 1982). Human mothers are able to carry and deliver more offspring well before their other offspring reach a viable age and must make decisions about how resources are allocated towards each offspring (Kaplan et al., 2000). This may be a reason why human mothers may neglect, reject or kill their offspring in precarious and harsh conditions (Hrdy, 1995).

Parental investment serves as a buffer between environmental risk and the child, thus informing the child’s IWM about how they can expect others to support and care for them. Due to the social nature of human beings (as compared to other primates), social-emotional resources, such as parental investment, are incredibly salient which increases the risk of social-emotional insecurity (Kaplan et al., 2000). In fact, material resource insecurity can cause feelings of social-emotional insecurity in humans via activation of the hypothalamic-pituitary-adrenal (HPA) axis. When humans experience hunger, pain, or fatigue, HPA axis activation facilitates support-seeking behaviour in humans (this is also referred to as the “tend and befriend” response to stress among females; Taylor, 2006). If needs for support are not met, it can induce subjective feelings of insecurity. Additionally, it is more difficult for parents in such situations to parent responsively and
effectively. This, in turn, compounds the effects of felt-insecurity, and reinforces the child’s IWM of the world and others as mistrustful and unable to provide support, thus increasing the likelihood that the child establishes an insecure attachment relationship with their parent (Bowlby, 1973; Chisholm, 1993; 2003).

Research on the developmental implications of harsh and unpredictable environments has dependably suggested that such ecologies have the potential to shape developmental pathways. Animal models have been useful to demonstrate the effects of social environment on reproductive cycle. For example, the Bruce effect describes the phenomenon of pregnant female rats spontaneously aborting or resorbing their fetuses if they are exposed to the pheromones of a male who is not the sire (Bruce, 1959; Heske & Nelson, 1984). Similarly, the Vandenbergh effect describes the occurrence of female juvenile mice undergoing accelerated puberty earlier than controls when exposed to adult males, likely due to exposure to male urine that, in turn, triggers the release of GnRH (Vandenbergh, 1967). Moreover, Cameron and colleagues (2005) provided support for the psychosocial acceleration theory hypothesis by demonstrating that maternal licking and grooming behaviours towards newborn rat pups regulated gene expression such that more maternal behaviours lowered stress reactivity, slowed the rate of sexual maturation and sexual behaviour, and eventually influenced later parenting behaviours. These maternal licking and grooming behaviours mediated the relationship between gene expression in newborn rat pups and the extent to which the rearing conditions were stressful or supportive (Cameron et al., 2005). These results were in line with Chisholm’s (1999) earlier supposition that physiological pathways, namely activation of the HPA axis, would link early rearing experience and later reproductive behaviour, as well as
Belsky and colleagues’ (1991) proposal that the neuroendocrine system was likely intertwined with this relationship.

In humans, the relationship between early stress and earlier pubertal development is obscured by confounding variables such as health, weight, and nutrition. There is, however, some empirical evidence to suggest that there is a unique pathway between early stress and timing of puberty, despite the influence of such factors. Notably, Moffitt, Caspi and Belsky (1992) found evidence that suggested that early stressors, including (but not limited to) father-absence, predicted earlier menarche, after controlling for the effects of nutrition. The results of this study were later replicated by Belsky and colleagues (2007) who suggested that more negativity in the family environment (i.e., higher levels of conflict and harsh maternal control) predicted earlier menarche, and vice versa. Additionally, Ellis and Essex (2007) followed 120 children over eleven years to examine the relationship between early childhood environments and variability in timing of pubertal maturation. Their results were consistent with paternal investment theory, as they demonstrated that “paternally-based measures of family environment” were able to uniquely predict timing of andrenarche over and above the maternally-based measures. Moreover, the results also supported psychosocial acceleration theory, as higher levels of both socioeconomic status (SES) and indices of parental supportiveness during preschool were associated with less secondary sexual development in fifth grade. Furthermore, it was determined that body mass index (BMI) was not a mediating factor in this relationship. However, this may be because the BMI range in this sample was restricted. This study also replicated results previously obtained by Ellis and colleagues (1999) that
implicated positive and supportive parental relationships with lower rates of secondary sexual development in later childhood.

**Potential confounds.** There are some notable potential confounds in the relationship between stressful early environments and early pubertal development in girls. First, there is a significant body of evidence that suggests that pubertal timing is heritable. Several studies have concluded that genotypic effects account for 50-80% of the variance in pubertal timing in girls (e.g., Kaprio et al., 1995; Treloar & Martin, 1990). However, this also means that the remaining variance is attributable to environmental influences, as well as measurement error. For example, Malina, Ryan and Bonci (1994) examined the correlations in menarcheal timing between mother-daughter dyads and sister-sister dyads. Although both these pairs are expected to correlate similarly, sister-sister dyads were correlated consistently higher than the mother-daughter dyads, suggesting that sharing a rearing environment increases the likelihood of similar menarcheal timing more than genetic influence (Malina, Ryan & Bonci, 1994).

There is also a reasonable possibility that parents are passing on the genetic propensity for both early pubertal development and cyclical dysfunctional familial dynamics (e.g., Moffitt et al., 1992). However, there is also substantial evidence that suggests that the influence of genetics does not preclude the increased possibility of early pubertal development arising from a stressful upbringing (e.g., Rowe, 2000). For example, Mendle and colleagues (2006) found that the relationship between step-father presence and early pubertal development was mediated by genetics when they utilized a children-of-twins research design. Conversely, Tither and Ellis (2008) were unable in replicate this relationship.
Ellis (2004) noted that these results should be interpreted with caution. From an evolutionary perspective, natural selection would have favoured physiological mechanisms that calibrated pubertal timing based on a range of recurrently present social and environmental cues, including cues that were novel and required deviation away from normal operations. Furthermore, in cultures that are socio-economically stable, we can assume that differences in early puberty are largely genetically determined. For example, Chasiotis, Scheffer, Restmeier and Keller (1998) examined pubertal timing during a time of social and political disruption that impacted East Germans more significantly than it did West Germans. There was no significant relationship between mothers and daughters in menarcheal timing among East Germans, but there was a significant relationship among West Germans. Similarly, Hajn and Komenda (1985) found a similar pattern of results between mothers and daughters in a sample from rural and urban areas in the Czech Republic. Additionally, among Finnish children born in the 1970s, environment accounted for very little variation in pubertal timing due to the successful strong welfare policies of the state (Kaprio et al., 1995)

Another potential confound has to do with an individual’s diet, and consequently their BMI. Rat studies have demonstrated that when these mammals are stressed they will consume more “comfort foods” (i.e., foods that are high in sugar and fat) than their regular rat chow. This change in diet triggers a chain of endocrine-related events, including increases in insulin and leptin and eventual increases in body fat, as well as a decreased autonomic and adrenocortical response to stress (Pecoraro, Reyes, Gomez, Bhargava & Dallman, 2004; Dallman, Pecoraro & la Fleur, 2004). Increases in fat levels also signal the secretion of the hormone leptin, that in turn stimulates the hypothalamus to
secrete gonadotropin-releasing hormone (GnRH). These actions then stimulate the pituitary-ovarian axis in girls and initiates pubertal development (Wilson et al., 2003). Like rats, humans in stressful environments are also prone to eating foods that are higher in sugar and fat, and more likely to contribute to excess body fat and a higher BMI (Dallman et al., 2004). Greater BMI has been associated with earlier secondary sexual characteristics and menarche (e.g., Cooper, Kuh, Egger, Wadsworth & Barker, 1996; St. George, Williams & Silva, 1994). These effects are further compounded by low SES, which may limit accessibility to healthy foods such as fruits and vegetables (Dallman et al., 2004).

Other Theories of Accelerated Pubertal Development

Energetics theory. Energetics Theory is a middle-level LH-based theory that posits that nutrition and available energy in childhood predicts timing of puberty (Ellison, 2001). The first hypothesis suggests that greater food availability and excess metabolic energy (indicative of a resource-rich environment) will be associated with earlier puberty (Ellison, 2001). These hypotheses arose from the suggestion that favourable early environments should signal to an organism that earlier reproduction should be successful, whereas unpredictable early environments should signal to an organism that they should conserve energy and resources for predictably better conditions later (Ellison, 2001; Ellis, 2004). Indeed, within societies where differences between the social classes are most substantial, researchers consistently report that girls from higher social classes begin pubertal development earlier than girls from lower classes (see Ellis, 2004 for review). Furthermore, increases in global health and nutrition over the last 150 years have paralleled a significant drop in the average age of menarche from 17 years old to 13 years
old between 1830 and 1970 (Eveleth & Tanner, 1990). This effect is most striking in low
SES populations, as they have experienced the most dramatic increase in conditions over
time (e.g., Bangladesh), whereas these effects are not observable in societies where lower
social classes do not suffer from systematic malnutrition and disease (e.g., Canada; see
Ellis, 2004 for review). Several studies have concluded that girls who are either
malnourished or consume fewer calories than average have later pubertal development
(e.g., Adair, 2001; Kumra, Mehta & Deodhar, 1990; Satyanarayana & Naidu, 1979;
Frisch, 1972). This process appears to be mediated by low circulating levels of pituitary
gonadotropins (Kulin, Bwibo, Mutie & Santer, 1984). Hence, it would appear that there is
sufficient support for the first hypothesis, but only under conditions of severe
malnutrition.

The second hypothesis suggests that, due to this excess metabolic energy and food
availability, girls who reproduce early will have greater reproductive capacity than those
who reproduce later. Adolescent mothers generally have smaller pelvic capacities and
smaller body sizes, are more likely to convert less energy into fetal weight gain
(Moerman, 1982; Garn, Pesick & Petzold, 1986), are more likely to have antenatal
complications and mortality, and more likely to have postnatal complications, such as
low birth weight, prematurity, and stillbirth (Black & DeBlassie, 1985; Furstenberg,
Brooks-Gunn & Chase-Lansdale, 1989; Luster & Mittelstaedt, 1993). Moreover, there is
a pattern across mammalian species of greater competence among adult mothers
(Promislow & Harvey, 1990), and children of older mothers generally have better
cognitive, behavioural, social, developmental and survival outcomes (Black & DeBlassie,
1985; Brooks-Gunn & Furstenberg, 1986; Konner & Shostak, 1986; Overpeck, Brenner,
Trumble, Trifiletti & Berendes, 1998). As such, the data appear to support the first, but not the second, hypothesis of Energetics Theory (Ellis, 2004).

**Stress-suppression theory.** The primary supposition of Stress-Suppression theory is that \( K \)-selected animals, such as human beings, should delay puberty if they are experiencing adverse or stressful social conditions (MacDonald, 1999; E.M. Miller, 1994). This theory has been largely supported by research linking stress to suppression of the hypothalamic-pituitary-gonadal HPG axis in mammals (e.g., Chrousos, 1998; Meaney, 2001; McEwen, 1998). When the duration and the magnitude of the stress response is substantial, the functioning of the hypothalamic-pituitary-gonadal (HPG) axis is altered such that the effects of GnRH are stunted. Thus, the link between the stress-response system and the HPG axis provides a potential mechanism for delayed pubertal development due, in part, to psychosocial stressors.

Whereas the Stress-Suppression hypothesis has never been tested in young female primates or humans, agricultural studies have provided evidence suggesting the contrary. Among gilts (i.e., female pigs), management stressors (i.e., truck transport, relocation to new pens) combined with exposure to boars generally resulted in earlier pubertal development, whereas gilts raised in total confinement experienced delayed pubertal development (Thompson & Savage, 1978). While controlled evidence of humans does not exist, median ages at menarche before, during, and after World War II suggest a pattern of delayed pubertal maturation during the war across Japan, the Soviet Union, and several European countries. However, several confounding factors, such as food rationing, increased physical activity and prevalence of disease, cloud interpretations of this data (see Ellis, 2004 for review).
Paternal investment theory. Paternal investment theory posits that the father’s role in the family during the child’s early life, as well as the mother’s sexual behaviour and attitudes towards men, bias the development of an individual toward early, rather than later, pubertal development (Ellis & Garber, 2000; Ellis et al., 1999; 2003). Paternal investment is described as having uniquely regulatory effects on a daughter’s development such that inconsistency and harshness in the father-daughter relationship skews reproductive development towards a strategy that assumes paternal investment in offspring will be limited, and long-term pair-bonds will be short-term and unstable.

Among the primates, humans are the only species in which males exhibit caregiving behaviours towards offspring. This suggests that paternal investment is a fairly recent behavioural adaptation (Ellis, 2004). Maternal parental care is the ubiquitous foundation of caring and rearing offspring across societies, whereas male parental care is far more variable. Thus, paternal investment strategies that supported the development of a viable offspring would have been favoured by natural selection. However, the degree to which any strategy is fitness-enhancing is relative to the environment, meaning that a variety of caregiving strategies may have been selected for (Geary, 2000). Furthermore, natural selection would have likely favoured female psychological mechanisms that predicted the degree to which potential male mates would invest in their families. Thus, it would logically follow that a sensitive-period during early development would evolve to assess and encode information about the availability and quality of potential paternal care and lay the groundwork for future reproductive strategy development (Ellis, 2004). Additionally, if paternal investment is a facultative adaptation (i.e., an adaptation that is expressed under certain proximal conditions) that enhances reproductive success, it
should similarly signal to daughters that the current social milieu favours a reproductive strategy where paternal investment is unreliable. Hence, girls in these conditions would be expected to maximize their reproductive potential by accelerating pubertal development and sexual debut, and seeking out short-term pair-bonds with which to have an increased number of offspring with (Ellis & Garber, 2000; Ellis et al., 1999; 2003).

This theorizing has been supported by a number of empirical studies. It has been cross-culturally validated by Barber (2001) who found that young women who were reared without a father present of varying cultural backgrounds were more likely to become pregnant during adolescence and become single parents. Jones and colleagues (1972) found that girls who experienced father-absence before the age of 5 were three-times more likely to experience menarche before the age of 12 than girls who were raised in biologically intact households. Ellis and colleagues (1999) found that girls raised without a father were more than twice as likely to have completed pubertal development before grade seven (12-13 years old). Likewise, Quinlan (2003) observed the likelihood of early menarche doubling among girls raised in father-absent homes (as compared to girls in father-present homes). Similarly, Moffitt and colleagues (1992) found that girls who experienced father absence before age 11 were twice as likely to experience menarche before age 12. Romans (2003) and colleagues were able to replicate these results about a decade later.

The quality of the mother-father relationship may also be a salient indicator that paternal investment is unstable or unlikely. Indeed, Ellis and Garber (2000) found that early pubertal development in girls was more likely when they were exposed to a stressful relationship between their mother and father. However, Quinlan (2003) was
unable to replicate these results. Several mammalian animal models suggest that the introduction of an unrelated male may trigger accelerated pubertal development in prepubertal females. For example, captive female baboons who were exposed to three genetically-unrelated and unfamiliar males experienced menarche 30% earlier than average captive baboons (Colmenares & Gomendio, 1988). There is reasonable evidence to suggest a similar effect in human girls. Mekos, Hetherington and Clingempeel (1992) examined the difference in menarcheal timing between girls, aged 9-13, in male-absent families and in stepfather-present families using longitudinal analysis. Pubertal development was assessed twice, and was based on measures of breast development, menarcheal status and the presence of body hair. After controlling for pubertal development at Time 1, results indicated that stepfather-presence, but not male-absence, appeared to accelerate pubertal development, suggesting that the introduction of an unrelated man into the family increased speed of maturation.

**Child development theory.** The primary supposition of child development theory is that pubertal timing acts as a mechanism to extend childhood in an enriched environment, and shorten childhood under conditions of adversity (Ellis, 2004). The premise of child development theory converges with both psychosocial acceleration theory and paternal investment theory in terms of agreement that childhood experiences impact pubertal timing, and that pubertal timing influences the onset of dating and sexual behaviour. Child development theory diverges in terms of the conceptualization of how pubertal timing is related to variability in mating and parenting strategies (Ellis, 2004). Of particular interest in child development theory is the transition from a pre-reproductive stage to a reproductive stage – that is, the period in which resource allocation shifts from
prioritizing somatic functioning to reproductive effort. In this sense, variability in
pubertal timing is an adaptation that calibrates the length of the pre-reproductive period to
coordinate with the quality of a given child’s social environment.

There is a large body of evidence that suggests that the human life history
includes a lengthy period from infancy to adolescence because it allows for increased
brain development and learning potential, as well as more time to learn important
physical, cognitive, behavioural and social skills (e.g., Bjorklund & Pellegrini, 2002;
Bogin, 1999; Geary, 2002; Kaplan, Hill, Lancaster & Hurtado, 2000). By delaying
puberty to develop in this manner, there is a necessary trade-off of valuable reproductive
opportunity. Child development theory extends from life history theory to describe the
trade-offs between delaying maturation, which increases the likelihood of mortality
before reproducing, and accelerating maturation, which decreases the amount of time
spent developing (as described above).

Across all prominent theories of early pubertal development (i.e., psychosocial
acceleration, energetics theory, stress-suppression, paternal investment) is the agreement
that earlier pubertal development predicts earlier dating and sexual behaviour among
girls. However, Ellis (2004) maintains that despite this well-established link, there is only
limited evidence to suggest that earlier pubertal development is associated with
unrestricted sociosexuality, poor-quality pair-bonding, a greater number of sexual
partners and low parental investment due to the cross-sectional and/or retrospective
nature of most of the data collected on this issue. Thus, child development theory exists
as a “revision” in so far as it attempts to address three “anomalies” of these prominent
earlier theories: (1) long-term inference, (2) shared-environment issues and (3) the lack of
relationships between early pubertal development and several dimensions of mating (Ellis, 2004).

First, the main argument against long-term inference is that it does not make adaptive sense for childhood experience to solely calibrate adult reproductive behaviour due to almost certain variability in environmental conditions over time (Rowe, 2000). Child development theory does not require long-term inference in this regard. Rather, the theory posits that the female child adjusts the timing of her pubertal development based on the existing quality of parental investment and other familial resources (Ellis, 2004). Second, despite significant efforts from researchers to assert the effects of shared environments on the timing of pubertal development (e.g., Ellis, 2004; Ellis & Essex, 2007), a great deal of skepticism remains surrounding the veracity of shared environmental effects in light of behaviour genetic research (Ellis, 2004). However, if the evidence for shared environment effects is indeed weak, this does not infringe on the validity of child development theory as the theory only posits that children are calibrating their developmental timing based on micro-level qualities of their parents’ reproductive strategies, rather than macro-level qualities of their broader social environments (Ellis, 2004). Last, the empirical evidence to support the notion that early pubertal timing feeds forward to predict qualitative dimensions of reproductive strategy, such as intimacy in pair-bonding and quality of later parental care, is yet to exist in any conclusive capacity. While future research in this area may negate the propositions of both psychosocial acceleration theory and paternal investment theory, it will not disrupt child development theory (Ellis, 2004).

Why girls (and not boys)?
My study focuses on pubertal development in girls for three primary reasons: First, the examination of pubertal development from a life history perspective highlights the trade-offs organisms often make between allocating resources towards growth or reproduction. This trade-off may be most salient for girls due to the heavy reproductive and somatic investment of carrying, delivering and breastfeeding offspring (Ellis, 2004). Second, due to the easily remembered and distinct nature of menarche, it is a valid and easily accessed self-report measure. Despite the potential for first ejaculation to be an equivalent measure among boys, most of the extant literature is focused on female pubertal development. This serves a practical purpose for the course of this study. Last, there are notable potential negative psychosocial and cultural consequences of early pubertal development for girls. Blumstein Posner (2006) has suggested that early pubertal development “must be understood within the framework of societal beliefs, fears and expectations about adolescent sexuality”. Indeed, girls who develop womanly bodies ahead of their peers are prone to higher rates of body-dissatisfaction due to feelings of alienation from one’s body (e.g., Williams & Currie, 2000). Furthermore, pubertal development in girls is associated with self-consciousness, negative body image and higher rates of depressive symptoms (Summers-Effler, 2004; Brooks-Gunn, 1988; Alsaker, 1992). As such, it would appear that pubertal development may increase the risk of experiencing negative psychosocial outcomes in girls.

**Personality**

Life history strategy theory predicts that suites of co-adapted traits evolved via natural selection. Several theorists have suggested that there are a multitude of sexual, reproductive, parental and social behaviours that contribute to a latent factor – the “K-
factor” (e.g., Figueredo, Vásquez, Brumbach & Schneider, 2007; Gladden, Figueredo & Jacobs, 2007; Dunkel & Decker, 2010). Specifically, personality traits have been a prime candidate for observing patterns of “behavioural syndromes” that may be akin to, or indicative of, life history strategy. A $K$-selected life history strategy should be associated with long-term planning (i.e., less future discounting; Wilson & Daly, 1997). Because pay-offs from social cooperative relationships are likely to be delayed over multiple years, a $K$-selected life history strategy might be expected to be associated with personality traits that emphasize being social, altruistic and adherence to social norms (Rushton, 1985). Such individuals would thus be expected to seek out and form stable, long-term pair bonds, and invest more in functions related to somatic growth and maintenance (Manson, 2016). Conversely, an $r$-selected life history strategy could be associated with more future discounting, and would thus emphasize short-term gains, such as short-term mating, and be coupled with personality traits associated with an antagonistic social orientation and less investment in somatic functioning (Wilson & Daly, 1997; Rushton, 1985). Figueredo and colleagues (2005) found that among university students, the $K$-factor accounted for 92% of the variance on items related to salient life outcomes, such as attachment to one’s father, investment from one’s father, adult romantic attachment style, mating effort, Machiavellianism, and risk-taking. This work was later replicated in a sample of northern Mexican adults (Tal et al., 2006).

Researchers using the Five Factor Model (FFM; Costa & McCrae, 1992) have suggested that a $K$-selected life history strategy should be associated with higher Conscientiousness, Extraversion, Agreeableness and Openness, and lower Neuroticism (i.e., higher Emotional Stability) (e.g., Figueredo, Vásques, Brumbach & Schneider,
2007). The current study examined personality variation using the HEXACO Model of Personality (Ashton & Lee, 2007). The biggest difference between the Big Five Model and the HEXACO model is the addition of a sixth factor – Honesty-Humility – which captures an organism’s propensity towards altruism or antagonism. Furthermore, the HEXACO has explicit evolutionary underpinnings that make it the ideal choice for examining the relationship between personality and dating and sexuality in girls through a life history perspective. The traits in the HEXACO model can be interpreted as being related to one of two adaptive functions: (1) Endeavour-related functions or (2) Relationship and social activity-related functions (Ashton & Lee, 2007). Extraversion, Conscientiousness and Openness describe one’s propensity to engage in, and allocate time and effort towards, social activities, task-related activities and idea-related activities respectively (Ashton & Lee, 2007). Honesty-Humility and Agreeableness are thought to be indices of an individual’s orientation towards reciprocal altruism. Whereas Honesty-Humility is a marker of an individual’s willingness to exploit others (or avoid exploiting others) for personal gain, Agreeableness measures an individual’s willingness to forgive or be exploited by others (Ashton & Lee, 2007). The double dissociation between Honesty-Humility and Agreeableness has been empirically validated using economic-game paradigms that assess propensities towards fairness versus forgiveness (Hilbig, Zettler, Leist & Heydasch, 2013). Emotionality is hypothesized to be uniquely related to an individual’s orientation towards kin altruism (Ashton & Lee, 2007; Ashton et al., 2014). At the facet level of Emotionality, Sentimentality and Dependence tap into an individual’s capacity for empathetic concern and attachment, whereas Fear and Anxiety
tap into risk-aversion, which is related to the ability to provide continued parental
investment (Ashton et al., 2014).

Manson (2016) found that individuals who pursued a $K$-selected life history
strategy tended to be higher in the HEXACO traits Extraversion, Agreeableness and
Conscientiousness. There was also some evidence that suggested that those pursuing a $K$-
selected life history strategy were higher in Honesty-Humility than those pursuing an $r$-
selected life history strategy (Manson, 2016). Contrary to life history strategy research
using the FFM, there was no evidence to suggest that life history strategy was related to
Emotionality or Openness. Likewise, Book, Visser and Volk (2014) linked $r$-selected life
history strategies with the higher levels of the traits which make up the Dark Triad (i.e.,
Machiavellianism, Narcissism and Psychopathy). Furthermore, later analyses published
by Hodson and colleagues (2017) demonstrated “near-complete overlap” (i.e., 95%) of
the Dark Triad with the HEXACO trait Honesty-Humility, thus suggesting that these two
measures are indistinct. Higher levels of such traits (i.e., Honesty-Humility, the Dark
Triad) increase the propensity for an individual to behave in a manipulative or an
exploitative way for short-term personal gain (Book et al., 2014).

The evidence linking attachment to personality traits is mixed. Shaver and
Brennan (1992) found evidence using the FFM that suggested that those who were
securely attached were lower in Neuroticism (i.e., high in Emotional Stability), higher in
Agreeableness and higher in Extraversion. However, further post-hoc analyses revealed
that at the facet-level, the difference in Extraversion between securely attached
individuals and insecurely attached individuals was driven solely by differences in
Gregariousness. Furthermore, no significant differences in Conscientiousness and
Openness to Experience between securely and insecurely attached individual were found at the trait-level. However, further analyses revealed that insecurely attached individuals were significantly higher on the Impulsivity facet of the Conscientiousness trait than securely attached individuals.

Nofle and Shaver (2006) reviewed several studies that examined attachment style and personality using the FFM and Ainsworth’s (1979) attachment classifications. Their results suggested an overall pattern of securely attached individuals being higher in Conscientiousness, Agreeableness and Extraversion, and lower in Neuroticism. Anxiously-attached individuals were typically higher in Neuroticism and lower in Extraversion. There was contention with regard to results that suggested anxiously-attached individuals were lower in Agreeableness and Conscientiousness. Lastly, those with avoidant-attachment were also higher in Neuroticism and lower in Extraversion, but the overall results more clearly suggested that they were also lower in Agreeableness. Follow-up hierarchical regression analyses suggested that anxious attachment was strongly associated with Neuroticism, followed by Conscientiousness to a more moderate extent. Avoidant attachment was strongly associated with Agreeableness, followed by Extraversion and Conscientiousness to a more moderate extent.

Multiple personality constructs have been used to predict outcomes related to dating, relationships and sexual behaviour. Uysal’s (2016) dissertation presented evidence that suggested that Machiavellianism (part of the Dark Triad) was related to both anxious attachment and relationship dissatisfaction. Similarly, Jonason, Hatfield and Boler (2014) found that lower levels of the HEXACO trait Honesty-Humility was associated with having many casual sex relationships, whereas higher Conscientiousness
was associated with involvement in serious romantic relationships, and higher Extraversion was associated with the propensity to be in romantic or sexual relationships in general. Provenzano and colleagues (2018) conducted path analyses that suggested that Honesty-Humility was related to have more sexual partners through bullying behaviour among older and younger adolescents. Orme (2017) hypothesized that individuals who are higher in humility (i.e., individuals who would score highly on the Honesty-Humility facet) are more likely to have stability in their relationships due to an increased ability to respond to threat appropriately, and a focus on the well-being of others. However, this conceptualization of humility may be more in-line with the HEXACO trait Emotionality (as opposed to the HEXACO conceptualization of Honesty-Humility), due to its association with kin altruism and empathy (Ashton et al., 2014).

The Current Study

The proposed research questions are: Are early life experiences that are indicative of parental investment (as measured by attachment and life history strategy) related to dating and sexuality in girls? Do personality and pubertal development represent potential mechanisms that link early experiences of parental investment to dating and sexuality?

Life history strategy and attachment style may both be indicative of the degree to which an organism expects parental investment. I hypothesize that $K$-selected life history strategies and more secure attachment will be associated with less pubertal development (both biologically- and psychosocially-oriented) and higher levels of Honesty-Humility and Conscientiousness. All of these will translate into more selective and restricted dating and sexual activity. Likewise, I hypothesize that $r$-selected life history strategies and insecure anxious and avoidant attachment styles will be associated with more advanced
pubertal development, lower levels of Honesty-Humility and Conscientiousness, and less selective and restricted dating activity (See Figure 1).

Insecure attachment is hypothesized to be a cue to a developing organism that they should pursue a quantity-oriented reproductive strategy, akin to an $r$-selected life history strategy (Belsky, Steinberg & Draper, 1991; Chisholm, 1993). Furthermore, insecure attachment styles are characterized by a mistrustful worldview and an exploitative orientation towards others. This orientation may best be reflected by Honesty-Humility, as it is an index of one’s willingness to exploit other people for personal gain. Additionally, earlier pubertal development is part of an $r$-selected life history strategy (Chisholm, 1993). $r$-selected history strategies have been associated with lower levels of Honesty-Humility (Manson, 2016) and higher levels of Dark Triad traits (Book, Visser & Volk, 2014). It should be noted that the current study did not aim to implicate pubertal development, or the sexual activity that often follows, as antagonistic or antisocial behaviours per se. Rather, low levels of Honesty-Humility in this case may be best conceptualized as part of an adaptive strategy that maximizes reproductive success under precarious conditions.
Figure 1. Conceptual model in which the relationship between dimensions of early experience of parental investment uncertainty and dating and sexuality is mediated by pubertal development and personality.
Methodology

Participants

Participants for the current study were 202 adolescent girls between the ages of 12-18 who were recruited from various sports teams, youth groups and extracurricular organizations across southern Ontario. The majority of the participants reported being middle-class (70.3%) and Caucasian (63.1%). 26 cases that were outliers were not included in the sample.

Procedure

Data for the current study was collected as part of the Brock Adolescent Development study. Adult group leaders of sports teams, youth groups and extracurricular clubs from southern Ontario were contacted about adolescent members of their organization participating in the data collection prior to its commencement. Written permission to attend a group meeting was obtained from group leaders. Adolescents who were interested in participating were given a package to bring home that included a consent form and an assent form. Approximately a week later, research assistants would return to the team or club meeting and collect consent and assent forms. Upon completion of the assent and/or consent forms, participants were given an ID number and the link to an online survey. Participants were compensated with $20 for their time.

Measures

Demographics

Participants were asked to provide demographic information about their sex, their ethnicity, their family’s structure and their socio-economic status.

Life History Strategy
Life history strategy theory was assessed using the Mini-K Short Form of the Arizona Life History Battery (ALHB) (Figueroedo et al., 2014). The Mini-K is a 14-item self-report measure that evaluates several domains related to life history strategy, including personality (does not include Honesty-Humility), social strategies, emotional intelligence, romantic partner history, emotional intelligence and cognitive functioning. Items are rated on a 7-point scale (-3 = disagree strongly; +3 = agree strongly). A sample item reads: I can often tell how things will turn out. Higher scores on the Mini-K indicate a slower life history strategy, while lower scores on the Mini-K indicate faster life history strategies. See Table 1 all reliability coefficients.

**Pubertal Development**

Pubertal development was assessed using self-report items from the Pubertal Development Scale (Earls, Brooks-Gunn, Vicary & Brumbaugh, 2011) – three items will be used to assess biologically-oriented pubertal development, and one item will be used to assess psychosocially-oriented pubertal development. The Pubertal Development Scale asks questions about the physical changes happening to the adolescent’s body. Each question has a different structure of responses that is appropriate for that specific item.

**Biologically-oriented pubertal development.** A single variable of biologically-oriented pubertal development was created using an aggregation technique proposed by Moran and colleagues (2007). Three indicators of pubertal development in girls were used to create a composite proportion score variable of pubertal development: menarcheal status, breast budding and body hair growth. Menarcheal status was a single self-report item in which participants reported whether they had, or had not, experienced menarche (i.e., first menstruation). Breast budding was a single self-report item in which
participants reported their breast development on a scale ranging from 1 (Not much) to 4 (Breast growth is complete). Body hair growth was a single self-report item in which participants reported the extent to which their body hair had developed on a scale ranging from 1 (Has not yet started growing) to 4 ([Body hair growth] seems complete). These items were chosen because they represent three biological and objective measures of pubertal development. Proportion scores are created by dividing each score by the highest possible score on the variable. This technique was useful as dichotomous and continuous variables can be expressed as value between 0 and 1. Proportion scores for each variable were aggregated together to create a composite pubertal development score. See Table 1 for reliability co-efficient.

**Psychosocially-oriented pubertal development.** Psychosocially-oriented pubertal development was a single self-report item that asked participants to assess whether they perceived their pubertal development to be earlier or later than most other girls, on a scale of 1 (Much earlier) to 5 (Much later).

**Attachment**

Global anxious and avoidant attachment was assessed using the Relationship Structures (ECR-RS) Questionnaire (Fraley, Heffernan, Vicary & Brumbaugh, 2011). The ECR-RS assesses the way important persons are mentally represented by an individual on a 7-point scale (1 = strongly disagree, 7 = strongly agree). Global measures are created by averaging scores across four domains. The global avoidant attachment score is created using the mean of mother-related (or mother-like) attachment avoidance, father-related (or father-like) attachment avoidance, friend-related attachment avoidance and partner-related attachment avoidance. A sample item reads: “It helps to turn to this
person in times of need”. Similarly, the global anxious attachment score is created using a mean of mother-related (or mother-like) attachment anxiety, father-related (or father-like) attachment anxiety, friend-related attachment anxiety and partner-related attachment anxiety. A sample item reads: “I often worry that this person doesn’t really care for me”.

**Personality**

Personality was assessed using the 60-item self-report HEXACO Personality Inventory-Revised (HEXACO-PRI; Lee & Ashton, 2004) that is rated on a 5-point scale (1=strongly disagree, 5=strongly agree). The HEXACO assesses personality across six factors: Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to Experience. Higher scores indicate higher levels of the factor.

**Dating and Sexuality**

A measure of dating and sexuality was created by using three indicators of dating and sexual behaviour to create a composite proportion score variable of dating and sexual behaviour: dating activity, number of partners, and interest in dating. Dating activity was a single self-report item in which participants reported how often they go on dates with a girl or boy, just the two of them, on a scale ranging from 1 (Never) to 5 (Very Often). Number of partners was a single self-report item in which participants reported how different partners they have had a consensual sexual experience with. The range was 0 to 6. Interest in dating was a single self-report item in which participants reported their interesting in dating at the time of data collection, on a scale ranging from 1 (Not at all interested) and 5 (Very interested). Scales were coded such that higher scores represented less restricted dating and sexuality.
Table 1. Reliability coefficients

<table>
<thead>
<tr>
<th>Scale</th>
<th>Measured Variable</th>
<th>Number of Items</th>
<th>α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini-K (Fiquerodo et al., 2014)</td>
<td>Life History Strategy</td>
<td>14</td>
<td>.81</td>
</tr>
<tr>
<td>ECR-RS (Fraley et al., 2011)</td>
<td>Avoidant Attachment</td>
<td>24</td>
<td>.92</td>
</tr>
<tr>
<td></td>
<td>Anxious Attachment</td>
<td>12</td>
<td>.88</td>
</tr>
<tr>
<td>Pubertal Development Scale (adapted from Earls et al., 1997-2000)</td>
<td>Biologically-oriented pubertal development</td>
<td>3</td>
<td>.63</td>
</tr>
<tr>
<td>HEXACO (Ashton &amp; Lee, 2007)</td>
<td>Honesty-Humility</td>
<td>10</td>
<td>.70</td>
</tr>
<tr>
<td></td>
<td>Conscientiousness</td>
<td>10</td>
<td>.75</td>
</tr>
<tr>
<td>Dating and Sex Questionnaire</td>
<td>Dating and Sexuality</td>
<td>3</td>
<td>.59</td>
</tr>
</tbody>
</table>

*Note.* Scale items are self-report.

Statistical Analysis

Path analysis was conducted using MPlus version 8.3 software (Muthén & Muthén, 2007-2018). The analysis was conducted in two phases. The first phase tested direct pathways from the exogenous variables (i.e., age, life history strategy, anxious attachment and avoidant attachment) to the outcome of interest (i.e., dating and sexuality). The second phase used path analysis to test the hypothesized model in which pubertal development (i.e., biologically-oriented and psychosocially-oriented pubertal development) and personality (i.e., Honesty-Humility and Conscientiousness) mediate the association between life history strategy and dating activity, and attachment (i.e., anxious attachment and avoidant attachment) and dating activity.
Age was entered as a covariate because it is likely to impact both the extent of pubertal development and the extent to which an adolescent is engaging in dating activity and is expected to account for a significant amount of variance.

Empirical tests of skewness and kurtosis indicated that all variables were within the acceptable parameters of skewness and kurtosis (e.g., +/- 2; Field, 2013). However, visual examination of histograms suggested potential issues regarding skewness for the measures of avoidant attachment (see Figure 5, Appendix B), anxious attachment (see Figure 6, Appendix B), biologically-oriented pubertal development (see Figure 7, Appendix B) and dating and sexuality (see Figure 14, Appendix B). As such, direct effects were estimated using Maximum Likelihood Robust (MLR) to correct for the skewed distribution of some of the variables. Maximum Likelihood (ML) estimation with bootstrapped confidence intervals using 10,000 samples (95% bias corrected) was used to test for indirect effects.

Results

Data Screening

Univariate tests of normality, linearity, and independence were conducted. Multivariate tests of normality were conducted. Standardized scores were created for each variable. Cases with scores that were outside +/- 3 standard deviations away from the mean were considered outliers. Outliers were removed from the data and were not used in the analyses (see Tables 1 and 2). The results of the tests of assumptions are presented in Appendix A and Appendix B. After the removal of 26 outliers, the final sample included 202.

Descriptive Statistics and Bivariate Correlations
Means, standard deviations and bivariate correlations are presented in Table 2.
Table 2.

Descriptive Statistics and Bivariate Correlations Among the Variables of Interest

<table>
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<tbody>
<tr>
<td>1. Age</td>
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<td>2. Life History</td>
<td>-.08</td>
<td>-</td>
<td></td>
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<td>3. Avoidant</td>
<td>.02</td>
<td>-.40***</td>
<td>-</td>
<td></td>
<td></td>
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<tr>
<td>4. Anxious</td>
<td>.20**</td>
<td>-.33***</td>
<td>.65***</td>
<td>-</td>
<td></td>
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<td>5. BPD</td>
<td>.51***</td>
<td>-.07</td>
<td>-.01</td>
<td>.07</td>
<td>-</td>
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<tr>
<td>6. PSPD</td>
<td>-.13†</td>
<td>.30**</td>
<td>-.12</td>
<td>-.24**</td>
<td>-.30***</td>
<td>-</td>
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<tr>
<td>7. HH</td>
<td>-.18**</td>
<td>.24***</td>
<td>-.25**</td>
<td>-.31***</td>
<td>-.14*</td>
<td>.16*</td>
<td>-</td>
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<tr>
<td>8. C</td>
<td>-.10</td>
<td>.30***</td>
<td>-.21**</td>
<td>-.15*</td>
<td>-.16*</td>
<td>.16*</td>
<td>.37***</td>
<td>-</td>
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<tr>
<td>9. D/S</td>
<td>.40***</td>
<td>.035</td>
<td>.14†</td>
<td>.18*</td>
<td>.18**</td>
<td>-.12†</td>
<td>-.19**</td>
<td>-.09</td>
<td>-</td>
</tr>
</tbody>
</table>

Mean 14.57 1.14 2.30 1.86 .79 3.02 3.49 3.63 .35
SD 1.50 .79 .94 .96 .79 .87 .56 .55 .20

Notes. Life History = Life History Strategy; Avoidant = Attachment Avoidance; Anxious = Attachment Anxiety; BPD = Biologically-Oriented Pubertal Development; PSPD = Psychosocially-Oriented Pubertal Development; HH = Honesty-Humility; C = Conscientiousness; D/S = Dating and Sexuality; SD = Standard Deviation. †p<.10, *p<.05, **p<.01, ***p<.001.
**Direct Path Model**

A direct effects model was first tested in which dating and sexuality was regressed on age, life history strategy, anxious attachment, and avoidant attachment. Results suggested a significant direct pathway from life history strategy to dating and sexuality, and a significant direct pathway from age to dating and sexuality (See Figure 2). No other significant direct pathways were observed (See Table 3).

Table 3.

*Direct effects of proposed path model*

<table>
<thead>
<tr>
<th>Outcomes and Predictors</th>
<th>β</th>
<th>B</th>
<th>SE</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dating and Sexuality on</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life History Strategy</td>
<td>.251***</td>
<td>.017</td>
<td>3.289</td>
<td>[.104, .397]</td>
</tr>
<tr>
<td>Attachment Anxiety</td>
<td>.090</td>
<td>.017</td>
<td>.931</td>
<td>[-.100, .279]</td>
</tr>
<tr>
<td>Attachment Avoidance</td>
<td>.162</td>
<td>.017</td>
<td>1.707</td>
<td>[-.020, .344]</td>
</tr>
<tr>
<td>Age</td>
<td>.409***</td>
<td>.008</td>
<td>5.421</td>
<td>[.272, .547]</td>
</tr>
</tbody>
</table>

*Notes.* B and SE (standard error) are unstandardized parameter estimates. 95% CI (confidence interval) are standardized estimates. Non-indented variables are outcome variables. Indented variables are predictor variables. ***$p<.001$.**
Figure 2. Significant pathways of direct model. Dashed lines indicated tested paths that were not statistically significant. “d” is used to denote disturbances.
Direct Path Model Without Age

A direct effects model was first tested in which dating and sexuality was regressed on life history strategy, anxious attachment, and avoidant attachment.

Results suggested a significant direct pathway from life history strategy to dating and sexuality, such that more K-selected (i.e. slower) were associated with less restrictive dating and sexuality. There was also a significant direct path from anxious attachment to dating and sexuality, such that more attachment anxiety was associated with less restricted dating and sexuality (See Figure 3). No other significant direct effects were observed (See Table 4).

Table 4.

Direct effects of proposed path model without age as a covariate

<table>
<thead>
<tr>
<th>Outcomes and Predictors</th>
<th>β</th>
<th>B</th>
<th>SE</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dating and Sexuality on</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life History Strategy</td>
<td>.220**</td>
<td>.018</td>
<td>2.694</td>
<td>[.063, .377]</td>
</tr>
<tr>
<td>Attachment Anxiety</td>
<td>.212*</td>
<td>.016</td>
<td>2.251</td>
<td>[.026, .397]</td>
</tr>
<tr>
<td>Attachment Avoidance</td>
<td>.088</td>
<td>.017</td>
<td>.902</td>
<td>[-.101, .276]</td>
</tr>
</tbody>
</table>

Notes. B and SE (standard error) are unstandardized parameter estimates. 95% CI (confidence interval) are standardized estimates. Non-indent variables are outcome variables. Indented variables are predictor variables. *p<.05, **p<.01.
Figure 3. Significant direct pathways of model without covariate. Dashed lines indicate tested paths that were not statistically significant. “d” is used to denote disturbances.
**Hypothesized Model**

The hypothesized model was then tested in which dating/sexuality was regressed on pubertal development, Honesty-Humility, Conscientiousness, life history strategy, avoidant attachment, anxious attachment and age. Further, pubertal development, Honest-Humility, and Conscientiousness were regressed on life history strategy, avoidant attachment, anxious attachment and age. There was a significant relationship between life history strategy and Honesty-Humility, such that slower (i.e., $K$-selected) life history strategies were associated with that higher levels of Honesty-Humility. Life history strategy was associated with dating and sexuality. However, the direction of the association was unexpected, such that slower (i.e., more $K$-selected) strategies were related to less restricted dating and sexuality.

As hypothesized, Honesty-Humility was associated with dating and sexuality, such that lower levels of Honesty-Humility were associated with less restricted and selective dating and sexuality. There was a significant relationship between life history strategy and Conscientiousness, such that slower (i.e., $K$-selected) life history strategies were associated with higher levels of Conscientiousness.

Last, there was a significant indirect pathway from life history strategy to dating and sexuality through Honesty-Humility [95% CI -.101, -.002]. Results are reported in Table 5, and significant pathways are illustrated in Figure 4.
Table 5.

Path Coefficients for Model

<table>
<thead>
<tr>
<th>Outcomes and Predictors</th>
<th>β</th>
<th>B</th>
<th>SE</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dating and Sexuality on</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life History Strategy</td>
<td>.324***</td>
<td>.016</td>
<td>4.477</td>
<td>[.186, .462]</td>
</tr>
<tr>
<td>Attachment Anxiety</td>
<td>.030†</td>
<td>.016</td>
<td>.325</td>
<td>[-.150, .210]</td>
</tr>
<tr>
<td>Attachment Avoidance</td>
<td>.156</td>
<td>.015</td>
<td>1.869</td>
<td>[-.004, .317]</td>
</tr>
<tr>
<td>Bio Pubertal Development</td>
<td>-.029</td>
<td>.061</td>
<td>-.377</td>
<td>[-.179, .121]</td>
</tr>
<tr>
<td>P/S Pubertal Development</td>
<td>-.095</td>
<td>.012</td>
<td>-1.486</td>
<td>[-.22, .030]</td>
</tr>
<tr>
<td>Honesty-Humility</td>
<td>-.265***</td>
<td>.019</td>
<td>-4.155</td>
<td>[-.389, -.141]</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>-.040</td>
<td>.018</td>
<td>-.0711</td>
<td>[-.150, .070]</td>
</tr>
<tr>
<td>Age</td>
<td>.383***</td>
<td>.009</td>
<td>4.919</td>
<td>[.263, .530]</td>
</tr>
</tbody>
</table>

| **Bio Pubertal Development on**          |       |      |     |                |
| Life History Strategy                    | -.038  | .019 | -.563 | [-.171, .094]  |
| Attachment Avoidance                     | -.072  | .023 | -.695 | [-.273, .128]  |
| Attachment Anxiety                       | .023   | .019 | .253  | [.154, .199]   |
| Age                                      | .478***| .009 | 7.586 | [.376, .581]   |

| **P/S Pubertal Development on**          |       |      |     |                |
| Life History Strategy                    | .137†  | .093 | 1.690 | [-.022, .297]  |
| Attachment Avoidance                     | .081   | .086 | .878  | [-.100, .262]  |
| Attachment Anxiety                       | -.168† | .090 | -1.658 | [-.364, .029]  |
| Age                                      | -.116  | .046 | -1.434 | [.274, .042]   |

| **Honesty Humility on**                  |       |      |     |                |
| Life History Strategy                    | .193*  | .054 | 3.039 | [.017, .369]   |
| Attachment Avoidance                     | -.035  | .052 | 1.679 | [-.246, .176]  |
| Attachment Anxiety                       | -.190† | .056 | 1.055 | [-.403, .023]  |
| Age                                      | -.097  | .024 | .655  | [-.241, .048]  |

| **Conscientiousness on**                 |       |      |     |                |
| Life History Strategy                    | .244***| .054 | 3.039 | [.089, .399]   |
| Attachment Avoidance                     | -.159† | .052 | 1.679 | [-.345, .027]  |
| Attachment Anxiety                       | .133   | .056 | 1.055 | [-.098, .325]  |
| Notes. Bio Pubertal Development = Biologically-Oriented Pubertal Development; P/S = Psychosocially-Oriented Pubertal Development; B and SE (standard error) are unstandardized parameter estimates. 95% CI (confidence interval) are standardized estimates. Non-indented variables are outcome variables. Indented variables are predictor variables. †p<.10, *p<.05, **p<.01, ***p<.001. |
Figure 4. Significant pathways.

Note. All paths, disturbances, errors and covariances were tested in the model. However, only significant direct paths are indicated in diagram for ease of presentation. Indirect pathway is indicated with a bolded line. Disturbances are noted with a “d”.
Hypothesized Model Without Age as a Covariate

The hypothesized model was then tested without including age as a covariate. When age was not accounted for in the model, the results differed significantly in multiple ways. First, the relationship between attachment anxiety and psychosocially-oriented pubertal development was statistically significant, such that perceiving one’s development as earlier than one’s peers was associated with more attachment insecurity. Third, the relationship between attachment anxiety and Honesty-Humility was statistically significant, such that lower levels of Honesty-Humility were associated with higher levels of attachment insecurity. Last, the relationship between biologically-oriented pubertal development and dating and sexual history was statistically significant, such that less restricted dating and sexuality was positively associated with pubertal development. Results are reported in Table 4, and significant pathways are illustrated in Figure 5.
### Table 4.

*Results of hypothesized model without age as a covariate*

<table>
<thead>
<tr>
<th>Outcomes and Predictors</th>
<th>β</th>
<th>B</th>
<th>SE</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dating and Sexuality on Life History Strategy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life History Strategy</td>
<td>.309***</td>
<td>.016</td>
<td>4.108</td>
<td>[.166, .452]</td>
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<tr>
<td>Attachment Anxiety</td>
<td>.107</td>
<td>.016</td>
<td>1.149</td>
<td>[-.076, .291]</td>
</tr>
<tr>
<td>Attachment Avoidance</td>
<td>.106</td>
<td>.016</td>
<td>1.211</td>
<td>[-.064, .277]</td>
</tr>
<tr>
<td>Bio Pubertal Development</td>
<td>.160*</td>
<td>.062</td>
<td>2.077</td>
<td>[.010, .311]</td>
</tr>
<tr>
<td>P/S Pubertal Development</td>
<td>-.092</td>
<td>.014</td>
<td>-1.286</td>
<td>[-.231, .047]</td>
</tr>
<tr>
<td>Honesty-Humility</td>
<td>-.286***</td>
<td>.021</td>
<td>-3.980</td>
<td>[-.426, -.145]</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>-.038</td>
<td>.020</td>
<td>-.0630</td>
<td>[-.157, .081]</td>
</tr>
<tr>
<td><strong>Bio Pubertal Development on Life History Strategy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life History Strategy</td>
<td>-.075</td>
<td>.022</td>
<td>-.953</td>
<td>[-.228, .077]</td>
</tr>
<tr>
<td>Attachment Avoidance</td>
<td>-.164</td>
<td>.026</td>
<td>-1.373</td>
<td>[-.388, .061]</td>
</tr>
<tr>
<td>Attachment Anxiety</td>
<td>.166</td>
<td>.022</td>
<td>1.627</td>
<td>[-.034, .365]</td>
</tr>
<tr>
<td><strong>P/S Pubertal Development on Life History Strategy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life History Strategy</td>
<td>.146†</td>
<td>.094</td>
<td>1.792</td>
<td>[-.014, .307]</td>
</tr>
<tr>
<td>Attachment Avoidance</td>
<td>.103</td>
<td>.083</td>
<td>1.158</td>
<td>[-.072, .278]</td>
</tr>
<tr>
<td>Attachment Anxiety</td>
<td>-.202*</td>
<td>.085</td>
<td>-2.127</td>
<td>[-.387, -.018]</td>
</tr>
<tr>
<td><strong>Honesty Humility on Life History Strategy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life History Strategy</td>
<td>.201*</td>
<td>.065</td>
<td>2.271</td>
<td>[.028, .375]</td>
</tr>
<tr>
<td>Attachment Avoidance</td>
<td>-.017</td>
<td>.063</td>
<td>-.159</td>
<td>[-.222, .189]</td>
</tr>
<tr>
<td>Attachment Anxiety</td>
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<td>.057</td>
<td>-2.189</td>
<td>[-.418, -.018]</td>
</tr>
<tr>
<td><strong>Conscientiousness on Life History Strategy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life History Strategy</td>
<td>.248**</td>
<td>.054</td>
<td>3.084</td>
<td>[.093, .403]</td>
</tr>
<tr>
<td>Attachment Avoidance</td>
<td>-.150†</td>
<td>.050</td>
<td>-1.630</td>
<td>[-.222, .189]</td>
</tr>
<tr>
<td>Attachment Anxiety</td>
<td>.100</td>
<td>.054</td>
<td>.980</td>
<td>[-.101, .301]</td>
</tr>
</tbody>
</table>

*Notes.* Bio Pubertal Development = Biologically-Oriented Pubertal Development; P/S = Psychosocially-Oriented Pubertal Development; B and SE (standard error) are unstandardized parameter estimates. 95% CI (confidence interval) are standardized estimates. Non-indentied variables are outcome variables. Indented variables are predictor variables. †p<.10, *p<.05, **p<.01, ***p<.001.
Figure 5. Significant pathways of model after removing age as a covariate.

Note. All paths, disturbances, errors and covariances were tested in the mode. However, only significant direct paths are indicated in diagram for ease of presentation. Indirect paths are indicated with a bolded lined. Disturbances are noted with “d”.
Discussion

The purpose of my study was to explore the extent to which life history strategy and attachment were related to pubertal development and personality (i.e., Honesty-Humility and Conscientiousness), and how these relationships impacted dating and sexuality among adolescent girls. While there is a large body of literature examining the influence of pubertal development on dating, life history strategy on personality, and personality and attachment, my study added to the literature by examining these relationships in light of a contemporary and evolutionarily-informed model of personality, the HEXACO. While my hypotheses were not supported in full, a number of interesting relationships surfaced.

My study sought to replicate previous findings that suggest that the relationship between attachment insecurity and dating and sexuality is mediated by pubertal timing in adolescent girls. Furthermore, my study tested whether the personality traits Honesty-Humility and Conscientiousness would mediate the relationship between life history strategy and dating and sexuality, and attachment and dating and sexuality, among girls. The results of these tests were unexpected and thus highlighted concerns about using the framework of life history strategy to predict within-group variability and the utility of the Mini-K measure.

First, the results of my study suggested that pubertal development (biologically- or psychosocially-oriented) was not a mediator between life history strategy, attachment anxiety or attachment avoidance and dating and sexuality, despite theoretical and empirical evidence that suggests the contrary (e.g., Belsky et al., 1991; Ellis, 2004).

Second, in line with previous research, slower (i.e., more K-selected) life history strategies were associated with higher levels of Conscientiousness. In the HEXACO model of personality, higher levels of Conscientiousness are associated with orderliness, attention to
detail, dutifulness, but most notably, higher levels of Conscientiousness are associated with long-term planning and goal-setting (Ashton & Lee, 2007). As such, it is unsurprising that life history strategy is related to Conscientiousness, as slower (i.e., r-selected) strategies are thought to emphasize investment in somatic growth and maintenance over mating and parenting.

However, contrary to my hypotheses, the relationship between life history strategy and dating and sexuality was not mediated by Conscientiousness (after accounting for the effects of age). This was unexpected, as both Conscientiousness is conceptually related to life history strategy. Previous research has implicated Big Five Conscientiousness with life history strategy (e.g., Figueredo, Vasques, Brumbach & Schneider, 2007). Furthermore, life history strategy is especially conceptually related to Conscientiousness as it taps into future discounting (i.e., focusing on short-term rewards over long-term gains), and should thus be predictive of the degree of restrictiveness that characterizes an individual’s dating and sexual behaviour.

Third, the results of my study suggested that the relationship between life history strategy and dating and sexuality may be partially mediated by Honesty-Humility. Theory and previous literature would predict that faster (i.e., r-selected) strategies would predict less restrictive dating and sexuality. As such, the positive association between life history strategy and dating and sexuality was unexpected. However, the direction of these relationships in regard to Honesty-Humility were expected – that is, slower life history strategies were associated with higher Honesty-Humility, which in turn is associated with more restricted dating and sexuality. Thus, it would appear that Honesty-Humility is acting as a suppressor variable in this relationship. A suppressor variable increases the magnitude of the relationship between an independent variable and a dependent variable. Furthermore, the opposing directions of the indirect and direct pathways may be indicative of an inconsistent mediation, which occurs when a particular
mediational pathway changes the direction of the effect from the independent to the dependent variable. Thus, Honesty-Humility appears to both change and strengthen the function of the relationship between life history strategy and dating and sexuality in my study.

Given these results, it appears that my study’s measure of life history strategy is not performing as expected. I propose two possible explanations for these results: 1) Life history theory as a theoretical groundwork has been misapplied in my study and/or 2) there are methodological issues associated with the life history measure in the current sample.

**Potential Issues in Using Life History Theory to Explain Within-Species Variability**

Life history theory has a well-established history of usefulness and validity within the ecological and biological sciences (e.g., Pianka, 1970). Life history theory, when applied at the species-level, predicts how organisms will favour allocating their limited resources - either towards maintaining their physical body and health, or towards mating and parenting, depending on whether their mortality is density-independent or density-dependent. In other words, in climates where resources are limited and mortality is likely, species should favour the allocation of their resources towards mating and producing offspring to increase the likelihood of propagating their genes to the next generation. These species are more likely to have many offspring of whom they invest in less. Conversely, in climates where resources are less limited and mortality is unlikely, species should favour the allocation of their resources towards the maintaining bodily health and strength. These species are more likely to have fewer offspring of whom they invest more in (e.g., Pianka, 1970). While these predictions appear to reliable at a species-level, some significant issues emerge in applying life history theory to within-species variability within humans.
The application of life history theory to the social sciences is contentious. On $r$ and $K$ selection, Stearns (1992, p.206) commented that life history theory as an explanation for individual differences was “suggestive and influential but incorrect.” Conversely, Mueller (1997, p. 270) supposed that “physics has frictionless hockey pucks, thermodynamics has Carnot engines, and evolutionary ecology has $r$- and $K$-selection.” Despite polarization in the field, the idea that suites of co-adapted life history strategy traits has persisted. One of the most prominent theories in this field is Rushton’s (1985) Differential K theory which proposes that individual differences result from one’s place on the $r$- to $K$-selected spectrum. This theory has been especially inflammatory as it has been perceived by some as a means to explain behavioural differences between races as a consequence of placement on this spectrum. Despite contention, research continued in this area, eventually giving rise to the identification of the “$K$-Factor”, which encompasses supposed life history characteristics such as attachment, mating, Machiavellianism, risk-taking propensity and personality (Figueredo, Vasquez, Brumbach & Schneider, 2004). Further research gave rise to the latent construct “Super-$K$” factor, which was composed of measures of family relationships, kin support, religiosity and socioeconomic status (Figueredo, Vasquez, Brumbach & Schneider, 2007). In turn, these latent constructs provided the basis for the construction of the Arizona Life History Battery (Figueredo et al., 2004) and the short-form version the Mini-$K$ scale (Figueredo et al., 2006), which have been used extensively in the field of evolutionary psychological research.

Despite a large body of literature that applies life history principles to human behaviour, there is growing awareness among researchers that the foundation on which life history strategy has been applied to within-species human behaviour may be faulty – that is, the process by which species are adapted to their environment (i.e., natural selection) has been falsely conflated
with the process by which the environment influences individual-level traits (i.e., developmental plasticity; Zietsch & Sidari, 2019). Thus, while natural selection may have led to phenotypic plasticity among humans, there is no known Mendelian process by which genes are selected together in clusters to best suit an environment.

If life history theory has indeed been misapplied to human behavioural variability, then it may be reasonable to suggest that the assumption that traits are co-adapted together to produce a coherent life history strategy may be inaccurate. Indeed, there are several reasonable explanations for trait covariation that do not rely on the assumption of co-evolved clusters of traits.

First, traits may covary together due to non-random mating strategies. For example, there may be the case where shorter men preferentially seek out and mate with shorter women. While this may initiate a pattern of trait co-variation across a population, it would not necessarily serve an overarching function (e.g., Keller et al., 2013; Zietsch & Sidari, 2019). Second, traits may cluster together due to pleiotropy (i.e., one gene causes more than one phenotype; Zietsch & Sidari, 2019). Third, correlations among traits are not evidence that a suite of genes underlie the expression of a co-ordinated life history strategy. In fact, there are multiple explanations for trait correlation that are both simpler and more plausible: a) one heritable trait may be influencing another heritable trait; b) one heritable trait may interact with the environment to influence another trait; c) both traits may be under the influence of another third trait; or d) two or more traits are linked by a developmental process (Zietsch & Sidari, 2019).

Similarly, theories that posit that life history strategy traits emerged as an evolved response to early stress may also be based on faulty groundwork. Many supposed life history traits, such as personality and sociosexuality (among others) are highly heritable (e.g., Figueredo
et al., 2014). Furthermore, the remaining variance in many life history traits that are not captured by heritability may be best attributed to residual factors rather than shared environmental factors (Zietsch & Sidari, 2019; Figueredo et al., 2004). While many studies that examine the relationships between adult traits and developmental environment do control for confounding genetic factors, they often yield small or null effects (e.g., Mendle et al., 2006, 2009; McAdams et al., 2014). Thus, to assume that life outcomes related to life history strategy emerge in large part from developmental events may be an ineffective means of explaining individual differences among humans.

Additionally, the validity of the measure of life history strategy used in my study, the Mini-K, has been contested. Specifically, the ability of the Mini-K (and similar scales) to capture a single measure of life history speed has recently been questioned, such that any given score does not appear to directly correspond to a position on a fast-to-slow life history continuum (Copping, Campbell and Muncer, 2014). Figueredo and colleagues (2014) have suggested that by only focusing on fitness returns (i.e., the ends of a behaviour), the important processes (i.e., the functional means of a behaviour) by which these outcomes come about is lost. However, critiques of life history measures warrant serious consideration, as they arise from legitimate concerns surrounding translating lifestyle factors, such as religiosity and social support, that are hypothesized to be related to a single “K-factor”, to actual fitness returns. If the items on life history measures are to accurately assess one’s placement on the r to K spectrum, then they should strongly predict actual life outcomes that correspond with evolutionary fitness. However, these relationships are rarely tested (Copping, Campbell & Muncer, 2014). In fact, a review of psychometric measures of life history strategy found that mating effort did not correspond with the Arizona Life History Battery or the Mini-K (Olderbak, Gladden, Wolf & Figueredo, 2014).
Furthermore, as highlighted by Copping and colleagues (2014), outcomes of life history strategy are rarely interpreted in light of sex differences, despite widely and well-established differences between the sexes in regard to allocating effort towards mating versus parenting.

In sum, life history theory presents an attractive explanation of individual differences among humans that makes intuitive sense to students and researchers alike, as it provides a simple explanation of human behaviour variability – that is, human beings are adapted to make the best of their given circumstances. However, when taken out of the original context (i.e., species-level comparisons) and applied to within-species variability, there is good reason for skepticism surrounding whether life history theory provides a suitable framework for studying development.

**Attachment Theory as a Viable Explanation**

The results of my study suggested that higher levels of attachment anxiety were related to lower Honesty-Humility. These results raise the question: What purpose might low Honesty-Humility serve to an individual with attachment anxiety? Attachment theorists, such as John Bowlby and Mary Ainsworth, suggested that attachment was both a lens through which personality development may be understood, but also as a component of human behaviour that came about through natural selection (Ainsworth & Bowlby, 1991). As such, these results suggest that further investigation may be warranted in regard to whether the development of lower levels of Honesty-Humility is an adaptive response under the conditions of anxious attachment, and therefore representative of developmental plasticity. For example, individuals who are lower in Honesty-Humility are more likely to have relationships that lack depth and intimacy (Ashton & Lee, 2007). As such, the combination of attachment anxiety and lower Honesty-Humility may reflect an inclination towards self-protection in interpersonal
relationships. Indeed, a large-scale survey of American adults suggested that attachment anxiety is related to having experienced interpersonal trauma, such as abuse, neglect or assault, having a poor internal locus of control and attributing external control to luck or powerful other persons, increased Neuroticism, and decreased Extraversion and Openness (from the FFM) (Mickelson, Kessler & Shaver, 1997).

There is also the possibility that attachment anxiety may be related to lower levels of Honesty-Humility due to the genetic and environment contributions of parents. In the HEXACO model, individuals with lower Honesty-Humility scores are also more likely to exploit others for personal gain, be motivated by material wealth, and have an increased sense of self-importance (Ashton & Lee, 2007). Personality traits, like many other psychological characteristics, are, in part, heritable (e.g., Plomin et al., 1994). Given the profile of an individual with lower levels of Honesty-Humility, it may be reasonable to suggest that a parent with low levels of Honesty-Humility may have higher standards for their offspring, have more self-centered, or even narcissistic, interests and may offer warmth and security towards their offspring only conditionally. In this case, a child’s attachment anxiety may, in part, reflect a lack of unconditional love and respect from their parents. Furthermore, if parents create a competitive home environment, this may further exacerbate the tendency to act in a way that prioritizes self-gain, even if means exploiting other persons in the process.

Limitations

The results of my study should be interpreted in light of a number of limitations. The results of the current study suggested that pubertal development does not mediate the relationship between life history and dating activity or attachment and dating activity. Despite significant criticism of life history theory as a set of working assumptions, this result exists in
contention with a substantial portion of evolutionary psychological literature on the subject – that is, pubertal development, specially earlier pubertal development, is believed to accelerate one’s dating and sexual debut, and is related to less restrictive dating and sexual behaviours. There may be a number of practical and methodological reasons why this relationship did not emerge in my study.

First, there are some notable challenges involved with using pubertal development data, especially in the case of using adolescent participants. The most significant challenge was measuring menarcheal status, as approximately 20% of my participants had not yet reached menarche. This was particularly problematic because these cases were neither missing data, nor true zeroes. My solution to this problem was two-fold; First, a dichotomous variable of menarcheal status as constructed, indicating whether or not a participant had experienced menarche. Second, to bolster the measure of pubertal development, a proportion variable that included menarcheal status, breast budding and body hair growth was constructed. These measurement issues may have been particularly related to the age range of the participants (12-18), as the average age of menarche is approximately 12 years old in Western societies (Hillard, 2002). While I am confident with the construction of proportion variables as a viable solution, future studies endeavouring to measure pubertal development may benefit from extending the age range.

Second, my measures of pubertal development and dating activity may have been impacted by a number of specific sample characteristics. The sample consisted of adolescent girls who were involved in extracurricular activities such as sports. The sample’s involvement in extracurriculars may have impacted the variance in the measure of dating activity simply as a function of having more structured and supervised time after school, and therefore may have
limited opportunities to go on dates and interact with potential romantic or sexual partners. Additionally, there was limited variability in regard to socio-economic status within the sample. This is perhaps an artifact of how the data for the current study was collected – that is, it is reasonable to assume that a group of adolescents involved in extracurricular activities are likely to come from families who can afford after-school activities, and who have the means to support their children’s after-school activities (e.g., only work one job during the day, so they are able to take the child to after-school activities).

Third, there may be concern with the number of items in two of my measures: the measures of biologically-oriented pubertal development, psychosocially-oriented pubertal development and dating and sexuality. Internal consistency is necessarily limited with fewer items in a measure, and is impossible to determine in the case of a single item measures. Furthermore, given that the measures in question are likely to change, it is perhaps inappropriate to try to ascertain test-retest reliability. In terms of validity, short item measures are less likely to capture the nuances of the particular construct it is trying to measure. Again, this is particularly true of one-item measures. However, Brooks-Gun and colleagues (1987) found that adolescent girls’ self-reports of breast development and body hair growth correlated highly with physician reports. Furthermore, every girl in this study was able to correctly identify her menstrual status. As such, it is reasonable to conclude that self-report data for measures of pubertal development are generally reliable and valid.

Last, my study may have been limited in regard to power. Power is the likelihood of detecting an effect if there is one. One way to increase power is to increase sample size. For path analysis, the typical recommendation is to have at least 200 participants, ideally 300. After removing outliers, I was left with 202 participants. While the sample size is technically
acceptable, it would limit by ability to detect an effect if there was one, particularly if such an effect is smaller. That said, increasing the power in my study would be unlikely to reverse the unexpected indirect effect I found that goes against life history theory. Thus I have a reasonable degree of confidence in replicability of my results as well as the absence of significant undetected relationships.

Future Directions

Life history strategy has been used widely in the field of evolutionary psychology to predict individual differences in behaviour. However, my study has contributed modestly to the growing doubt of life history theory’s utility in the developmental sciences. According to scientific philosopher Thomas Kuhn (1962), science is never linear and must undergo paradigm shifts. Kuhn (1962) proposed three stages of what he coined “revolutionary science”: 1) “Prescience” – the stage where research is conducted under no overarching paradigm; 2) “Normal science” – which is conducted in an effort to expand the paradigm by testing central predictions; and 3) “Crisis” – which is reached after contradictory evidence (i.e., “anomalies”) has amassed to the point where a new paradigm must be accepted. Given the widespread use of life history theory in the social sciences, and the growing awareness of its potential misapplication, I suggest that the field may be approaching its own “crisis” that necessitates a reformulation of our collective ideas about whether life history strategy can be applied within populations, and what how the field should proceed if the predictions of life history theory cannot be empirically validated. Within the scope of my thesis, the field may benefit from examining the implications of building and testing middle-level models with life history theory as the set of underlying assumptions about individual differences.
Conclusion

The current study sought to examine the nature of the relationships among life history strategy, attachment, pubertal development, personality, and dating and sexuality among teenage girls. To test these relationships, a theoretically-grounded path model was tested with direct and indirect pathways from life history strategy, attachment anxiety and attachment avoidance to dating and sexuality via biologically-oriented pubertal development, psychosocially-oriented pubertal development, Honesty-Humility and Conscientiousness.

The results of my study suggested that Honesty-Humility may partly mediate the pathway between life history strategy and dating and sexuality. However, the directionality of my results was unexpected – that is, slower life history strategies were associated with less restricted dating and sexuality. These results, instead, were more in line with a growing body of literature that suggests a misapplication of life history theory in the social sciences (e.g., Copping, Campbell & Muncer, 2014; Zietsch & Sidari, 2019).

The results of my study also suggested that attachment anxiety was related to Honesty-Humility. However, no significant indirect pathway was observed through attachment anxiety to dating and sexuality through Honesty-Humility. However, previous research has suggested that lower Honesty-Humility is related to having more sexual partners (e.g., Jonason, Hatfield & Boler, 2014; Provenzano et al., 2018). Further research will be necessary to confirm this link.

Thus, if Honesty-Humility did indeed at least partially mediate the relationship between attachment insecurity and dating and sexuality in girls, this may be evidence of an adaptive strategy that increases fitness under conditions of parental investment uncertainty through a tendency to have more superficial and short-term relationships, and to prioritize investing resources in one’s self, rather than in relationships with others.
While the current study’s hypotheses were not confirmed in full, the results highlight the potential role of personality during adolescence in predicting outcomes related to life history strategy and attachment for girls. Specifically, this study provides support for framing some traits that are typically considered “maladaptive” in a new light – that is, they may be rational, useful and adaptive strategies under certain environmental conditions. Consequently, future research on adolescents may benefit from taking a strengths-based perspective when examining outcomes for girls that are related to life history strategy or attachment.

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Appendix A

Testing of Statistical Assumptions

Cleaning Data

First, each model variable was sorted by ascending and descending values. Values that were identified as out of range were corrected by referring back to the self-report measure and correcting the value. Descriptive statistics confirmed that all values for each scale were within the range. Various measures were taken to assess the normality of the data.

Outliers

Outliers were identified by creation of standardized scores for each continuous variable of interest – Life History Strategy, Global Avoidant Attachment, Global Anxious Attachment, Breast Budding, Body Hair Growth, Honesty-Humility, Conscientiousness, Dating Activity, Number of Partners and Interest in Dating. Criteria for outlier identification was +/- 3 standard deviations away from the mean. Outlier identification numbers and corresponding z-scores are listed in Table 1. Participants with scores which were +/- 3 standard deviations away from the mean were removed.
Table 1.

Raw Scores and Z-Scores of Univariate Outliers

<table>
<thead>
<tr>
<th>Variable</th>
<th>ID Number</th>
<th>Raw Score</th>
<th>Z Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life History Strategy</td>
<td>717</td>
<td>-1.77</td>
<td>-3.38</td>
</tr>
<tr>
<td></td>
<td>166</td>
<td>-1.69</td>
<td>-3.29</td>
</tr>
<tr>
<td></td>
<td>352</td>
<td>-1.50</td>
<td>-3.06</td>
</tr>
<tr>
<td>Global Avoidant Attachment</td>
<td>904</td>
<td>5.63</td>
<td>3.25</td>
</tr>
<tr>
<td>Global Anxious Attachment</td>
<td>162</td>
<td>6.33</td>
<td>3.49</td>
</tr>
<tr>
<td></td>
<td>204</td>
<td>5.83</td>
<td>3.08</td>
</tr>
<tr>
<td>Body Hair Growth</td>
<td>380</td>
<td>1</td>
<td>-3.36</td>
</tr>
<tr>
<td></td>
<td>382</td>
<td>1</td>
<td>-3.36</td>
</tr>
<tr>
<td></td>
<td>992</td>
<td>1</td>
<td>-3.36</td>
</tr>
<tr>
<td></td>
<td>378</td>
<td>1</td>
<td>-3.36</td>
</tr>
<tr>
<td>Number of Partners</td>
<td>917</td>
<td>12</td>
<td>6.35</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>10</td>
<td>5.23</td>
</tr>
<tr>
<td></td>
<td>583</td>
<td>8</td>
<td>4.10</td>
</tr>
<tr>
<td></td>
<td>182</td>
<td>8</td>
<td>4.10</td>
</tr>
</tbody>
</table>

Univariate Normality

Age

Visual inspection of the histogram suggested that the data are normally distributed, as the majority of the scores clustered around the mean, and the curve was bell-shaped and relatively symmetrical (see Figure 1). Using the liberal anchors of +/- 2 (Field, 2013), skewness and kurtosis values were well within the range of normal (Skewness = .302; Kurtosis = -.890). Thus, given that both visual inspection, and skewness and kurtosis values agree, I conclude that the data for the variable “Age” are normally distributed.

Breast Budding

Visual inspection of the histogram suggested that the data are normally distributed, as the majority of the scores clustered around the mean, and the curve was bell-shaped and relatively symmetrical (see Figure 2). Using the liberal anchors of +/- 2 (Field, 2013), skewness and
kurtosis values were well within the range of normal (Skewness = -.238; Kurtosis = -.288). Thus, given that both visual inspection, and skewness and kurtosis values agree, I conclude that the data for the variable “Breast Budding” are normally distributed.

**Body Hair Growth**

Visual inspection of the histogram suggested that the data are normally distributed, as the majority of the scores clustered around the mean, and the curve was bell-shaped and relatively symmetrical (see Figure 3). Using the liberal anchors of +/- 2 (Field, 2013), skewness and kurtosis values were well within the range of normal (Skewness = -.641; Kurtosis = -.562). Thus, given that both visual inspection, and skewness and kurtosis values agree, I conclude that the data for the variable “Body Hair Growth” are normally distributed.

**Life History Strategy**

Visual inspection of the histogram suggested that the data are normally distributed, as the majority of the scores clustered around the mean, and the curve was bell-shaped and relatively symmetrical (see Figure 4). Using the liberal anchors of +/- 2 (Field, 2013), skewness and kurtosis values were well within the range of normal (Skewness = -.528; Kurtosis = .334). Thus, given that both visual inspection, and skewness and kurtosis values agree, I conclude that the data for the variable “Life History Strategy” are normally distributed.

**Global Avoidant Attachment**

Visual inspection of the histogram suggested that the data was may be positively skewed (see Figure 5). However, using the liberal anchors of +/- 2 (Field, 2013), skewness and kurtosis values were well within the range of normal (Skewness = .538; Kurtosis = -.339). Thus, I conclude that the data for the variable “Global Avoidant Attachment” are normally distributed.

**Global Anxious Attachment**
Visual inspection of the histogram suggested that the data were positively skewed and leptokurtic (see Figure 6). However, using the liberal anchors of +/- 2 (Field, 2013), skewness and kurtosis values were well within the range of normal (Skewness = 1.296; Kurtosis = .902). Thus, I conclude that the data for the variable “Global Anxious Attachment” are normally distributed.

**Biologically-Oriented Pubertal Development**

Visual inspection of the histogram suggested that the data was negatively skewed and leptokurtic (see Figure 7). Using the liberal anchors of +/- 2 (Field, 2013), skewness and kurtosis values were well within the range of normal (Skewness = -1.256; Kurtosis = 1.005). Thus, given that both visual inspection, and skewness and kurtosis values agree, I conclude that the data for the variable “Biologically-Oriented Pubertal Development” are normally distributed.

**Psychosocially-Oriented Pubertal Development**

Visual inspection of the histogram suggested that the data are normally distributed, as the majority of the scores clustered around the mean, and the curve was bell-shaped and relatively symmetrical (see Figure 8). Using the liberal anchors of +/- 2 (Field, 2013), skewness and kurtosis values were well within the range of normal (Skewness = -.058; Kurtosis = -.125). Thus, given that both visual inspection, and skewness and kurtosis values agree, I conclude that the data for the variable “Psychosocially-Oriented Pubertal Development” are normally distributed.

**Honesty-Humility**

Visual inspection of the histogram suggested that the data are normally distributed, as the majority of the scores clustered around the mean, and the curve was bell-shaped and relatively symmetrical (see Figure 9). Using the liberal anchors of +/- 2 (Field, 2013), skewness and kurtosis values were well within the range of normal (Skewness = .177; Kurtosis = -.272). Thus,
given that both visual inspection, and skewness and kurtosis values agree, I conclude that the data for the variable “Honesty-Humility” are normally distributed.

**Conscientiousness**

Visual inspection of the histogram suggested that the data are normally distributed, as the majority of the scores clustered around the mean, and the curve was bell-shaped and relatively symmetrical (see Figure 10). Using the liberal anchors of +/- 2 (Field, 2013), skewness and kurtosis values were well within the range of normal (Skewness = -.032; Kurtosis = -.413). Thus, given that both visual inspection, and skewness and kurtosis values agree, I conclude that the data for the variable “Conscientiousness” are normally distributed.

**Dating Activity**

Visual inspection of the histogram suggested that the data are normally distributed, as the majority of the scores clustered around the mean, and the curve was bell-shaped and relatively symmetrical (see Figure 11). Using the liberal anchors of +/- 2 (Field, 2013), skewness and kurtosis values were well within the range of normal (Skewness = 1.477; Kurtosis = 1.224). Thus, given that both visual inspection, and skewness and kurtosis values agree, I conclude that the data for the variable “Dating Activity” are normally distributed.

**Number of Partners**

Visual inspection of the histogram suggested that the data was may be positively skewed (see Figure 12). Furthermore, using the liberal anchors of +/- 2 (Field, 2013), skewness and kurtosis values were outside the range of normal (Skewness = 2.797; Kurtosis = 7.739). Due to the nature of the variable, and the age range of our participants (Mean age = 14.5), this distribution is to be expected as it reflects a relatively low rate of sexual activity. However, due
to the skewed and leptokurtic nature of the distribution, results should be interpreted with a fair
degree of caution.

**Interest in Dating**

Visual inspection of the histogram suggested that the data are normally distributed, as the
majority of the scores clustered around the mean, and the curve was bell-shaped and relatively
symmetrical (see Figure 13). Using the liberal anchors of +/- 2 (Field, 2013), skewness and
kurtosis values were well within the range of normal (Skewness = -.314; Kurtosis = -.967). Thus,
given that both visual inspection, and skewness and kurtosis values agree, I conclude that the
data for the variable “Interest in Dating” are normally distributed.

**Linearity**

Scatterplots were generated depicting the relationship between each of the continuous
variables. Visual inspection of these scatterplots and the line of best fit suggested that there were
linear relationships between all variables (See Figures 15-96).

**Predictors measured without error**

Cronbach’s alpha statistic were generated for each scale of interest to determine if the
measure was reliable (See Table 1).

**Homoscedasticity**

To test for the assumption of homoscedasticity, a scatterplot was generated, with the
regression standardized residual on the y-axis, and unstandardized predicted values on the x-axis.
A cone-shaped pattern would be suggestive of homoscedasticity being an issue, indicating that
the error term is the not a congruent value across the independent variables. There was no
observable cone-shaped pattern, which suggests that the variance around the regression line is
comparable across the independent variables. Thus, I conclude that the data for all outcome variables meet the assumption of homoscedasticity (see Figure 97).

**Independence of Residuals**

To test for independence of residuals, participant ID number was plotted against the standardized residual of each of the outcomes. Participant ID number was also used to test whether timing of participation in the study impacted participant scores. There were no patterns in the data, suggesting that the standardized residual values are independent for each of the outcome variables (see Figure 98).

**Multivariate Outliers**

The parameters for Cook’s distance were calculated by multiplying the variable mean by 3 ($\mu = 0.0062228 \times 3 = 0.0186684$). The identified outliers, standardized residuals and Leverage values are presented in Table 12. The parameters for Leverage values were also calculated by multiplying the variable mean by 3 ($\mu = 0.0397727 \times 3 = 0.1193181$). The parameters to be excluded from the analysis as an outlier were +/-3. The identified outliers presented in Table 2.
Table 2.

*Multivariate Outliers Identified Using Cook’s Distance and Leverage Values*

<table>
<thead>
<tr>
<th>ID Number</th>
<th>Standardized Residual</th>
<th>Cook’s Distance</th>
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</thead>
<tbody>
<tr>
<td>648</td>
<td>3.08</td>
<td>.090</td>
</tr>
<tr>
<td>1025</td>
<td>2.09</td>
<td>.075</td>
</tr>
<tr>
<td>860</td>
<td>3.95</td>
<td>.060</td>
</tr>
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<td>61</td>
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<td>206</td>
<td>2.78</td>
<td>.045</td>
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<td>651</td>
<td>2.63</td>
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<tr>
<td>283</td>
<td>1.95</td>
<td>.029</td>
</tr>
<tr>
<td>670</td>
<td>-1.45</td>
<td>.026</td>
</tr>
<tr>
<td>888</td>
<td>-1.42</td>
<td>.022</td>
</tr>
<tr>
<td>235</td>
<td>2.19</td>
<td>.021</td>
</tr>
<tr>
<td>143</td>
<td>1.61</td>
<td>.020</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID Number</th>
<th>Standardized Residual</th>
<th>Leverage Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>109</td>
<td>.77</td>
<td>.134</td>
</tr>
<tr>
<td>90</td>
<td>-.84</td>
<td>.133</td>
</tr>
</tbody>
</table>

*Multivariate Normality*

Skewness and kurtosis values and histograms of the standardized residuals values were created. Visual inspection of the Standardized Residual data suggested that the multivariate data was normally distributed (See Figure 99). Using the liberal anchors of +/-3, skewness and kurtosis values confirmed that the data was normally distributed (Skewness = .929; Kurtosis = -.053). Therefore, I conclude that the multivariate data is normally distributed.
Appendix B

Figure 1. Distribution of Age Data
Figure 2. Distribution of Breast Budding Data
Figure 3. Distribution of Body Hair Growth Data
Figure 4. Distribution of Life History Strategy Data
Figure 5. Distribution of Global Avoidant Attachment Data
Figure 6. Distribution of Global Anxious Attachment Data
Figure 7. Distribution of Biologically-Oriented Pubertal Development Composite Data
Figure 8. Distribution of Psychosocially-Oriented Pubertal Development Data
Figure 9. Distribution of Honesty-Humility Data
Figure 10. Distribution of Conscientiousness Data
Figure 11. Distribution of Dating Activity Data
Figure 12. Distribution of Number of Partners Data
Figure 13. Distribution of Interest in Dating Data
Figure 14. Distribution of Dating and Sexuality Composite Data
Figure 15. Scatterplot illustrating linear relationship between Age and Breast Budding.
Figure 16. Scatterplot illustrating linear relationship between Age and Body Hair Growth.
Figure 17. Scatterplot illustrating linear relationship between Age and Life History Strategy.
Figure 18. Scatterplot illustrating linear relationship between Age and Attachment Avoidance.
Figure 19. Scatterplot illustrating linear relationship between Age and Attachment Anxiety.
Figure 20. Scatterplot illustrating linear relationship between Age and Biologically-Oriented Pubertal Development.
Figure 21. Scatterplot illustrating linear relationship between Age and Psychosocially-Oriented Pubertal Development.
Figure 22. Scatterplot illustrating linear relationship between Age and Honesty-Humility.
Figure 23. Scatterplot illustrating linear relationship between Age and Conscientiousness.
Figure 24. Scatterplot illustrating linear relationship between Age and Dating Activity.
Figure 25. Scatterplot illustrating linear relationship between Age and Number of Partners.
Figure 26. Scatterplot illustrating linear relationship between Age and Interest in Dating.
Figure 27. Scatterplot illustrating linear relationship between Age and Dating and Sexuality Composite.
Figure 28. Scatterplot illustrating linear relationship between Breast Budding and Body Hair Growth.
Figure 29. Scatterplot illustrating linear relationship between Breast Budding and Life History Strategy.
Figure 30. Scatterplot illustrating linear relationship between Breast Budding and Attachment Avoidance.
Figure 31. Scatterplot illustrating linear relationship between Breast Budding and Attachment Anxiety.
Figure 32. Scatterplot illustrating linear relationship between Breast Budding and Psychosocially-Oriented Pubertal Development.
Figure 33. Scatterplot illustrating linear relationship between Breast Budding and Honesty-Humility.
Figure 34. Scatterplot illustrating linear relationship between Breast Budding and Conscientiousness.
Figure 35. Scatterplot illustrating linear relationship between Breast Budding and Dating Activity.
Figure 36. Scatterplot illustrating linear relationship between Breast Budding and Number of Partners.
Figure 37. Scatterplot illustrating linear relationship between Breast Budding and Interest in Dating.
Figure 38. Scatterplot illustrating linear relationship between Breast Budding and Dating and Sexuality.
Figure 39. Scatterplot illustrating linear relationship between Body Hair Growth and Life History Strategy.
Figure 40. Scatterplot illustrating linear relationship between Body Hair Growth and Attachment Avoidance.
Figure 41. Scatterplot illustrating linear relationship between Body Hair Growth and Psychosocially-Oriented Pubertal Development.
Figure 42. Scatterplot illustrating linear relationship between Body Hair Growth and Honesty-Humility.
Figure 43. Scatterplot illustrating linear relationship between Body Hair Growth and Conscientiousness.
Figure 44. Scatterplot illustrating linear relationship between Body Hair Growth and Dating Activity.
Figure 45. Scatterplot illustrating linear relationship between Body Hair Growth and Number of Partners.
Figure 46. Scatterplot illustrating linear relationship between Body Hair Growth and Interest in Dating.
Figure 47. Scatterplot illustrating linear relationship between Body Hair Growth and Dating and Sexuality.
Figure 48. Scatterplot illustrating linear relationship between Life History Strategy and Attachment Avoidance.
Figure 49. Scatterplot illustrating linear relationship between Life History Strategy and Attachment Anxiety.
**Figure 50.** Scatterplot illustrating linear relationship between Life History Strategy and Biologically-Oriented Pubertal Development.
Figure 51. Scatterplot illustrating linear relationship between Life History Strategy and Psychosocially-Oriented Pubertal Development.
Figure 52. Scatterplot illustrating linear relationship between Life History Strategy and Honesty-Humility.
Figure 53. Scatterplot illustrating linear relationship between Life History Strategy and Conscientiousness.
Figure 54. Scatterplot illustrating linear relationship between Life History Strategy and Dating Activity.
Figure 55. Scatterplot illustrating linear relationship between Life History Strategy and Number of Partners.
Figure 56. Scatterplot illustrating linear relationship between Life History Strategy and Interest in Dating.
Figure 57. Scatterplot illustrating linear relationship between Life History Strategy and Dating and Sexuality.
Figure 58. Scatterplot illustrating linear relationship between Attachment Avoidance and Attachment Anxiety.
Figure 59. Scatterplot illustrating linear relationship between Attachment Avoidance and Biologically-Oriented Pubertal Development.
Figure 60. Scatterplot illustrating linear relationship between Attachment Avoidance and Psychosocially-Oriented Pubertal Development.
Figure 61. Scatterplot illustrating linear relationship between Attachment Avoidance and Honesty-Humility.
Figure 62. Scatterplot illustrating linear relationship between Attachment Avoidance and Conscientiousness.
Figure 63. Scatterplot illustrating linear relationship between Attachment Avoidance and Dating Activity.
Figure 64. Scatterplot illustrating linear relationship between Attachment Avoidance and Number of Partners.
Figure 65. Scatterplot illustrating linear relationship between Attachment Avoidance and Interest in Dating.
Figure 66. Scatterplot illustrating linear relationship between Attachment Avoidance and Dating and Sexuality.
Figure 67. Scatterplot illustrating linear relationship between Attachment Anxiety and Biologically-Oriented Pubertal Development.
Figure 68. Scatterplot illustrating linear relationship between Attachment Anxiety and Psychosocially-Oriented Pubertal Development.
Figure 69. Scatterplot illustrating linear relationship between Attachment Anxiety and Honesty-Humility.
Figure 70. Scatterplot illustrating linear relationship between Attachment Anxiety and Conscientiousness.
Figure 71. Scatterplot illustrating linear relationship between Attachment Anxiety and Dating Activity.
Figure 72. Scatterplot illustrating linear relationship between Attachment Anxiety and Number of Partners.
Figure 73. Scatterplot illustrating linear relationship between Attachment Anxiety and Interest in Dating.
Figure 74. Scatterplot illustrating linear relationship between Attachment Anxiety and Dating and Sexuality.
Figure 75. Scatterplot illustrating linear relationship between Biologically-Oriented Pubertal Development and Psychosocially-Oriented Pubertal Development.
Figure 76. Scatterplot illustrating linear relationship between Biologically-Oriented Pubertal Development and Honesty-Humility.
Figure 77. Scatterplot illustrating linear relationship between Biologically-Oriented Pubertal Development and Conscientiousness.
Figure 78. Scatterplot illustrating linear relationship between Biologically-Oriented Pubertal Development and Dating Activity.
Figure 79. Scatterplot illustrating linear relationship between Biologically-Oriented Pubertal Development and Number of Partners.
Figure 80. Scatterplot illustrating linear relationship between Biologically-Oriented Pubertal Development and Interest in Dating.
Figure 81. Scatterplot illustrating linear relationship between Biologically-Oriented Pubertal Development and Dating and Sexuality.
Figure 82. Scatterplot illustrating linear relationship between Psychosocially-Oriented Pubertal Development and Honesty-Humility.
Figure 83. Scatterplot illustrating linear relationship between Psychosocially-Oriented Pubertal Development and Conscientiousness.
**Figure 84.** Scatterplot illustrating linear relationship between Psychosocially-Oriented Pubertal Development and Dating Activity.
Figure 85. Scatterplot illustrating linear relationship between Psychosocially-Oriented Pubertal Development and Number of Partners.
Figure 86. Scatterplot illustrating linear relationship between Psychosocially-Oriented Pubertal Development and Interest in Dating.
Figure 87. Scatterplot illustrating linear relationship between Psychosocially-Oriented Pubertal Development and Dating and Sexuality.
Figure 88. Scatterplot illustrating linear relationship between Honesty-Humility and Conscientiousness.
**Figure 89.** Scatterplot illustrating linear relationship between Honesty-Humility and Dating Activity.
Figure 90. Scatterplot illustrating linear relationship between Honesty-Humility and Number of Partners.

Simple Scatter of Honesty–Humility by How many different partners have you had a voluntary sexual experience with...

\[ y = 3.54 - 0.08x \]

R\(^2\) Linear = 0.031
Figure 91. Scatterplot illustrating linear relationship between Honesty-Humility and Interest in Dating.
Figure 92. Scatterplot illustrating linear relationship between Honesty-Humility and Dating and Sexuality.
Figure 93. Scatterplot illustrating linear relationship between Conscientiousness and Dating Activity.
Figure 94. Scatterplot illustrating linear relationship between Conscientiousness and Number of Partners.
Figure 95. Scatterplot illustrating linear relationship between Conscientiousness and Interest in Dating.
Figure 96. Scatterplot illustrating linear relationship between Conscientiousness and Dating and Sexuality.
Figure 97. Testing the Assumption of Homoscedasticity
Figure 98. Testing the Assumption of Independence of Residuals using ID Number
Figure 99. Distribution of Standardized Residuals