THE DEVELOPMENTAL SPAN OF SOCIAL STRATEGIES, TEMPERAMENT, & STRESS-RELATED HEALTH

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Abstract:

Social hierarchies involve social dynamics that may create physical and emotional challenges (Hawley, 2003). One component related to social hierarchies is social positioning and the control of important resources. The method of controlling resources within a complex hierarchy is the basis of Resource Control Theory (Hawley, 1999). Most human studies reveal that effective social strategy use is related to social positioning. In particular, the combination of prosocial and coercive strategies (bi-strategic controllers) is related to social dominance. Additionally, certain temperament traits such as effortful control are important in allowing the individual to use the most effective social strategy. The social strategy use may also be impacted by biology. The current set of studies examines the relationship between testosterone exposure in the prenatal environment (through the 2nd and 4th digit ratio), self-reported social positioning, temperament, social strategy usage, childhood psychosocial stressors, and health in middle childhood (10-12), emerging adulthood, and adulthood. The results of these studies show that at all developmental periods studied, social strategies are important to gain and maintain social positioning. It appears that in childhood and adulthood prosocial skills are the most valuable for social positioning while during emerging adulthood it is the use of both prosocial and coercive strategies that is most valuable for social status. Additionally, at all points in development studied here, effortful control was related to improved health and in some instances it was also related to social strategy usage. Finally, it appears the prenatal environment may create a developmental trajectory influencing social strategies use and outcome, and thereby influencing health. These preliminary findings may help clarify the relationship between social positioning, prenatal and postnatal environments, temperament, social strategies, and overall health throughout the developmental life span.

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CHAPTER I

INTRODUCTION

At all ages, group interactions involve dynamics such as communication, relationships, resource obtainment, and social understanding. These social dynamics often involve physical and emotional challenges encompassing the intricate workings of some form of social hierarchy (Hawley, 1999). Social hierarchies are often characterized by wealth, power, status, employment, abilities, popularity, or many other qualities. Several important behavioral and biological factors are associated with the social dynamics of hierarchies.

One factor related social dynamics is social positioning. Studies have suggested that biological factors may impact social standing. In some instances, physical size can play a critical role (Thomsen, Frankenhuis, Ingold-Smith, and Carey, 2011; Tremblay,. 2010). However, most human studies reveal that flexible social strategy usage creates and maintains dominant positioning (Hawley, 2003). In addition, certain personality and temperament traits such as conscientiousness and effortful control are important in

allowing the individual to use the most effective social strategy at the appropriate time. It is also possible that testosterone exposure from the prenatal environment may not only help the individual prepare for their birth world but, the organizational effects of this hormone may influence their social strategies and social standing later in life.

Another component involved in social dynamics, and in particular hierarchies, is social stress. This stress is usually related to striving for status and the struggle for acquiring resources (Sapolsky, 2004). Social stress impacts quality of life as well as overall health. Prior research has shown that many factors are associated with social stress, such as stability of the hierarchies (Sapolsky, 2004). Other factors include the timing and duration of social stress as well as the saliency of the stress to the individuals (Flinn, 2006). Overall, the consensus from the research is that there is a relationship between social hierarchies and stress, but these studies have produced mixed results. In particular, it appears different social positions respond to stress differently with some studies showing dominant individuals having a stronger physiological response to hierarchical systems while others show that it is subordinate individuals having a stronger response (Davis, Donzella, Krueger, & Gunner, 1999; Ostner, Heistermann, & Schulke, 2008; Poisbleau, Fritz, Guillon, & Chastel, 2005). This difference in response may be differentially related to stress or arousal related to opportunities, dependent on the perception of the individual and her/his phenotype (Ellis, Essex, & Boyce, 2005; Nesse & Young, 2000). The literature lacks a comprehensive view of sex differences in social positioning, as well as how developmental history might impact health and overall status. Information on some components of stress, such as prenatal environment, may lead to a better understanding of long-term health outcomes and social strategy usage.

The current study aids in this knowledge by examining the developmental trajectory of the relationship of self-reported social positioning, social strategy usage, temperament, prenatal testosterone exposure (using 2nd to 4th digit ratio, 2D:4D), early life stress experiences, and health in three age groups.

CHAPTER II

REVIEW OF LITERATURE

Defining Dominance

One important concept in social hierarchies is social positioning. In particular, individuals that are seen at the top of the social hierarchy are often seen as popular, leaders, and/or dominant. Social dominance is based on hierarchical group-based systems of inequality (Pratto, Sidanius, Stallworth, & Malle, 1994) and involves leadership and prominence or visibility within the hierarchy (Hawley, 2014). The individualist perspective suggests that we align with social networks in part because of what they can do for us. However, there is a dualism in human motivation and behavior. Competitive forces give rise to both antagonistic and other oriented behavioral strategies (Hawley, 2008). The theoretical perspective of Resource Control Theory provides a context to understand both competitive and cooperative behavior within social status striving.

Resource Control Theory describes strategy usage in order to control and

manipulate social resources within the hierarchy (Hawley, 2014). We can examine this perspective further through the Social Centrality Hypothesis which states, aggression in the service of effective resource control can not only be effective but also appealing to the social group, such that peers gravitate towards the effective resource controller. A subset of aggressors can be socially skilled and socially appealing. The benefits of associating with these individuals may outweigh the costs (Hawley, 2008). Resource Control Theory examines the function of social dominance over the form. For example, which social strategy is more beneficial in a given context? In some instances it is adaptive to use aggression and in other instances cooperation is more beneficial (Hawley, 2011). So, two very different behaviors can have the same goal (attainment of social resources), and be used by the same individual, with the variation attributed to context.

Hawley and colleagues have defined five resource control strategy types based on social strategy usage: noncontrollers, typical controllers, prosocial controllers, coercive controllers, and bi-strategic controllers (Hawley, 2003). Hawley defines these groups based on self-reported, peer-reported, or parent/teacher-reported use of prosocial and coercive strategies for resource obtainment. Directly competitive behaviors, such as coercive strategies (making others or forcing others to follow plans) begins early and is followed at four to five years of age with indirectly competitive behaviors, such as prosocial strategies (helping, cooperation, and reciprocation (Hawley, 2008). Noncontrollers score lower than 33% on prosocial and coercive strategies. Typical controllers score less than 66% on both but, only in the lower 33% of one. Prosocial controllers score 66% or above on prosocial strategies but lower on coercive. Coercive controllers score 66% or above on coercive strategies but lower on prosocial strategies.

Finally, bi-strategic controllers score 66% or above on both coercive and prosocial strategies.

Socially dominant individuals often use both coercive and prosocial strategies (bi-strategic controllers) in order to gain and maintain resources (Hawley, 2008; Roseth, et al., 2011). Resources may be anything from money, time, support, or assistance. For example, often individuals that are bi-strategic will both assist others and control others in order to gain and maintain the resources they are interested in. This bi-strategic behavior often leads to the individual not necessarily being liked by most, but being perceived as socially prominent or dominant. Bi-strategic individuals are rated by peers as being high on intimacy and fun, but also high on conflict and aggression (Hawley, Little, & Card, 2007). It is, perhaps, this social strategy that might be most interesting in terms of effective control of social resources and associated physiological correlates due to their social focus, flexible strategy use, and ability to effectively wield social power (Hawley, Little & Pasupathi, 2002).

Temperament/Personality and Social Positioning

Studies have found a variety of temperament and personality traits related to social dominance. Often characteristics such as extraversion are studied in relationship to top social positions. Extroverted individuals reported the largest personal network size (Vanbrabant, et al., 2012) and the combination of extraversion and emotional stability was related to the largest amount of observed popularity (van der Linden, Scholte, Cillessen, Nijenhuis, & Segers, 2010). However, other components of personality may play a large role in resource obtainment within the hierarchy. In particular, increased conscientiousness and effortful control is related to improved social and career status as

well as the use of both prosocial and coercive strategies (bi-strategic), possibly enabling the best contextual usage of prosocial or coercive strategies related to an ever-changing social context (Hawley, Little, & Pasupathi, 2002; Massey, Byrd-Craven, Auer, & Swearingen, 2014). Similarly, overt aggression was found to be related to conscientiousness in high school individuals that were bi-strategic (Massey, Byrd-Craven, Auer, & Swearingen, 2014). It appears that conscientiousness is not only related to the type of strategy used, but is related to being able to use that strategy at the best time, consistent with the Social Centrality Hypothesis (Hawley, 2008).

Testosterone and Social Positioning

Many biological components are related to social positioning and how an individual responds to social interactions. One primary component is sex hormones or sex steroids. Sex hormones include androgens (primarily testosterone), estrogens (primarily estradiol), and progestogens. Progesterone can be converted to testosterone and testosterone is a precursor to estradiol, therefore, all hormones are present in both sexes (Mazur & Booth, 1998). For the purpose of this paper, testosterone will be the primary hormone discussed.

Hormonal exposure primarily takes place at two times during the life cycle. The first time is prenatally when the developing fetus is exposed to surges of fetal androgens, which influence the organization of the brain through changes in the density of neurons and pattern of dendritic growth (Archer, 1991). During approximately 12 to 18 weeks gestation, fetal testosterone enters the amniotic fluid from diffusion through the fetal skin and later it enters the fluid via fetal urine (Robinson, Judd, Young, Jones, and Yen, 1977; Nagamani, McDonough, Ellegood, and Mahesh, 1979). Androgens are present in the

first trimester, with high expression in the temporal cortex. Prenatal androgens (testosterone) affect neural development by averting programmed cell death, influencing neural connectivity, and altering neurochemical profiles in areas of the brain such as the cerebral cortex, cerebellum, Medio basal hypothalamus, amygdala, corpus callous, and the cingulate cortex (Baron-Cohen, Knickmeyer, and Belmonte, 2005). Additionally, there is evidence that fetal testosterone may lead to individual differences in cerebral lateralization (Baron-Cohen, 2004) and that androgen binding is higher in the right frontal lobe and left temporal lobe in males. Overall, the male brain is more strongly lateralized than the female brain. The amount of prenatal testosterone exposure has also been shown to be related to sex differences concerning motor skills, spatial and mathematical abilities, verbal abilities and even interest in rough and tumble play (Baron-Cohen, et al., 2004). Testosterone in-utero can increase aggressive vigilance later in life by up-regulation of vasopressin gene expression in the amygdala and reduced prefrontal control (Terbrug and van Honk, 2013), which been shown to be related to social behavior.

The second time period in which hormonal exposure takes place is during puberty and is 'activational' (Archer, 1991). At both time periods, hormone production can be impacted by stress, alcohol use, and smoking (Baron-Cohen, Lutchmaya, and Knickmeyer, 2004). There are two major theories involving how testosterone influences behavior. The basal theory states that testosterone shows heritable variation and is stable overtime. The reciprocal theory states that testosterone is impacted by context. Both stable, genetic differences and contextual cues, of course, impact how testosterone will influence behavior (Mazur and Booth, 1998). Testosterone creates changes in the

amygdala and hypothalamus resulting in differential gene expression. This is often related to reduced orbitofrontal cortex-amygdala connectivity. Testosterone can increase general reward sensitivity through up-regulation of the dopamine system. It may also decrease fear vigilance by effecting the HPA axis and GABA receptors (Terburg and van Honk, 2013).

2D:4D

Prenatal testosterone exposure can be most accurately studied through amniocentesis; however, amniocentesis is risky to both the fetus and mother, and thus is not always conducted. A less invasive measure is available--the ratio of length between the second and fourth finger digits (i.e., 2D:4D). One study examined 29 children and compared 2D:4D to fetal testosterone (FT) and estradiol (FE) levels that were obtained from amniocentesis. Results revealed that spearman rank test found a negative association between 2D:4D and FT/FE ($r = -.47$, $z = 2.49$, $p = .01$) (Lutchmaya, Baron-Cohen, Raggatt, Knickmeyer, and Manning, 2004). In addition, an experimental task on rat pups found that the group with increased prenatal testosterone treatments had increased 2D:4D on both left front paws (Talarovicova, Krskova, & Blazekova, 2009). Overall, findings reveal that 2D:4D is related to prenatal testosterone exposure and therefore this has become the primary means for studying the amount of exposure.

2D:4D ratios are examined through hand scans or photographs. Participants are asked to remove all rings and sit straight while placing both hands flat on a color laser scanner, or palm up and flat for a photograph. The scanned hand images are then studied using a digital Vernier caliper to measure the second digit (index finger) and fourth digit (ring finger) to the nearest hundredths of a millimeter. Measurements are taken from the

innermost proximal crease up to the fingertip. To get a ratio, the 2D measurement is divided by the 4D measurement (Lutchmaya, et al., 2004; Trivers, Manning, and Jacobson, 2006). It has been shown that a smaller 2D:4D is related to increased exposure to prenatal testosterone (Baron-Cohen, et al., 2004). The 2D:4D remains stable overtime (Trivers, et al., 2006). Garn, Burdi, Babler, and Stinson (1975) have shown that the formation of the digits in utero occurs by 13 weeks, and the bone-to-bone ratio is consistent from this point into an individual's adulthood. The 2D:4D has also been shown to be related to fetal growth, hand preference, autism, Asperger's syndrome, sperm counts, family size, age at myocardial infractions in men and breast cancer in women (Lutchmaya, et al., 2004). Other works have also shown 2D:4D to be related to personality dimensions (such as cooperation, aggression, and impulsivity sensation seeking), similar to testosterone studies later in life.

2D:4D and Dominance

The 2D:4D ratio has been shown to be associated with a variety of personality traits and characteristics. Circulating levels of testosterone is often linked with aggression; however, examination of the literature shows mixed results. Lower 2D:4D has been shown to be related to increased aggression, impulsivity, sensation seeking, and increased physical fitness (Honekopp, Mannin, & Muller, 2006; van der Meij, Almela, Bunk, Dubbs, and Salvador, 2012; Vermeersch, et al, 2010;Wacker, Mueller, & Stemmler, 2013). In addition, lower ratios have been seen to be related to unprovoked attacks during a simulated war game for males and females (McIntyer, Barrett, McDermott, Johnson, Cowden, and Rosen, 2007). Interestingly, it appears that lower 2D:4D is also related to increased cooperation (Millet and Dewitte, 2006). However, this

cooperation was observed in the context of coalitional social interactions which often can elicit a cooperative response (Geary, Byrd-Craven, Hoard, Vigil, & Numtee, 2003). Males and females with congenital adrenal hyperplasia (CAH; which is caused by atypical levels of prenatal androgens) show different personality characteristics from individuals without this disorder. Females with CAH were reported as less empathetic and had greater physical aggression than the control group, while males with CAH were less dominant, more empathetic, and had less physical aggression than the control group (Mathews, Fane, Conway, Brook, & Hines, 2009).

Recent literature has suggested that the organizational effects of pre-natal testosterone may impact a variety of behaviors (Wacker, Mueller, & Stemmler, 2013). Some research in non-human animals has shown that the 2D:4D ratio is related to increase in dominance. For example, two studies showed that female rhesus macaques and female baboons with lower 2D:4D ratios had higher ranking in the group (Howlett, Marshall, and Hughes, 2012; Nelson, Hoffman, Gerald, and Shultz, 2009). In humans, aggressive dominance was related to 2D:4D ratio, but sociable dominance was not (van der Meij et al., 2012).

Viewing social dominance using the Social Centrality Hypothesis and tactical strategy usage might help clarify the results on testosterone and dominance. For example, physical aggression may or may not be seen in status related encounters. Also, cooperation may play a role in dominance but only in certain circumstances. Supporting this idea, Burton, Bolt, Hadjikyriacou, Silton, Kilgallen, & Allimant (2011) found a significant relationship in males between smiling and relational aggression and in females, the use of smiling and flirtation to "make people receptive to my ideas" was

associated with a more male-typical 2D:4D finger length ratio pattern as well as a trend for flirtation to be associated with greater physical aggression. Additionally, one study found that more male typical (or lower) 2D:4D ratios were related to emotional stability, especially for females (Lindová, Hrušková, Pivoňková, Kuběna, & Flegr, 2008). This may mean greater control of emotions and allowing for flexible strategy use, and therefore to be viewed more positively by others. Taken together, these findings indicate that it is plausible that dominance (bi-strategic controllers) may be related to prenatal testosterone.

Dominance and social positioning are a necessity of hierarchies in any cooperative social species. The need for hierarchies has led to a circulatory problem of hierarchies and stress. For example, social positioning in some hierarchies may create groups with more physical and psychological stress and this may lead to chronically high cortisol output and a risk for many health problems (Sapolsky, 2004). It is important to look at not only what creates social positioning but, how associated stress responses might impact health and if these aspects change with age or sex of the individuals.

Status, Stress, and Health

Many social interactions in human and non-human animals elicit physiological reactions, exhibiting a biological sensitivity to social contexts or psychosocial stress response (Boyce & Ellis, 2005; Ellis, Essex, & Boyce, 2005). Activity in the HPA axis has been of particular interest to psychological science due to its central role in the maintenance of homeostatic regulatory processes of the body in response to changing environmental stimuli (McEwen, 1998). As one component of the hierarchically organized stress response system (SRS) (Del Giudice, Ellis, & Shirtcliff, 2011), the HPA

axis appears to be particularly sensitive to social stimuli (Dickerson & Kemeny, 2004). Stimuli that are interpreted as posing a physical or psychological threat, are challenging, and may stimulate the HPA axis to release glucocorticoids (Nesse & Young, 2000), in primates primarily taking the form of cortisol (Sapolsky, Romero, & Munck, 2000). Indeed, social challenges have been demonstrated to reliably stimulate the release of cortisol (for review, see Dickerson & Kemeny, 2004), particularly those perceived as having the potential for gain or loss of social resources (Nesse & Young, 2000). Social hierarchies represent a specific source of psychosocial challenge that has been associated with neuroendocrine reactivity (Flinn, 2006; Sapolsky, 2004).

Studies on animals have shown a link between social positioning and cortisol (or corticosterone) levels, although results do vary according to sex, social structure, temperament of the group and stability of the hierarchy (Czoty, Gould, & Nader, 2009; Poisbleau, et al., 2005; Sapolsky, 2004). In human studies, cortisol levels have been studied in school age children. Results revealed that cortisol response was related to extroversion and associated with a larger response than family socioeconomic status (Bruce, Davis, & Gunner, 2002; Davis, et al., 1999; West, Sweeting, Young, & Kelly, 2010).

Cortisol is an integral part of dealing with the ups and downs of everyday life by influencing the amount of energy released, the immune activity, and the level of mental alertness, memory, and learning (Flinn, & England, 1995; McEwen, 1998). The HPA system appears to be responsive to stressors that involve socio-evaluative threat (Dickerson & Kemeny, 2004). This underscores the importance of examining individual variability in how this system reacts to naturally occurring socio-evaluative stressors. Studies have

shown that lack of social support, or gaps in social support networks are related to an increase in overall HPA activity (Taylor, Klein, Lewis, Gruenewald, Gurung, & Updegraff, 2000). However, if the HPA system is activated repeatedly, without opportunity for recovery, it is associated with some costs. Chronic stress, and thus HPA activity, can be a risk factor for a variety of illnesses including auto-immune disorders, mental illness, hypertension, digestion problems, irregular ovulatory cycles, irritable bowel syndrome, erectile dysfunction, muscle atrophy, fatigue, increased morbidity and many other problems (Sapolsky, Romero, & Munck, 2000; Sapolsky, 2004). Overall, studies have shown psychosocial stressors can result in chronic HPA activation which results in immune suppression leading to a variety of negative health consequences (Flinn & England, 1995; McEwen, 1998: Sapolsky, 2004).

Sex Differences in Social Hierarchies and Psychosocial Stress Response

Men and women view and express social dominance differently. In one study, it was found that the greater the female identified with being a female the lower she rated social dominance orientation. The opposite was found for males (Wilson and Liu, 2003). Also, males have been reported to supported group based dominance more than females (Pula, McPherson, & Parks, 2012). Geary and colleagues (2003) proposed that accompanying selection pressures (for example, male philopatry) for boys and men favored the evolution of large, competitive coalitions and this results in the formation of within-coalition dominance hierarchies. Dominance within these groups is seen to be highly related to overt aggression (physical and verbal) and coalitional support (Rose, Swenson, & Waller, 2004). Several studies showed that dominant males acted more physically aggressive and the subordinate males were more affected by social stress (Czoty, Gould,

& Nader, 2009; Poisbleau, et al., 2005). However, men also use relational aggression when physical aggression is not socially sanctioned (Geary, Byrd-Craven & Massey, 2014). Females are often socialized to positively affiliate with others, most likely reflecting exaggeration of predispositions toward sociability (Geary, 2010). Often females use relational aggression (i.e. excluding others and spreading rumors) in threatening social situations to disrupt social networks of competitors and thereby gain resources but still maintain their reputation (Crick & Nelson, 2002; Geary, 2010; Geary, et al., 2003; Rose, Swenson, & Waller, 2004). In addition, girls are often more distressed by relational aggression than are boys (Paquette & Underwood, 1999).

Female hierarches are often seen as unstable and studies have found females at the top hierarchical position often have the highest concentration of cortisol (Kornienko, Clemans, Out & Granger, 2013; Massey, et al., 2014; Savin-Williams, 1978). One possible interpretation of this finding is that HPA activity may facilitate socially dominant adolescent girls and women vying for the dominant position, due to the unpredictable nature of that position on the hierarchy. For men, hierarchies are viewed as more stable and often the subordinate males have higher levels of cortisol, creating better attentional focus for movement within the group (Massey, et al., 2014).

Sex differences account for a considerable degree of difference in response to social stress reactivity. Males show more of a physiological response to an achievement stressor and females show more of a physiological response to social rejection stressors (Stroud, Salovey, & Epel, 2002). Males' response to stress has been referred to as fight-or-flight (Cannon, 1932). Fight-or-flight responses involve two systems. The primary responding system is the sympathetic nervous system and the HPA is more delayed in responding

(McEwen, 1998; Nesse & Young, 2000). "Tend-and-befriend" behavioral response to stress is often demonstrated by women (Taylor, et al., 2000). Tending is nurturing behavior designed in order to protect oneself and their offspring. This is often seen when individuals form (small) coalitions to provide and receive protection during threatening events. Befriending is creating and maintaining social systems. Geary and Flinn (2002) expanded on Taylor's theory by adding that men also tend and befriend but, perhaps not as often as women. Although studies have shown differences in males and females response to social stressors, the current body of literature lacks a comprehensive study of how social stressors, such as social positioning, might impact the health of males and females differently.

Current Studies

The current literature on social hierarchies, stress, temperament, prenatal testosterone and health outcomes is vast. However, there are significant gaps in the literature that this study addressed. Additional research is needed to determine the characteristics and traits that create social positioning and if prenatal testosterone might be precursor for dominance. Research is also needed to determine how status affects stress-related health outcomes, as this is one of the primary mechanisms through which health disparities originate. Finally, these aspects need to be further examined to determine the impact of sex and age.

The current study uses a developmental cross-sectional study in order to examine the relationship between self-reported social positioning, temperament, social strategy usage, early life stress experiences, prenatal testosterone exposure, and health in childhood (10-12 year olds), emerging adulthood (college students), and adulthood (adults in the workplace).

It was predicted that the 2D:4D ratio would be related to health based on the previous literature regarding the developmental outcomes of prenatal testosterone exposure (Honekopp, Manning, & Muller, 2006). It was predicted that those individuals using a combination of prosocial and coercive social strategies (bi-strategic controllers) would have greater health (Hawley et al., 2007; Massey, Byrd-Craven, & Swearingen, 2014). In addition, it was predicted that personality traits such as effortful control (and its components, i.e. activation control), would be related to better health (Massey, et al., 2014; Hawley, Johnson, Mize, & McNamara, 2007). Finally, it was predicted that those individuals self-reported as dominant would use a combination of prosocial and coercive strategies (bi-strategic) (Hawley, 2003).

Study One

The current study examines the relationship between testosterone exposure in the prenatal environment (through the 2D:4D finger digit ratio), self-reported social positioning, temperament, social strategy usage, early life stress experiences, and health in childhood (10-12 years old). Specific hypotheses include the following:

- It was predicted that the 2D:4D ratio would be related to health, based on the previous literature regarding the developmental outcomes of prenatal testosterone exposure (Honekopp, Manning, & Muller, 2006).
- It was predicted those using a combination of prosocial and coercive social strategies (bi-strategic controllers) would have greater health (Hawley et al., 2007; Massey, et al., 2014).

- In addition, it was predicted that personality traits such as effortful control, would be related to increased health (Massey, et al., 2014; Hawley, et al., 2007).
- Finally, it was predicted that those individuals self-reported as dominant would use a combination of prosocial and coercive strategies (bi-strategic) (Hawley, 2003).

Study Two

The current study examines the relationship between testosterone exposure in the prenatal environment (through the 2D:4D finger digit ratio), self-reported social positioning, temperament, social strategy usage, early life stress experiences, and health in emerging adulthood (college students). Specific hypotheses include the following:

- It was predicted that the 2D:4D ratio would be related to health, based on the previous literature regarding the developmental outcomes of prenatal testosterone exposure (Honekopp, Manning, & Muller, 2006).
- It was predicted those individuals using the combination of prosocial and coercive social strategies (bi-strategic controllers) would have greater health (Hawley et al., 2007; Massey, et al., 2014).
- In addition, it was predicted the personality traits of effortful control (and its components, i.e. activation control), would be related to better health (Massey, et al., 2014; Hawley, et al., 2007).
- Finally, it was predicted that those individuals self-reported as dominant would use a combination of prosocial and coercive strategies (bi-strategic) (Hawley, 2003).

Study Three

The current study examines the relationship between prenatal testosterone exposure (through the 2D:4D finger digit ratio), self-reported social positioning, temperament, social strategy usage, early life stress experiences, and health in adulthood (adults in the workplace). Specific hypotheses include the following:

- It was predicted that the 2D:4D ratio would be related to health, based on the previous literature regarding the developmental outcomes of prenatal testosterone exposure (Honekopp, Manning, & Muller, 2006).
- It was predicted those individuals using the combination of prosocial and coercive social strategies (bi-strategic controllers) would have greater health (Hawley et al., 2007; Massey, et al., 2014).
- In addition, it was predicted that personality traits such as effortful control, would be related to increased health (Massey, et al., 2014; Hawley, et al., 2007).
- Finally, it was predicted that those individuals self-reported as dominant would use a combination of prosocial and coercive strategies (bi-strategic) (Hawley, 2003).

CHAPTER III

METHODOLOGY

Common Method

Measures

Demographic Questionnaire – This questionnaire assessed age, sex, handedness, and popularity rank of individual on a scale of 1 to 5.

Resource Control Strategies Inventory (RCSI) – This was used to assess characteristics of resource control, resource obtainment, and popularity. All questionnaires were completed based on the participant average behavior. This questionnaire is a modified version of the resource control strategy assessment with a reliability of .78 to .88 (Hawley, et al., 2007).

Rothbart's Temperament Questionnaires – (Short Forms) Assessments of temperament that include general constructs of effortful control (activation control), negative affect, extraversion/surgency, and orienting sensitivity. Reliabilities were above .60 for all scales (Capaldi & Rothbart, 1992; Evans and Rothbart, 2007).

Health and Wellness Questionnaire – Assessment of how often in the last 6 months the person has been ill, and how often they have missed school or work. This questionnaire included the standardized RAND 36-Item Health Inventory that assesses physical and emotional well-being with an internal consistency of .81 and a test-retest reliability of .89 (Brouwer et al., 2007).

Adverse Childhood Experience (ACE) – Assessment of stressful or negative experiences that occurred during the childhood period (Felitti, et al., 1998). The ACE shows a test-retest reliability of .52 to .72 (Dube, et al., 2004).

Procedures

All participants were asked to sign the informed consent and then complete a packet of questionnaires. Upon completion of the questions, participants were asked to remove all rings and a straight line was drawn on their hands on the innermost proximal crease of the 2nd and 4th digit. Participants' hands were then scanned or photographed. The hand images are then studied using a digital Vernier caliper to measure the second digit (index finger) and fourth digit (ring finger) to the nearest hundredths of a millimeter. Measurements were taken from the innermost proximal crease (line drawn) up to the fingertip. To get a ratio, the 2D measurement is divided by the 4D measurement (Lutchmaya, et al., 2004; Trivers, Manning, and Jacobson, 2006).

Study One

Participants

Twenty-one children (males n = 14, females n = 7, age range 10-12) participated in the study and were recruited from a variety of locations including, girl scouts, church groups, and sporting groups.

Measures

All measures were listed in the common methods section. Three questions were removed from the Adverse Childhood Experiences questionnaire in order for more open responses from the parents (Did an adult or person at least 5 years older than you ever….Touch or fondle you or have you touch their body in a sexual way? OR Attempt or actually have oral, anal, or vaginal intercourse with you?.... Did a parent or other adult in the household often or very often…..Push, grab, slap, or throw something at you? OR Ever hit you so hard that you had marks or were injured?, Was your mother or stepmother: Often or very often pushed, grabbed, slapped, or something thrown at her? OR Sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard? OR Ever repeatedly hit over at least a few minutes or threatened with a gun or knife?). The version of the Rothbart's Temperament Questionnaire that was used for this age group is the Early Adolescent Temperament Questionnaire revised (EATQ-R).

The Early Adolescent Temperament Questionnaire revised (EATQ -R) – (adolescents) a highly differentiated assessment of temperament in adolescents with convergent reliabilities between parent and child reports being above .60 for all scales (Capaldi & Rothbart, 1992).

Procedure

Teachers, leaders, coaches, and supervisors were asked if children could take place in a study involving status, temperament, strategies, stress and health. After the person in charge of the group signed consent, parents and children were asked to sign a consent form as well. Parents were then asked to complete all questions previously

mentioned in the general methods. In addition, the child was asked to complete an additional copy of the modified version of the Resource Control Strategies Inventory.

Plan of Analysis

To test the first hypothesis, that the 2D:4D ratio would be related to health, participants' digit ratios in right hands were entered in a linear regression to determine if they predicted health (RAND-36). Additionally, participants' digit ratios in the left hand were entered in a linear regression to determine if they predicted health (RAND-36).

To test the second hypothesis, that individuals using a combination of prosocial and coercive social strategies (bi-strategic controllers) would have greater health, participants' scores on two prosocial questions from the RCSI were summed and scores on two coercive questions from the RCSI were summed. In order to determine bi-strategic controllers, the scores for prosocial and coercive were summed (Hawley, et al., 2007). A linear regression was conducted with bi-strategic strategy usage predicting health (from the RAND-36).

In order to test the third hypothesis, that personality traits such as effortful control, would be related to increased health, scores of effortful control, from the EATQ-R, were entered in to linear regression as a predictor variable to health (RAND-36).

Finally, in order to test the fourth hypothesis, that those individuals self-reported as dominant would use a combination of prosocial and coercive strategies (bi-strategic), participants' scores on two prosocial questions from the RCSI were summed and scores on two coercive questions from the RCSI were summed. In order to determine bi-strategic controllers, the scores for prosocial and coercive were summed. A linear

regression was conducted with bi-strategic strategies predicting dominance (self-reported social positioning).

Study Two

Participants

One hundred and ninety undergraduates participated in the study and were recruited through a subject pool website and given research credit for participating (males n = 85, females n = 104, age range 18-26).

Measures

All measures were listed in the common methods section. The version of the Rothbart's Temperament Questionnaire that was used was the ATQ.

> *The Adult Temperament Questionnaire (ATQ)* – (adults) a highly differentiated assessment of temperament in adults with reliabilities as assessed by coefficient α for 13 of 18 of the temperament scales reaching a level of .80 or higher, and only one scale was lower than .70 (Evans & Rothbart, 2007).

Plan of Analysis

To test the first hypothesis, that the 2D:4D ratio would be related to health, participants' digit ratios in right hands were entered in a linear regression to determine if they predicted health (RAND-36). Additionally, participants' digit ratios in the left hand were entered in a linear regression to determine if they predicted health (RAND-36).

To test the second hypothesis, that individuals using a combination of prosocial and coercive social strategies (bi-strategic controllers) would have greater health, participants' scores on two prosocial questions from the RCSI were summed and scores on two coercive questions from the RCSI were summed. In order to determine bi-

strategic controllers, the scores for prosocial and coercive were summed. A linear regression was conducted with bi-strategic strategy usage) predicting health (from the RAND-36).

In order to test the third hypothesis, that personality traits such as effortful control would be related to increased health, scores for effortful control, from the EATQ-R, were entered in to linear regression as a predictor variable to health (RAND-36).

Finally, in order to test the fourth hypothesis, that those individuals self-reported as dominant would use a combination of prosocial and coercive strategies (bi-strategic), participants' scores on two prosocial questions from the RCSI were summed and scores on two coercive questions from the RCSI were summed. In order to determine bi-strategic controllers, the scores for prosocial and coercive were summed. A linear regression was conducted with bi-strategic scores predicting dominance (self-reported social positioning). It was predicted those individuals using the combination of prosocial and coercive social strategies (bi-strategic controllers) would have greater dominance (Hawley et al., 2007; Massey, et al., 2014).

Study Three

Participants

Twenty-nine adults (males n = 9, females n = 20, age range 26-65) participated in the study and were recruited from a variety of workplaces. Adults were recruited in groups of four or more from workplaces such as plumbing shops, newspaper offices, and business offices.

Measures

All measures were listed in the common methods section. The version of the Rothbart's Temperament Questionnaire that was used was the ATQ.

The Adult Temperament Questionnaire (ATQ) – (adults) a highly differentiated assessment of temperament in adults with reliabilities as assessed by coefficient α for 13 of 18 of the temperament scales reaching a level of .80 or higher, and only one scale was lower than .70 (Evans and Rothbart, 2007).

Procedures

Researchers approached supervisors from several establishments and asked if individuals could take part in a study involving the prenatal environment, status, temperament, strategies, stress and health. After the supervisor signed consent, individuals in the workplace were asked to participant and consent to the study. Interested individuals then filled out a series of questionnaires as mentioned in the common methods and procedures section above.

Plan of Analysis

To test the first hypothesis, that the 2D:4D ratio would be related to health, participants' digit ratios in right hands were entered in a linear regression to determine if they predicted health (RAND-36). Additionally, participants' digit ratios in the left hand were entered in a linear regression to determine if they predicted health (RAND-36).

To test the second hypothesis, that individuals using a combination of prosocial and coercive social strategies (bi-strategic controllers) would have greater health, participants' scores on two prosocial questions from the RCSI were summed and scores on two coercive questions from the RCSI were summed. In order to determine bi-strategic controllers, the scores for prosocial and coercive were summed. A linear

regression was conducted with bi-strategic strategy scores predicting health (from the RAND-36).

In order to test the third hypothesis, that personality traits such as effortful control, would be related to increased health, scores from the EATQ-R were entered in to linear regression as a predictor variable to health (RAND-36).

Finally, in order to test the fourth hypothesis, that those individuals self-reported as dominant would use a combination of prosocial and coercive strategies (bi-strategic), participants' scores on two prosocial questions from the RCSI were summed and scores on two coercive questions from the RCSI were summed. In order to determine bi-strategic controllers, the scores for prosocial and coercive were summed. A linear regression was conducted with bi-strategic strategies predicting dominance (self-reported social positioning).

CHAPTER IV

FINDINGS

Study One Results

In order to determine the relationship between social strategies, personality traits, and health a series of linear regressions were conducted, as described above. Descriptive statistics can be found in Table 1. Table 2 is a list of all correlations between variables of interest.

The results for hypothesis one were that 2D:4D right ratio did not predict health ($F(1,14) = 2.92$, $p = .11$, $\beta = .43$). Additionally, 2D:4D left ratio did not predict health ($F(1,14) = 1.02$, $p = .33$, $\beta = .27$).

Related to hypothesis two, bi-strategic usage reported by the child did not predict health ($F(1, 19) = .34$, $p = .56$, $\beta = -.14$). Also, bi-strategic usage of the child, reported by the parents, did not predict health ($F(1, 20) = .38$, $p = .54$, $\beta = .14$).

The results for hypothesis three were that effortful control predicted decreased role limitations due to physical functioning ($F(1, 20) = 4.80$, $p = .04$, $\beta = .45$).

Regarding hypothesis four, there was no relationship found between bi-strategic usage reported by the child and dominance ($F(1, 20) = .54$, $p = .47$, $\beta = -.17$). Similarly, there was no relationship found between bi-strategic strategy usage of the child reported by the parent and dominance ($F(1, 20) = .75$, $p = .40$, $\beta = .19$). However, affiliation did predicted dominance ($F(1, 20) = 4.42$, $p = .05$, $\beta = .43$). In addition, dominance predicted increased social functioning related to health ($F(1, 20) = 10.22$, $p = .00$, $\beta = .59$). Interestingly, there was a significant negative correlation between parent-reported coercive behaviors of the child and child-reported coercive behavior usage ($r = -.49$, $p=.03$).

Table 1

Descriptive Statistics for Variables of Interest Study One

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Social Functioning	21	150.00	50.00	200.00	164.2857	47.80914
Role Limit Due to Physical	21	400.00	.00	400.00	361.9048	107.12698
Effortful Control	21	2.18	2.29	4.46	3.2446	.58571
ACE	21	4.00	.00	4.00	.5238	.92839
Child-Report Prosocial	21	7.00	3.00	10.00	6.8095	2.11232
Child-Report Coercive	20	3.00	2.00	5.00	2.7500	1.06992
Child-Report Bi-strategic	20	9.00	5.00	14.00	9.7500	2.12442
Parent-Report Prosocial	21	5.00	5.00	10.00	7.2381	1.37495
Parent-Report Coercive	21	4.00	2.00	6.00	4.4762	1.43593
Parent-Report Bi-strategic	21	7.00	9.00	16.00	11.7143	2.26148
Dominance (self-reported)	21	3.00	2.00	5.00	3.6667	.79582
Affiliation	21	2.83	2.17	5.00	4.0238	.64984
Right Ratio	15	.133	.883	1.016	.93840	.035432
Left Ratio	15	.152	.838	.990	.94280	.041828

Table 2

Summary of Correlational Analyses Study One

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Social Functioning														
2. Role Limit due to Physical	.04													
3. Effortful Control	.05	.45*												
4. ACE	-.01	-.04	-.11											
5. Child-reported Prosocial	.03	.12	.24	-.10										
6. Child-reported Coercive	-.22	-.18	-.07	.09	-.13									
7. Child-reported Bi-strategic	-.22	.07	.21	-.11	.87**	.39								
8. Parent-reported Prosocial	.04	.37	.43	-.10	.40	-.62**	.01							
9. Parent-reported Coercive	.30	.06	-.28	-.12	.26	- .49*	-.01	.29						
10. Parent-reported Bi-strategic	.21	.26	.09	-.14	.41	-.69**	.00	.80**	.81**					
11. Dominance	.59**	.25	.32	-.09	.08	-.34	-.17	.17	.15	.19				
12. Affiliation	.59*	-.22	.02	-.09	-.24	-.21	-.35	-.05	-.01	-.04	.43**			
13. Right Ratio	.07	-.09	.49	.17	.30	-.04	.25	.10	.06	.10	.48	.22		
14. Left Ratio	.21	-.06	. 45	-.30	.40	.25	.48	-.22	-.01	-.14	.17	-.02	.40	

Note: *p < .05, **p < .01

Study Two Results

In order to determine the relationship between life stressors, 2D:4D ratio, social strategies, personality traits, health and sex a series of linear regressions were conducted. Descriptive statistics can be found in Table 3. Table 4 shows correlations between variables of interest.

The results for hypothesis one were that decreased 2D:4D right ratio predicted a decrease in role limitations due to physical health ($F(1,180) = 11.51$, $p = .001$, $\beta = -.246$), but this was true for females ($F(1, 96) = 13.98$, $p = .000$, $\beta = -.36$) but not males (F (1,

83) = 3.24, p = .08, β = -.20). No statistical findings were observed for left hands (F (1,180) = .88, p = .35, β = -.07).

Regarding hypothesis two, reported bi-strategic use predicted physical functioning (a component of the RAND-36) (F (1,185) = 6.79, p = .01, β = .19).

The results for hypothesis three were that effortful control predicted individuals' health (F (1,188) = 5.03, p = .03, β = .16), energy (F (1,188) = 17.45, p = .00, β = .29), emotional wellbeing (F (1,185) = 15.35, p = .00, β = .28), and social functioning (F (1,189) = 12.79, p = .00, β = .25).

Regarding hypothesis four, bi-strategic use predicted dominance (F (1,189) = 44.41, p = .000, β = .437) and this was true for males and females.

In addition, activation control predicted individuals' reported use of prosocial strategies (F (1,189) = 9.45, p = .00, β = .22). Finally, exploratory analyses revealed life stressors before age 18 (as assessed by the ACE) were significantly related to the left hand 2D:4D ratio (F (1,182) = 5.08, p = .03, β = .165), but upon further analyses this was true for females (F (1, 96) = 6.15, p = .02, β = .247) but not males (F (1, 85) = .01, p = .93, β = .01).

Table 3

Descriptive Statistics for Variables of Interest Study Two

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Dominance (Self-reported)	190	4.00	1.00	5.00	3.4263	.88032
ACE	190	7.00	13.00	20.00	19.1579	1.44615
Role Limit due to Physical	188	100.00	.00	100.00	89.6277	23.95115
Energy	189	90.00	10.00	100.00	48.3545	18.19008
Emotional Well-being	186	87.20	12.80	100.00	68.6280	19.53593
Social Functioning	190	75.00	25.00	100.00	84.8026	18.63729
Health	189	59.60	20.80	80.40	61.3397	12.90609
Activation Control	190	4.86	2.00	6.86	4.9767	.96544
Effortful Control	190	19.33	16.33	35.67	27.7684	3.88838
Right Ratio	183	.93	.85	1.79	.9766	.07354
Left Ratio	183	.27	.88	1.15	.9833	.03645
Prosocial Strategies	190	8.00	2.00	10.00	7.5000	1.38682
Coercive Strategies	190	6.00	2.00	8.00	4.0105	1.56344
Bi-Strategic Strategies	190	13.00	5.00	18.00	11.5105	2.38767

Table 4

Summary of Correlational Analyses Study Two

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Dominance														
2. ACE	.11													
3. Role Limit due to Physical	.04	.2												
4. Energy	.07	.21**	.19**											
5. Emotional Wellbeing	.08	.17*	.15**	.49**										
6. Social Functioning	.09	.03	.31**	.34**	.49**									
7. Health	.08	.06	.25**	.28**	.26**	.26**								
8. Activation Control	.12	.19**	.05	.30**	.23**	.23**	.14*							
9. Effortful Control	-.02	.18*	.09	.29**	.28**	.25**	.16*	-.01						
10. Right Ratio	.12	-.19**	-.25**	-.19*	-.12	.01	-.04	.02	.81**					
11. Left Ratio	-.01	-.03	-.07	-.11	-.06	-.01	-.11	-.07	-.07	.40**				
12. Prosocial Strategies	.45**	.10	.08	.09	-.08	-.00	.07	.22**	.09	-.01	.00			
13. Coercive Strategies	.27**	.11	.03	.03	-.10	-.04	.04	-.07	-.12	-.07	-.03	.31**		
14. Bi-Strategic Strategies	.44**	.13	.07	.07	-.11	-.03	.07	.08	-.03	-.06	-.02	.78**	.83**	

Note: *p < .05, **p < .01

Study Three Results

In order to determine the relationship between social strategies, personality traits, and health a series of linear regressions were conducted. Descriptive statistics can be found in Table 5. Table 6 is a list of the correlations between variables of interest.

The results for hypothesis one were that 2D:4D right ratio did not predicted health ($F(1,14) = 2.92$, $p = .11$, $\beta = .43$). Additionally, 2D:4D left ratio did not predicted health ($F(1, 14) = 1.02$, $p = .33$, $\beta = .27$).

For hypothesis two, bi-strategic strategy scores were not related to health ($F(1, 28) = .70$, $p = .41$, $\beta = .16$) However, the use of prosocial skills predicted physical functioning ($F(1, 28) = 5.74$, $p = .02$, $\beta = .42$) and energy ($F(1, 28) = 7.48$, $p = .01$, $\beta = .46$).

Regarding hypothesis three, effortful control predicted physical functioning ($F(1, 28) = 7.28$, $p = .01$, $\beta = .46$) and energy ($F(1, 28) = 4.65$, $p = .04$, $\beta = .38$).

For hypothesis four, bi-strategic scores did not predict dominance ($F(1, 28) = 1.86$, $p = .18$, $\beta = .25$). However, the use of prosocial skills did predicted dominance ($F(1, 28) = 5.77$, $p = .02$, $\beta = .42$).

Table 5

Descriptive Statistics for Variables of Interest Study Three

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Dominance (Self-Reported)	29	3.00	2.00	5.00	3.6207	.77523
Prosocial Strategies	29	6.00	4.00	10.00	7.4138	1.26822
Coercive Strategies	29	6.00	2.00	8.00	4.2414	1.61809
Bi-Strategic Strategies	29	10.00	8.00	18.00	11.6552	2.39458
Effortful Control	29	49.00	56.00	105.00	84.0690	12.10056
Health	29	425.00	75.00	500.00	331.8966	91.09859
Physical Functioning	29	750.00	250.00	1000.00	846.5517	207.85084
ACE	29	4.00	.00	4.00	.8621	1.05979
Right Ratio	22	.158	.871	1.029	.96038	.040951
Left Ratio	22	.107	.914	1.021	.96741	.028363

Table 6

Summary of Correlational Analyses Study Three

	1	2	3	4	5	6	7	8	9	10
1. Dominance										
2. Prosocial Strategies	.42*									
3. Coercive Strategies	.05	.37*								
4. Bi-Strategic Strategies	.25	.78**	.87**							
5. Effortful Control	-.06	.27	.16	.25						
6. Health	-.15	.10	.16	.16	-.09					
7. Physical Functioning	.17	.42*	.03	.25	.46*	-.03				
8. ACE	.11	-.04	-.13	-.10	-.30	-.19	-.10			
9. Right Ratio	-.21	-.37	-.17	-.32	-.05	.04	-.42	-.33		
10. Left Ratio	-.06	-.18	-.10	-.17	.13	.19	-.19	-42	.61**	

Note: *p < .05, **p < .01

CHAPTER V

CONCLUSION

Study One Discussion

Hypothesis one was not supported. The sample size of this study was very small and not all hand images were collected. When examining 2D:4D ratios large samples are need because the variability is very small (Lutchmaya, et al., 2004). Therefore, the lack of findings is most likely due to the limited number of participants in this study.

The findings from this study show that, even in childhood, effortful control is related to better health. This finding is consistent with the third hypothesis. Previous studies have found long term affects relating to effortful control. Specifically, effortful control was correlated with the development of impulse control, self-regulation, and conscientiousness thereby facilitating healthier choices and better overall success (Hampson, Edmonds, Goldberg, Dubanoski, & Hillier, 2015; Kern, Friedman, Martin, Reynolds, & Luong, 2009). One possibility is that children scoring high on effortful

may make better health choices allowing for fewer limitations due to their physical health.

We did not find a relationship between social strategy usage and dominance so the fourth hypothesis was not directly supported. However, affiliation was related to increased dominance. Affiliation is one aspect of prosocial skills and previous research has shown affiliation relating to social dominance, especially for children (Roseth, et al., 2011). In addition, one study found that social dominance was related to the combination of aggression and reconciliation early in the school year and by spring social dominance was related to affiliation (Pellegrini, et al., 2011). The current study was conducted in the spring semester of the school year. Other studies have reported that it is not affiliation alone which creates social dominance, but the combination of effective aggression and affiliation (Roseth, Pellegrini, Bohn, Ryzin, & Vance, 2007). The children in the current study did not report using a large number of coercive strategies. However, interestingly, parents reported their children using coercive strategies at a much larger rate. It may be that the children are choosing the socially desirable answer, or that they may be less aware of their coercive behavior. Previous studies have found that bi-strategic controllers use the social strategies at the appropriate times and therefore are not often observed using coercive strategies (Massey, et al., 2014). It may be that by early childhood they begin to not only hide coercive actions, but fail to report them as well.

We did not find a direct link between social strategy usage and health. However, as mentioned previously, affiliation (a component of prosocial strategies) was related to dominance. Additionally, in the current study dominance was related to increased social functioning relating to health. More specifically, increased dominance is related to an

increase in health resulting in improved social interactions. This supports hypothesis two and is supported by previous studies (Massey, et al., 2014).

Study Two Discussion

It appears that the prenatal environment and personality traits may impact physical functioning and other areas of health thereby influencing social status later in life. We know from previous research that individual's cumulative psychosocial stress level may impact overall health and health has been associated with social positioning. However, this is the first study to our knowledge that combines the effects of prenatal hormone exposure with health and social positioning.

The results from the current study revealed a unique result, that the ACE life history stressors were related to a more female typical or larger 2D:4D ratio, in females. Although, the explanation of this finding is unclear, one possible explanation for this finding is that a stressful prenatal environment created less testosterone thereby creating a higher ratio. Evidence has shown that individuals often exhibit a biological sensitivity to context (Boyce & Ellis, 2005), even prenatally. This sensitivity involves psychobiological mechanisms that monitor specific features of early environments as a basis for calibrating the development of stress response systems to adaptively match those environments. In this instance, it may be that the stressful (as observed by the ACE) prenatal and postnatal environment creates not only a change in the stress response system but, in the amount of testosterone produced by the mother and by the fetus. Although the stress of the prenatal environment was not tested, there is often a correlation between stressful prenatal and postnatal environments (Boyce & Ellis, 2005). Prenatal testosterone levels are affected by stress, alcohol use, smoking and spacing of births

(Dorner et al., 1987). Prenatal stress in male rats shows a reduced testosterone level compared to the controls (Stahl, Gotz, Poppe, Amendt, & Dorner, 1978). Additionally, maternal testosterone levels during pregnancy influence daughters' testosterone levels in the next generation (Kandel & Udry, 1999). This may mean that it is not only the current prenatal environment, but environments and experiences of previous generations that may impact the development of the fetus and specifically the 2D:4D ratio.

Another finding from the current study is that a more male typical or lower 2D:4D ratio in females was related to a decrease in role limitations due to physical health (as examined through the RAND). This is consistent with the first hypothesis, as well as, previous literature. For example, decreased 2D:4D ratio was found to be related to an increase in the physical fitness grades of males and females (Honekopp, Manning, & Muller, 2006). For females specifically, a lower 2D:4D ratio was found to be related to increased physical fitness (Paul, Kato, Hutkin, Vivekanandan, & Spector, 2006).

When examining physical functioning through the RAND, results also revealed that an increase in reported physical functioning was related to increased bi-strategic use, this is consistent with the second hypothesis. In a study with preschool children, it was found that preschoolers' health in the last six months was positively related to how often they used prosocial and coercive social strategies (bi-strategic) (Massey, et al., 2014). Similarly, physical attractiveness in preschoolers was positively related to bi-strategic use (Hawley et al., 2007). Physical attractiveness can be a proxy measure for health, as symmetry and developmental consistency are associated with health and are often seen as physically attractive. However, the direction for this finding remains unclear. It is possible that better health is related to more effective social strategy usage. It is also

possible, that that effective social strategy usage can lead to better health. Further studies are needed to determine the direction.

Temperament characteristics involving effortful control were related to not only social strategies but improved health as well. Activation control was related to increased use of prosocial strategies. Activation control is a subcomponent of effortful control and involves the capacity to perform an action where there is a strong tendency to avoid it. This is consistent with the Social Centrality Hypothesis (Hawley, 2003). Individuals may not want to act in a prosocial manner, but they may view this choice of strategy as most appealing for social status and resource control. As predicted by the third hypothesis, effortful control was related to a host of health related functions including energy, emotional wellbeing, and social functioning. It appears that perhaps the effective usage of social strategies, through effortful control, enables individuals to not only gain and maintain social positioning but, remain in better health as well.

Finally, bi-strategic use was related to social dominance, as predicted by the fourth hypothesis. This has been reported in many previous studies (Hawley, 1999; Hawley & Geldhof, 2012; Hawley, et al., 2007; Massey, et al., 2014). Overall, it appears that dominance or social positioning did not show a direct link to 2D:4D ratios. However, it appears that perhaps a stressful prenatal/postnatal environment may result in a difference in physical functioning for females and greater health therefore may allow them to use social strategies effectively, through effortful control, and this may result in higher levels of social positioning.

Study Three Discussion

Hypothesis one was not supported. The sample size of this study was very small and not all hand images were collected. When examining 2D:4D ratios large samples are need because the variability is very small (Lutchmaya, et al., 2004). Therefore, the lack of findings is most likely due to the limited number of participants in this study.

The current study found a relationship between strategy usage and health. More specifically, the use of prosocial strategies was related to better physical functioning and energy. This is somewhat consistent with the second hypothesis. These findings are similar to the study mentioned above college students and the study previously discussed that was conducted on preschoolers (Massey, et al., 2014). However, it was not bi-strategic use (as predicted) that was associated with this improvement in health but, the use of prosocial strategies only. It is unclear if individuals use coercive strategies but do not report them, or if adults often refrain from coercive strategies and use only prosocial ones. In either case, it does appear that appropriate strategy usage is related to better health in adults.

As seen previously, effortful control was related to increased health, as predicted in the third hypothesis. More specifically, effortful control was related to increased physical functioning and energy. It appears that appropriate control and perhaps appropriate use of social strategies allows individuals to have better health. Similarly, health was related to social functioning. The direction of this finding is unclear. It may be that individuals with greater health have better social functioning. However, it may also be that better social functioning allows for better overall health.

The results of the current study also reveal that strategy usage is related to higher levels of social dominance. However, for adults it appears that coercive strategies do not lead to greater social dominance only prosocial strategies, this is somewhat consistent with hypothesis four. Previous research has found that strategies at an early age are often found to be coercive but, as the child grows prosocial strategies are viewed as more appropriate to use (Hawley, 1999). However, very few studies have been conducted on adults. One study did examine adults and found that greater popularity in the workplace was related to increased visibility or centrality and increase views of organizational citizenship behaviors. These views are primarily beneficial actions like prosocial strategies (Scott & Judge, 2009). One important caveat to mention is that all strategy usages for the current study were self-reported. It may be that adults realize the appropriate socially desirable response and therefore do not report using coercive strategies. Overall, it appears there is a link between social dominance, social strategy usage, effortful control, and health.

General Discussion

The current body of literature discusses many factors that affect social status or social hierarchies. Some of these factors are personality characteristics (Young and Bradley, 1998; van der Linden, et al., 2010) and social strategy usage (Hawley, 1999). In addition, social positioning can have a large impact on stress response thereby creating differences in health outcomes (Dickerson and Kemeny, 2004). Overall, the consensus from the research is that there is a relationship between social hierarchies, stress, and health. However, the literature neglects research in many developmental time periods. The current studies aid in this knowledge through a comparison of age and gender

differences in social dominance, prenatal environment, temperament traits, life stressors, and health (See Table Seven for an overview of findings).

The results of these studies show that at all developmental periods studied, social strategies are important to gain and maintain social positioning. It appears that in childhood and adulthood prosocial skills are the most valuable for social positioning while during emerging adulthood it is the use of both prosocial and coercive strategies. Previous literature has shown both prosocial and coercive strategies relate to dominance (Hawley, 2003; Hawley, et al., 2007). However, previous literature also shows that as a person develops overtime prosocial strategies are used more often than coercive strategies (Hawley, 1999). Future studies are required in order to determine if coercive strategies are used but, not reported, as at both those developmental time periods socially desirable answers are often given.

Previous literature, as well as the current study, also shows effortful control (and its sub-components, i.e. activation control) relating to the use of bi-strategic strategies (Hawley, 2003). Effortful control allows for the effective use of social strategies at the appropriate time. This may explain why previous research has shown behaviors such as coercive strategies in use among children while not reported by teachers (Massey, et al., 2014).

In addition, at all points in development studied here, effortful control was related to improved health. This is similar to previous literature in which effortful control was related to improved health and career status (Kern, et al., 2009). High levels of effortful control aid in the development of self-regulation, impulse control, and conscientiousness. This combination may allow for better health-promoting behaviors and fewer health-

damaging or risky behaviors. The combination of effortful control and effective social strategy usage appear also to be linked to improved health. Bi-strategic behaviors, used effectively at the best time, may have acute rather than chronic hypothalamic-pituitary-adrenal (HPA) activation, consistent with previous human and nonhuman work in this area (Sapolsky, 2004; Sapolsky, et al., 2000). This may result in better overall health due to less chronic stress system activation, and therefore less inflammation and immunosuppression. An alternative explanation is that those individuals with the best overall health are better able to utilize social strategies within their peer groups and construct interactions to their advantage (Gluckman & Hanson, 2005; Miller & Todd, 1998). Future studies are needed to help clarify the direction of these findings. One novel aspect involved in the current study was how digit ratio is related to adverse childhood experiences and health. Although these results should be interpreted with extreme caution, it appears that the childhood environment, and potentially the prenatal environment, may impact not only the stress response system of the individual but the organizational effects of testosterone and health outcomes.

Overall, it appears that social strategy usage is important at all ages to gain and maintain social positioning. In addition, effortful control allows for the effective use of social strategies at appropriate times. This may create less chronic HPA activation and therefore, improved overall health. In addition, social support creates a buffer to negative stress and thereby may enhance health indirectly. The prenatal environment may create a developmental trajectory allowing individuals to use or not use social strategies effectively and thereby influencing health. Significant findings were not obtained for the middle childhood or adult sample because larger sample sizes are needed for the 2D:4D

ratio variability (Lutchmaya et al., 2004). The findings from the current studies add to the body of knowledge, however, additional research is needed.

Future studies should be conducted with a larger sample of children and adults in the workplace. Similarly, a longitudinal study would help identify a more direct connection between stress and health across the developmental trajectory. In addition, future studies should address the connection between theory of mind and empathy in relation to effortful control, effective social strategy usage, and social positioning. Studies would also benefit from using a physiological measure and experimental social stressor tasks. This would help determine the extent of HPA activation and perhaps identify which social position exhibits chronic HPA activation or failure to efficiently recover from a social stressor. These future studies would yield valuable information on the mechanisms behind the relationship of social hierarchies, social strategies, stress, and health.

Table Seven

Overview of Statistical Significant Findings for All Studies

	Health	Prosocial Strategies	Coercive Strategies	Bi-strategic Strategies
Effortful Control	+ Childhood + Early Adulthood + Adulthood	+ Early Adulthood (activation control)		
Dominance	+ Childhood	+ Childhood (affiliation) + Early Adulthood (through bi-strategic) +Adulthood	+ Early Adulthood (through bi-strategic)	+ Early Adulthood
Health		+ Early Adulthood (through bi-strategic) + Adulthood	+ Early Adulthood (through bi-strategic)	+ Early Adulthood
2D:4D	+ Early Adulthood (females only)			

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APPENDICES

A - Demographic Questionnaire Child

Please Circle The Answers Below That Best Represent Your Child

1.) My child is 10 11 12

2.) My child is male female

3.) My child is right handed left handed ambidextrous

4.) Among their peers my child is 1 2 3 4 5

Not Popular Somewhat Popular Very Popular

B - Demographic Questionnaire College

Please Circle The Answers Below That Best Represent You Currently

1.) I am 18 19 20 21 22 23 24 25 26+

2.) I am male female

3.) I am right handed left handed ambidextrous

4.) Among my peers I am 1 2 3 4 5
Not Popular Somewhat Popular Very Popular

C - Demographic Questionnaire Adult

Please Circle The Answers Below That Best Represent You Currently

1.) I am 30-35 36-40 41-45 46-50 51-55 56-60 60+

2.) I am male female

3.) I am right handed left handed ambidextrous

4.) My position in the company would be described as

Top level position Middle level position Entry level position

5.) Among my peers I am 1 2 3 4 5
Not Popular Somewhat Popular Very Popular

D – Resource Strategy Control Inventory (RCSI)

1.) I am kind and agreeable	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
2.) I gossips or spreads rumors about others if I am mad at them	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
3.) I am good at getting what I want	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
4.) I tell my friends to stop liking someone in order to get what I want	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
5.) I have good ideas or suggestions that others like to follow.	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
6.) I am the kind of person who ignores others or stops talking to them	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
7.) I am chosen by others to lead the group	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
8.) I push, kick, or punch others because I have been angered by them	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
9.) I know how to make someone smile	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]

10.) I make others do what I wants	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
11.) I usually get attention from others	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
12.) I have difficulty sitting still during lessons, fidgets uneasily in my seat, and may also be talkative and noisy	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
13.) I can tell how others are feeling	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
14.) I says mean things to others	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
15.) I start fights to get what I want	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
16.) I am thorough and make plans	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]
17.) I force others to follow my plans	Strongly disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly agree
	[ ]	[ ]	[ ]	[ ]	[ ]

E - Early Adolescent Temperament Questionnaire - Revised

Parent Report

Directions

On the following pages you will find a series of statements that people might use to describe their child. The statements refer to a wide number of activities and attitudes.

For each statement, please circle the answer which best describes how true each statement is for your child. There are no best answers. People are very different in how they feel about these statements. Please circle the first answer that comes to you.

You will use the following scale to describe how true or false a statement is about your child:

Circle number:	**If the statement is:**
1	Almost always untrue of your child
2	Usually untrue of your child
3	Sometimes true, sometimes untrue of your child
4	Usually true of your child
5	Almost always true of your child

Your son or daughter:	Almost always untrue	Usually untrue	Sometimes true, sometimes untrue	Usually true	Almost always true
1 Worries about getting into trouble.	1	2	3	4	5
2 When angry at someone, says thing s/he knows will hurt that person's feelings.	1	2	3	4	5
3 Has a hard time finishing things on time.	1	2	3	4	5
4 Thinks traveling to Africa or India would be exciting and fun.	1	2	3	4	5
5 If having a problem with someone, usually tries to deal with it right away.	1	2	3	4	5
6 Has a hard time waiting his/her turn to speak when excited.	1	2	3	4	5
7 Often does not seem to enjoy things as much as his/her friends.	1	2	3	4	5
8 Opens presents before s/he is supposed to.	1	2	3	4	5
9 Would be frightened by the thought of skiing fast down a steep slope.	1	2	3	4	5
10 Feels like crying over very little on some days.	1	2	3	4	5
11 If very angry, might hit someone.	1	2	3	4	5
12 Likes taking care of other people.	1	2	3	4	5
13 Likes to be able to share his/her private thoughts with someone else.	1	2	3	4	5

14	Usually does something fun for awhile before starting her/his homework, even though s/he is not supposed to.	1	2	3	4	5
15	Finds it easy to really concentrate on a problem.	1	2	3	4	5
16	Thinks it would be exciting to move to a new city.	1	2	3	4	5
17	When asked to do something, does it right away, even if s/he doesn't want to.	1	2	3	4	5
18	Would like to be able to spend time with a good friend every day.	1	2	3	4	5
19	Tends to be rude to people s/he doesn't like.	1	2	3	4	5
20	Is annoyed by little things other kids do.	1	2	3	4	5
21	Gets very irritated when someone criticizes her/him.	1	2	3	4	5
22	When interrupted or distracted, forgets what s/he was about to say.	1	2	3	4	5
23	Is more likely to do something s/he shouldn't do the more s/he tries to stop her/himself.	1	2	3	4	5
24	Enjoys exchanging hugs with people s/he likes.	1	2	3	4	5
25	Tends to try to blame mistakes on someone else.	1	2	3	4	5
26	Is sad more often than other people realize.	1	2	3	4	5

27 Can generally think of something to say, even with strangers.	1	2	3	4	5
28 Wouldn't be afraid to try a risky sport like deep sea diving.	1	2	3	4	5
29 Expresses a desire to travel to exotic places when s/he hears about them.	1	2	3	4	5
30 Worries about our family when s/he is not with us.	1	2	3	4	5
31 Gets irritated when I will not take her/him someplace s/he wants to go.	1	2	3	4	5
32 Slams doors when angry.	1	2	3	4	5
33 Is hardly ever sad, even when lots of things are going wrong.	1	2	3	4	5
34 Would like driving a racing car.	1	2	3	4	5
35 Has a difficult time tuning out background noise and concentrating when trying to study.	1	2	3	4	5
36 Usually finishes her/his homework before it's due.	1	2	3	4	5
37 Likes it when something exciting and different happens at school.	1	2	3	4	5
38 Usually gets started right away on difficult assignments.	1	2	3	4	5
39 Is good at keeping track of several different things that are happening around her/him.	1	2	3	4	5
40 Is energized by being in large crowds of people.	1	2	3	4	5

41	Makes fun of how other people look.	1	2	3	4	5
42	Doesn't criticize others.	1	2	3	4	5
43	Wants to have close relationships with other people.	1	2	3	4	5
44	Is shy.	1	2	3	4	5
45	Gets irritated when s/he has to stop doing something s/he is enjoying.	1	2	3	4	5
46	Usually puts off working on a project until it is due.	1	2	3	4	5
47	Is able to stop him/herself from laughing at inappropriate times.	1	2	3	4	5
48	Is afraid of the idea of me dying or leaving her/him.	1	2	3	4	5
49	Is often in the middle of doing one thing and then goes off to do something else without finishing it.	1	2	3	4	5
50	Is not shy.	1	2	3	4	5
51	Is quite a warm and friendly person.	1	2	3	4	5
52	Sometimes seems sad even when s/he should be enjoying her/himself like at Christmas, or on a trip.	1	2	3	4	5
53	Doesn't enjoy playing softball or baseball because s/he is afraid of the ball.	1	2	3	4	5
54	Likes meeting new people.	1	2	3	4	5
55	Feels scared when entering a darkened room at night.	1	2	3	4	5

56	Wouldn't want to go on the frightening rides at the fair.	1	2	3	4	5
57	Hates it when people don't agree with him/her.	1	2	3	4	5
58	Gets very frustrated when s/he makes a mistake in her/his school work.	1	2	3	4	5
59	Is usually able to stick with his/her plans and goals.	1	2	3	4	5
60	Pays close attention when someone tells her/him how to do something.	1	2	3	4	5
61	Is nervous being home alone.	1	2	3	4	5
62	Feels shy about meeting new people.	1	2	3	4	5

F - ADULT TEMPERAMENT QUESTIONNAIRE (VERSION 1.3)

Directions

On the following pages you will find a series of statements that individuals can use to describe themselves. There are no correct or incorrect responses. All people are unique and different, and it is these differences which we are trying to learn about. Please read each statement carefully and give your best estimate of how well it describes you. Circle the appropriate number below to indicate how well a given statement describes you.

circle #:	if the statement is:
1	extremely untrue of you
2	quite untrue of you
3	slightly untrue of you
4	neither true nor false of you
5	slightly true of you
6	quite true of you
7	extremely true of you

If one of the statements does not apply to you (for example, if it involves driving a car and you don't drive), then circle "X" (not applicable). Check to make sure that you have answered every item.

1. I become easily frightened.

1 2 3 4 5 6 7 X

2. I am often late for appointments.

1 2 3 4 5 6 7 X

3. Sometimes minor events cause me to feel intense happiness.

1 2 3 4 5 6 7 X

4. I find loud noises to be very irritating.

1 2 3 4 5 6 7 X

5. It's often hard for me to alternate between two different tasks.

1 2 3 4 5 6 7 X

6. I rarely become annoyed when I have to wait in a slow moving line.

1 2 3 4 5 6 7 X

7. I would not enjoy the sensation of listening to loud music with a laser light show.

1 2 3 4 5 6 7 X

8. I often make plans that I do not follow through with.

1 2 3 4 5 6 7 X

9. I rarely feel sad after saying goodbye to friends or relatives.

1 2 3 4 5 6 7 X

10. Barely noticeable visual details rarely catch my attention.

1 2 3 4 5 6 7 X

11. Even when I feel energized, I can usually sit still without much trouble if it's necessary.

1 2 3 4 5 6 7 X

12. Looking down at the ground from an extremely high place would make me feel uneasy.

1 2 3 4 5 6 7 X

13. When I am listening to music, I am usually aware of subtle emotional tones.

1 2 3 4 5 6 7 X

14. I would not enjoy a job that involves socializing with the public.

1 2 3 4 5 6 7 X

15. I can keep performing a task even when I would rather not do it.

1 2 3 4 5 6 7 X

16. I sometimes seem to be unable to feel pleasure from events and activities that I should enjoy.

1 2 3 4 5 6 7 X

17. I find it very annoying when a store does not stock an item that I wish to buy.

1 2 3 4 5 6 7 X

18. I tend to notice emotional aspects of paintings and pictures.

1 2 3 4 5 6 7 X

19. I usually like to talk a lot.

1 2 3 4 5 6 7 X

20. I seldom become sad when I watch a sad movie.

1 2 3 4 5 6 7 X

21. I'm often aware of the sounds of birds in my vicinity.

1 2 3 4 5 6 7 X

22. When I am enclosed in small places such as an elevator, I feel uneasy.

1 2 3 4 5 6 7 X

23. When listening to music, I usually like turn up the volume more than other people.

1 2 3 4 5 6 7 X

24. I sometimes seem to understand things intuitively.

1 2 3 4 5 6 7 X

25. Sometimes minor events cause me to feel intense sadness.

1 2 3 4 5 6 7 X

26. It is easy for me to hold back my laughter in a situation when laughter wouldn't be appropriate.

1 2 3 4 5 6 7 X

27. I can make myself work on a difficult task even when I don't feel like trying.

1 2 3 4 5 6 7 X

28. I rarely ever have days where I don't at least experience brief moments of intense happiness.

1 2 3 4 5 6 7 X

29. When I am trying to focus my attention, I am easily distracted.

1 2 3 4 5 6 7 X

30. I would probably enjoy playing a challenging and fast paced video-game that makes lots of noise and has lots of flashing, bright lights.

1 2 3 4 5 6 7 X

31. Whenever I have to sit and wait for something (e.g., a waiting room), I become agitated.

1 2 3 4 5 6 7 X

32. I'm often bothered by light that is too bright.

1 2 3 4 5 6 7 X

33. I rarely notice the color of people's eyes.

1 2 3 4 5 6 7 X

34. I seldom become sad when I hear of an unhappy event.

1 2 3 4 5 6 7 X

35. When interrupted or distracted, I usually can easily shift my attention back to whatever I was doing before.

1 2 3 4 5 6 7 X

36. I find certain scratchy sounds very irritating.

1 2 3 4 5 6 7 X

37. I like conversations that include several people.

1 2 3 4 5 6 7 X

38. I am usually a patient person.

1 2 3 4 5 6 7 X

39. When I am resting with my eyes closed, I sometimes see visual images.

1 2 3 4 5 6 7 X

40. It is very hard for me to focus my attention when I am distressed.

1 2 3 4 5 6 7 X

41. Sometimes my mind is full of a diverse array of loosely connected thoughts and images.

1 2 3 4 5 6 7 X

42. Very bright colors sometimes bother me.

1 2 3 4 5 6 7 X

43. I can easily resist talking out of turn, even when I'm excited and want to express an idea.

1 2 3 4 5 6 7 X

44. I would probably not enjoy a fast, wild carnival ride.

1 2 3 4 5 6 7 X

45. I sometimes feel sad for longer than an hour.

1 2 3 4 5 6 7 X

46. I rarely enjoy socializing with large groups of people.

1 2 3 4 5 6 7 X

47. If I think of something that needs to be done, I usually get right to work on it.

1 2 3 4 5 6 7 X

48. It doesn't take very much to make feel frustrated or irritated.

1 2 3 4 5 6 7 X

49. It doesn't take much to evoke a happy response in me.

1 2 3 4 5 6 7 X

50. When I am happy and excited about an upcoming event, I have a hard time focusing my attention on tasks that require concentration.

1 2 3 4 5 6 7 X

51. Sometimes, I feel a sense of panic or terror for no apparent reason.

1 2 3 4 5 6 7 X

52. I often notice mild odors and fragrances.

1 2 3 4 5 6 7 X

53. I often have trouble resisting my cravings for food drink, etc.

1 2 3 4 5 6 7 X

54. Colorful flashing lights bother me.

1 2 3 4 5 6 7 X

55. I usually finish doing things before they are actually due (for example, paying bills, finishing homework, etc.).

1 2 3 4 5 6 7 X

56. I often feel sad.

1 2 3 4 5 6 7 X

57. I am often aware how the color and lighting of a room affects my mood.

1 2 3 4 5 6 7 X

58. I usually remain calm without getting frustrated when things are not going smoothly for me.

1 2 3 4 5 6 7 X

59. Loud music is unpleasant to me.

1 2 3 4 5 6 7 X

60. When I'm excited about something, it's usually hard for me to resist jumping right into it before I've considered the possible consequences.

1 2 3 4 5 6 7 X

61. Loud noises sometimes scare me.

1 2 3 4 5 6 7 X

62. I sometimes dream of vivid, detailed settings that are unlike anything that I have experienced when awake.

1 2 3 4 5 6 7 X

63. When I see an attractive item in a store, it's usually very hard for me to resist buying it.

1 2 3 4 5 6 7 X

64. I would enjoy watching a laser show with lots of bright, colorful flashing lights.

1 2 3 4 5 6 7 X

65. When I hear of an unhappy event, I immediately feel sad.

1 2 3 4 5 6 7 X

66. When I watch a movie, I usually don't notice how the setting is used to convey the mood of the characters.

1 2 3 4 5 6 7 X

67. I usually like to spend my free time with people.

1 2 3 4 5 6 7 X

68. It does not frighten me if I think that I am alone and suddenly discover someone close by.

1 2 3 4 5 6 7 X

69. I am often consciously aware of how the weather seems to affect my mood.

1 2 3 4 5 6 7 X

70. It takes a lot to make me feel truly happy.

1 2 3 4 5 6 7 X

71. I am rarely aware of the texture of things that I hold.

1 2 3 4 5 6 7 X

72. When I am afraid of how a situation might turn out, I usually avoid dealing with it.

1 2 3 4 5 6 7 X

73. I especially enjoy conversations where I am able to say things without thinking first.

1 2 3 4 5 6 7 X

74. Without applying effort, creative ideas sometimes present themselves to me.

1 2 3 4 5 6 7 X

75. When I try something new, I am rarely concerned about the possibility of failing.

1 2 3 4 5 6 7 X

76. It is easy for me to inhibit fun behavior that would be inappropriate.

1 2 3 4 5 6 7 X

77. I would not enjoy the feeling that comes from yelling as loud as I can.

1 2 3 4 5 6 7 X

G - Health and Wellness

1.) How often have you been sick or ill in the last six months
Never 1-2 3-4 5-6 7-8 9+

2.) How often have you missed school or work in the last six months
Never 1 2 3 4 5+

3.) Do you now or have you ever smoked Yes No

4.) How often do you smoke:
Never Sometimes Always

1. In general, would you say your health is:	
Excellent	1
Very good	2
Good	3
Fair	4
Poor	5

2. **Compared to one year ago**, how would your rate your health in general **now**?	
Much better now than one year ago	1
Somewhat better now than one year ago	2
About the same	3
Somewhat worse now than one year ago	4
Much worse now than one year ago	5

The following items are about activities you might do during a typical day. Does **your health now limit you** in these activities? If so, how much? **(Circle One Number on Each Line)**

	Yes, Limited a Lot	Yes, Limited a Little	No, Not limited at All
3. **Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports	[1]	[2]	[3]
4. **Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	[1]	[2]	[3]
5. Lifting or carrying groceries	[1]	[2]	[3]
6. Climbing **several** flights of stairs	[1]	[2]	[3]
7. Climbing **one** flight of stairs	[1]	[2]	[3]
8. Bending, kneeling, or stooping	[1]	[2]	[3]
9. Walking **more than a mile**	[1]	[2]	[3]
10. Walking **several blocks**	[1]	[2]	[3]
11. Walking **one block**	[1]	[2]	[3]
12. Bathing or dressing yourself	[1]	[2]	[3]

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**? **(Circle One Number on Each Line)**

	Yes	No
13. Cut down the amount of time you spent on work or other activities	1	2
14. **Accomplished less** than you would like	1	2
15. Were limited in the **kind** of work or other activities	1	2
16. Had **difficulty** performing the work or other activities (for example, it took extra effort)	1	2

During the **past 4 weeks,** have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)? **(Circle One Number on Each Line)**

	Yes	No
17. Cut down the **amount of time** you spent on work or other activities	1	2
18. **Accomplished less** than you would like	1	2
19. Didn't do work or other activities as **carefully** as usual	1	2

20. During the **past 4 weeks,** to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups? **(Circle One Number)**

Not at all 1

Slightly 2

Moderately 3

Quite a bit 4

Extremely 5

21. How much **bodily** pain have you had during the **past 4 weeks**? **(Circle One Number)**

None 1

Very mild 2

Mild 3

Moderate 4

Severe 5

Very severe 6

22. During the **past 4 weeks,** how much did **pain** interfere with your normal work (including both work outside the home and housework)? **(Circle One Number)**

Not at all 1

A little bit 2

Moderately 3

Quite a bit 4

Extremely 5

These questions are about how you feel and how things have been with you **during the past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the **past 4 weeks** . . . **(Circle One Number on Each Line)**

	All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	None of the Time
23. Did you feel full of pep?	1	2	3	4	5	6
24. Have you been a very nervous person?	1	2	3	4	5	6
25. Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
26. Have you felt calm and peaceful?	1	2	3	4	5	6
27. Did you have a lot of energy?	1	2	3	4	5	6
28. Have you felt downhearted and blue?	1	2	3	4	5	6
29. Did you feel worn out?	1	2	3	4	5	6

30. Have you been a happy person?	1	2	3	4	5	6
31. Did you feel tired?	1	2	3	4	5	6

32. During the **past 4 weeks,** how much of the time has your **physical health or emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)?

(Circle One Number)

All of the time 1

Most of the time 2

Some of the time 3

A little of the time 4

None of the time 5

How TRUE or FALSE is <u>each</u> of the following statements for you.

(Circle One Number on Each Line)

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
33. I seem to get sick a little easier than other people	1	2	3	4	5
34. I am as healthy as	1	2	3	4	5

anybody I know					
35. I expect my health to get worse	1	2	3	4	5
36. My health is excellent	1	2	3	4	5

H - ACE 10-Question Survey

PRIOR TO YOUR 18th BIRTHDAY:

1. Did a parent or other adult in the household **often or very often**….

Swear at you, insult you, put you down, or humiliate you? OR

Act in a way that made you afraid that you might be physically hurt?

Yes No If yes enter 1 _____

2. Did a parent or other adult in the household **often or very often**…..

Push, grab, slap, or throw something at you? OR **Ever** hit you so hard that you had marks or were injured?

Yes No If yes enter 1 _____

3. Did an adult or person at least 5 years older than you **ever**….

Touch or fondle you or have you touch their body in a sexual way? OR

Attempt or actually have oral, anal, or vaginal intercourse with you?

Yes No If yes enter 1 _____

4. Did you **often or very often** feel that…..

No one in your family loved you or thought you were important or special? OR

Your family didn't look out for each other, feel close to each other, or support each other?

Yes No If yes enter 1 _____

5. Did you **often or very often** feel that.....

You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? OR

Your parents were too drunk or high to take care of you or take you to the doctor if you needed it?

Yes No If yes enter 1 _____

6. Was a biological parent **ever** lost to you through divorce, abandonment, or other reason?

Yes No If yes enter 1 _____

7. Was your mother or stepmother:

Often or very often pushed, grabbed, slapped, or ad something thrown at her? OR

Sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard?

OR

Ever repeatedly hit over at least a few minutes or threatened with a gun or knife?

Yes No If yes enter 1 _____

8. Did you live with anyone who was a problem drinker or alcoholic or who used street

drugs? Yes No If yes enter 1 _____

9. Was a household member depressed or mentally ill or did a household member attempt

suicide? Yes No If yes enter 1 _____

10. Did a household member go to prison? Yes No If yes enter 1 _____

I – IRB Approval Page for Child

Oklahoma State University Institutional Review Board

Date:	Tuesday, February 25, 2014
IRB Application No	AS1391
Proposal Title:	Children's Social Skills and Health
Reviewed and Processed as:	Expedited

Status Recommended by Reviewer(s): Approved Protocol Expires: 2/24/2015

Principal Investigator(s):

Amber R. Massey
116 North Murray
Stillwater, OK 74078

Jennifer Byrd-Craven
116 North Murray
Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1.Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval. Protocol modifications requiring approval may include changes to the title, PI advisor, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms
2.Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3.Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of the research; and
4.Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Dawnett Watkins 219 Cordell North (phone: 405-744-5700, dawnett.watkins@okstate.edu).

Sincerely,

Shelia Kennison, Chair
Institutional Review Board

J – IRB Approval Page College

Oklahoma State University Institutional Review Board

Date:	Thursday, September 26, 2013
IRB Application No	AS1392
Proposal Title:	College Students Social Skills and Health
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 9/25/2016

Principal Investigator(s):

Amber R. Massey
116 North Murray
Stillwater, OK 74078

Jennifer Byrd-Craven
116 North Murray
Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☐ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval. Protocol modifications requiring approval may include changes to the title, PI, advisor, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Dawnett Watkins 219 Cordell North (phone: 405-744-5700, dawnett.watkins@okstate.edu).

Sincerely,

Shelia H. Kennison

Shelia Kennison, Chair
Institutional Review Board

K – IRB Approval Page Adult

Oklahoma State University Institutional Review Board

Date:	Tuesday, February 25, 2014
IRB Application No	AS1393
Proposal Title:	Adult's Social Skills and Heatlh
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 2/24/2017

Principal Investigator(s):

Amber R. Massey
116 North Murray
Stillwater, OK 74078

Jennifer Byrd-Craven
116 North Murray
Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1.Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval. Protocol modifications requiring approval may include changes to the title, PI advisor, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms
2.Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3.Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of the research; and
4.Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Dawnett Watkins 219 Cordell North (phone: 405-744-5700, dawnett.watkins@okstate.edu).

Sincerely,

Shelia Kennison, Chair
Institutional Review Board

VITA

Amber Rhea Massey Abernathy

Candidate for the Degree of

Doctor of Philosophy

Dissertation: THE DEVELOPMENTAL SPAN OF SOCIAL STRATEGIES, TEMPERAMENT, & STRESS-RELATED HEALTH

Major Field: Psychology

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in Psychology at Oklahoma State University, Stillwater, Oklahoma/USA in May, 2015.

Completed the requirements for the Master of Science in Psychology at Oklahoma State University, Stillwater, Oklahoma/USA in 2012.

Completed the requirements for the Bachelor of Science in Psychology at Oklahoma State University, Stillwater, Oklahoma/USA in 2010.

Experience and Professional Memberships:

Massey-Abernathy, A. R., Byrd-Craven, J., Swearingen, C. L., (2015). The Biological Diary of a Woman: Physiological Consequences of Status and Social Rejection. *Evolutionary Psychological Science.*

Massey, A .R, Byrd-Craven, J., Auer, B. J., Swearingen, C. L. (2014). Climbing the Social Ladder: Physiological Response to Social Status in Adolescents. *Adaptive Human Behavior and Physiology*

Massey, A. R., Byrd-Craven, J., & Swearingen, C. L. (2014). Preschool Power Play: Resource Control Strategies Associated with Health. *Child Development Research, 2014*

First Place Graduate Poster at Oklahoma Psychological Society Conference

Preparing Online Instructor Certificate

Curriculum Assessment Committee Member