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<u>**I, Timothy S Nixon, hereby submit this original work as part of the requirements for the degree of Doctor of Philosophy in Criminal Justice.**</u>

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The Relationships between Age, Psychosocial Maturity, and

Criminal Behavior

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Abstract

Three relationships have drawn varying degrees of interest in the criminal justice literature. The relationship between age and crime is central to criminology. The relationship between age and psychosocial maturity has become increasingly important for discussions of juvenile justice punishment policy. Little work has been done examining how these three variables interact together. Specifically, the dual systems model and theories of psychosocial maturity suggest that increases in age should attenuate the strength of the relationship between psychosocial maturity and age, but this has not been tested. Using the Pathways to Desistance data, likely moderating relationships between age, psychosocial maturity and criminal behavior are assessed, and implications for punishment policy are discussed.

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Chapter 1

Introduction

When does a kid stop being a kid? With the answer to this question comes a host of important policy implications. An important difference between the juvenile and adult justice systems is the degree of orientation toward punishment. In part these diverging philosophies are based on differences in perceived culpability between juveniles and adults. Therefore, empirical distinctions between groups are important for policy arguments. We consider it unjust to punish someone too much – or too little. Our ability to identify, as precisely as possible, the beginning and end of that transition is central to deciding how someone should be dealt with in the criminal justice system. In particular, psychosocial maturity has been presented as an important source of differences between juveniles and adults (Brink, 2004; Feld, 2007; National Research Council, 2013; Scott & Steinberg, 2009; Steinberg & Cauffman, 1996). But a distinction based on contemporary developmental factors has fallen under some attacks. Some have argued that a lessened level of some developmental trait does not imply that an individual is unable to meet a minimum standard of rationality to be held culpable for their crimes (Morse, 1999).

Empirical evidence for psychosocial maturity has been widely accepted, making appearances in majority decisions in the Supreme Court. This acceptance has occurred in spite of several important limitations. This dissertation will outline the history of legal reasoning for mitigated punishment, identify overlap with constructs in the social sciences, and identify a gap in the current evidence used to claim that findings of psychosocial differences should influence punishment policy. Then, using a large longitudinal study, it will attempt to close this gap in the evidence.

Politics, Science, and the Juvenile Justice System

Why do we punish juveniles less harshly than adults? Historically minded scholars discuss the creation of the juvenile court and its rapid growth through 1920 as a single phase that lasted until the 1950s and '60s (Dawson, 1990; Fox, 1996; Platt, 2009). The creation of the juvenile court at the turn of the 20th century was built on the distinction that juveniles should be held legally culpable for their actions but should not be tried in criminal court. Early advocates and policymakers relied heavily on the notion that juvenile delinquents were simply victims of bad environments. Therefore, they are more amenable to – and deserving of – treatment rather than punishment. Treating juveniles differently in the corrections system is directly related to the desire to prevent children from being corrupted into a life of crime. This system remained relatively unchanged for nearly six decades.

In the 1960s and '70s, a plethora of factors converged to alter the justice system. Civil Rights protests (and resulting police brutality), the Vietnam War, rising crime, and highly publicized justice system failures (for example, the riots at Attica prison) all decreased the public's trust in the state as an agent for good. As the belief that the state could be counted on to effectively rehabilitate individuals faded, the justice system, as an arm of the state, came under intense scrutiny from the right and the left. The juvenile justice system was not spared this scrutiny. Growing criticism of the juvenile court (Caldwell, 1961) culminated in important changes in the 1960s. Two important Supreme Court decisions, Kent v. US (1966) and In re Gault (1967), extended legal protections to juveniles, increasing the presence of lawyers in the system. The informal nature of the court began to disappear. From the legislature, promises of politicians resulted in substantial changes to juvenile waiver laws. For example, after some highly publicized heinous crimes committed by juveniles (e.g. Willie Bosket in New York)

several states enacted legislation that lowered the age of responsibility. Depending on the crime, juveniles as young as 13 skipped the juvenile justice system and went directly into the adult criminal justice system (Butterfield, 2008; Snyder & Sickmund, 2006). This set of decades became known as the "get tough" era, a period that saw nationwide punishment reform aimed at harsher punishment for crimes (Cullen & Gendreau, 2000). The trend of state laws during the "get tough" movement was to enact mandatory minimums for adults, reduce the minimum age that juvenile offenders could be considered for transfer, and increase the variety of serious offenses that mandated a juvenile be prosecuted in adult court (Snyder & Sickmund, 2006). Each of these punishment changes was based on the seriousness of the offense, not the culpability of the offender.

Since the "get tough" movement, the legal opinions have begun to swing back the other way. There has been a push from legal and social science scholars who recommend that the immaturity of juveniles be categorically considered as a mitigating factor in punishment decisions (Brink, 2004; Emens, 2005; Feld, 2008; Taylor-Thompson, 2003; Williams, 2005). The judiciary has argued that the differences between juveniles and adults are sufficient to warrant mitigated punishment. A series of Supreme Court decisions has acted as the bellwether for gauging the trends of juvenile punishment. In 1976, the Supreme Court found the execution of juveniles did not violate the 8th Amendment prohibition against cruel and unusual punishment (Stanford v. Kentucky, 1989). Nearly two decades later, following the logic of Atkins v. Virginia (2002), the Court argued in Roper v. Simmons (2005) that the death penalty for anyone under age 18 constitutes cruel and unusual punishment. Soon after, the Court ruled that a sentence of life without parole was cruel and unusual for anyone under age 18 unless the crime was murder (Graham v. Florida, 2010). And more recently, the Court ruled mandatory life without parole is

unconstitutional for any juvenile (Miller v. Alabama, 2012).

The legislative and judicial shifts in the last several decades have thrown into sharp relief arguments about how juveniles should be treated. The adult and juvenile justice systems have been systematically stripped of their differences and are now remarkably similar. Dawson (1990) notes the numerous differences in terminology that imply the same practice. Adults are "arrested" while juveniles are "taken into custody," adults are "convicted" where juveniles are "adjudicated delinquent," and so on, but on the whole the systems are already remarkably similar (Feld, 1997). The shifts around punitive policy create a space in which empirical and scientific results may be in a spot to inform policy.

Juveniles Are Different: Evidence from Social Science

When a child is young enough, no one doubts the differences in competence. There are sufficient differences between a child and an adult that explain why we do not subject them to the same punishment. Even if a 4-year old is more mature than some of his or her playmates, no one argues the child should be held culpable as an adult if s/he hits a playmate. Though there is variation in maturity among the 4-year old children, it is surpassed in importance by the larger difference in maturity between adults and children.

After we get beyond obvious examples comparing, say, a four-year-old with an adult, the boundary begins to get muddier. By the teen years, it becomes quite gray. Well-spoken teenagers often appear more mature than adult counterparts. Even early in life, children can use rational thinking to support their decisions (Reyna & Farley, 2006). As juveniles age, the distribution of any measure of maturity will necessarily have more overlap with the distribution of the adult population. Another complexity is that in arenas like the court system juveniles have been treated as both competent and mature decision-makers and as incompetent immature decision-makers. In

Hodgson v. Minnesota (1990) the Court upheld a juvenile's right to be treated like an adult when deciding to have an abortion, but in Roper (2005) the Court cited the categorical immaturity of adolescents as a reason juveniles cannot be punished like adults. Both decisions relied in part on amicus briefs supplied by the American Psychological Association. The murky waters for designating maturity are apparent in the Court's decisions.

Specific to criminal justice is the more complicated question of what makes juveniles legally less responsible than adults. The mere presence of a difference does not necessarily imply anything about whether they are less culpable. Juveniles tend to be shorter than adults, but height is unrelated to culpability. The key is whether differences are morally relevant (Morse, 1997, 1998, 1999).

One method of examining moral relevance is to assert that a factor must diminish rationality, at least to some extent, to be relevant to influence the appropriate amount of punishment. Morse presented a theory of responsibility that pins the ability to punish on the rationality of the actor. Morse (1997) – who is not supportive of using immaturity to mitigate punishment – has argued that those who fit the requirement of normative competence and violate a rule should be held responsible for their actions. Morse (1997, pp. 24-25) describes normative competence as the actor's "general capacity to understand and to be guided by the reasons that support a moral prohibition." This standard for holding someone responsible requires that the person is capable of understanding the mores surrounding a particular action. In situations where the actor lacks rationality, we do not hold them responsible (the insanity defense is the obvious example). Thus, we can imagine that if maturational differences in adolescents influence decision-making, it may be through its effect on normative competence, or their rational decision-making ability. An adolescent offender may be generally able to understand that some

crime is wrong, and society has prohibitions against anyone committing that act. But situationally, the motivation and decision to commit crime are sufficiently strong that society should recognize their influence as diminishing the rationality of the actor.

No one has argued that juveniles just shy of their eighteenth birthdays should not be held culpable at all, but many have called for mitigated punishment based on developmental factors, especially psychosocial maturity. Increasingly, scholars have pushed for this mitigation to be applied to young adults in their mid-twenties (Farrington, Loeber, & Howell, 2012). For example, researchers have hypothesized that juveniles are less future oriented (e.g. Cauffman and Steinberg, 1996). Less concern for the future causes them to discount distant consequences. If this is a developmental difference, it may be that juveniles are incapable of properly understanding, weighing, and appreciating future consequences. They may not understand the risk to themselves, or to others. Implicit in this reasoning is the argument that a lack of understanding is tantamount to diminished rationality, and since rationality is connected to culpability and juveniles are less future oriented, they deserve mitigated punishment. Whether they are *incapable* of understanding those risks is a complex question that lies behind the legal logic of culpability and punishment.

Despite the general murkiness of distinctions between juveniles and adults, some broad lines have been drawn. Scholars initially theorized that juveniles may be different in their capacity and ability to use reason, or their capacity for thinking rationally (Steinberg, 2008). However, any differences between juveniles and adults in reasoning ability consistently disappear by age 16. For example, in a sample of 1,393 participants Grisso et al. (2003) evaluated three components that should underlie the ability to stand trial: reasoning, appreciation, and understanding. Results showed some differences in reasoning ability that do not quite line up

with the legal barrier of 18. Consistently, those aged 11-13 scored lower than adults. Adolescents aged 14-15 years old were different than adults on two of the three measures, and 16-17-year-olds never scored differently from adults.

While juveniles exhibit similar reasoning capacities by age 16, advocates for less punishment for juveniles point to decision-making differences as reasons for mitigated punishment. For example, when presented with a vignette and told to offer a defendant advice, younger individuals are more likely to recommend confessing to a crime (Grisso et al., 2003). In tandem with these results, growing numbers of researchers have called for juvenile justice reforms to recognize and respond to developmental differences between juveniles and adults (Brink, 2004; Feld, 2007; National Research Council, 2013; Scott & Steinberg, 2009; Steinberg & Cauffman, 1996).

Recently scholars have justified this distinction based on empirical psychological measures bolstered by neuroscience research that details structural brain changes through adolescence and early adulthood (Casey, Jones, & Hare, 2008; Galvan, 2010; Silverman, Jedd, & Luciana, 2015). Psychosocial maturity is one such construct. It was presented by Steinberg and Cauffman in 1996 as a complex set of interrelated and overlapping constructs (though the full history goes a little further back, Steinberg and Cauffman's 1996 model provides the base for contemporary evaluations). Specifically, Scott and Steinberg (2009) argue that incomplete psychosocial development negatively influences adolescent decision-making. They claim these factors diminish the ability of juveniles and young adults to consistently make pro-social (noncriminal) decisions.

The construct of psychosocial maturity is an attempt to evaluate developmental factors that society sees as important to punishment by empirically evaluate differences between

juveniles and adults. In *Rethinking Juvenile Justice,* Scott and Steinberg (2009) describe how psychosocial maturity captures the idea that while juveniles might be capable of rational thinking, in situations that involve peer pressure or heightened risk-taking, irresponsible decision-making processes are more likely to take over. They argue that psychosocially immature individuals have a diminished ability to make good decisions. In legal terms, those who are faced with difficult choices or act out of character might be candidates for mitigated (or eliminated) punishment. They also argue that juveniles have an incompletely developed character due in part to incomplete psychosocial development. The idea is simply that choices – especially criminal ones – are more difficult to avoid when development is incomplete. This does not mean the behavior should be excused, as in a more straightforward "hard choice" decision where someone has a gun to their head and if they do not commit a crime, they will be shot. Instead, they argue the punishment should be mitigated. Psychosocial maturity then captures some aspect of an ability to make decisions, which should be relevant for punishment and treatment when a person makes poor decisions. In short, if two people commit the same crime and one of them is psychosocially immature while the other is not, the immature one should receive a lesser punishment.

A brief history of psychosocial measurement is useful to frame this study. Psychosocial maturity was initially intended to identify factors that explain academic success. The model emphasized individual, interpersonal and social adequacy. Individual adequacy is the "capacity to function effectively on one's own," interpersonal adequacy the capacity to interact with others, and social adequacy the ability to work toward social goals (Greenberger, Josselson, Knerr, & Knerr, 1975). Individual adequacy consists of self-reliance, identity formation, and work orientation. Interpersonal adequacy can be identified by communication skills and social

trust, along with a knowledge of roles. Social adequacy includes commitment to social goals, openness to sociopolitical change, and tolerance of individual and cultural differences (Greenberger & Sorensen, 1974).

The initial psychosocial maturity index was developed using a sample of 2,291 5th, 8th, and 11th graders in a stratified random sample of South Carolina public schools. The initial questionnaire of 349 items was reduced to around 188 items (depending on the form used) in nine domains: self-reliance, work orientation, identity, communication skills, roles, enlightened trust, social commitment, tolerance, and openness to change (Greenberger et al., 1975).

Cauffman and Steinberg (1996) adapted Greenberger and Sorensen's psychosocial maturity index, reframing it into three domains: responsibility, temperance, and perspective. This choice reflects the areas of psychosocial maturity that are most likely to influence decision making. Responsibility encompasses feelings of autonomy and independence, the development of identity, and ego development. Responsibility could be indicated by an individual's feelings of self-reliance, which in turn could be measured by tapping into their inner locus of control or feelings of self-efficacy. Temperance refers to changes in levels of sensation seeking and ability to exercise judgment. Perspective involves components of considering the future and considering consequences to others.

In 2008, Steinberg presented a dual-systems model to explain how psychosocial maturity influences juvenile decision-making. The dual-systems model suggests that structural and functional changes in the brain during adolescence incline juveniles toward risk-seeking behavior. Accompanied by hormone changes, the limbic system, associated with reward processing, shows elevated activity under various conditions in adolescent brains. Some evidence suggests that the prefrontal cortex, most typically associated with higher cognitive

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functioning (executive decision-making, planning, and impulse control) is more active in adults (Ernst & Fudge, 2009; Somerville, Jones, & Casey, 2010; Steinberg, 2008). The meme is the teen mind is "all gas, no brakes" (Payne, 2012; Steinberg, 2004; Steinberg, 2008). According to this interpretation, juveniles prioritize rewards, especially in risky situations, because their brains have not developed enough to evaluate and appreciate consequences. Indeed, evidence on risky behavior supports this assertion. Commonly cited examples include higher rates of car accidents, less safe sexual behaviors, and, of course, increased rates of criminal activity (Eaton et al., 2012; Kann et al., 2014; Snyder & Sickmund, 2006).

Other studies have revealed changes in brain structure and connectivity during and after adolescence. There is a decrease in gray matter due to synaptic pruning, and heightened dopamine receptor density and activity (Galvan, 2010; Giedd, 2008; Luciana, Conklin, Hooper, & Yarger, 2005; Spear, 2000). The dopaminergic system is thought to underlie reward sensitivity, and changes in this system occur mostly in early adolescence. Another change is the white matter increases and gray matter decreases during adolescence (Schmithorst & Yuan, 2010; Sowell, Thompson, Holmes, Jernigan, & Toga, 1999). Decreases in gray matter are thought to indicate synaptic pruning, a process by which the brain keeps efficient and effective neural pathways and discards ineffective ones (Luna, Padmanabhan, & O'Hearn, 2010; Spear, 2000). These changes in connectivity and efficiency are important for higher order functions, emotional regulation and self-control.

The changes that continue into adulthood are thought to underlie changes in psychosocial maturity. The growth in psychosocial maturity will, ideally, be indicated by measurable and substantive changes in the constructs purported to measure psychosocial maturity. Finally, these psychosocial changes influence decision-making, thereby influencing behavior. If these

developmental factors reduce normative competence, it follows that these factors should justify mitigated punishment when sentencing juveniles.

Part of the difficulty in discussing juvenile punishment comes from implicit understandings of the important age groups. According to the law, juveniles are people younger than 18. But the developmental literature has moved toward a more flexible understanding of what it means to be a juvenile. Developmental psychologists variously discuss juvenile development as occurring from ages 12 – 18 (Grisso & Schwartz, 2000; Scott, Reppucci, & Woolard, 1995) or continuing until the mid-20s (Arnett, 2000; Steinberg, 2008).

In turn, this has created space for interesting and complex debates over the proper way to handle criminal young adults. No one expects teens to magically become more mature on their eighteenth birthday (Farrington et al., 2012), and the most prominent view now is that from age eighteen to sometime in the mid-twenties, individuals are best categorized as almost-adults. The core argument identifies juveniles and young adults as "more vulnerable, incompetent, and dependent," and that these differences warrant categorically different punishment and treatment options (Woolard, 2012, p. 724). A range of options have been recommended, including a "youth discount" for sentence length, specialized courts for young adults, more rehabilitation options, and reentry support (Farrington et al., 2012).

A person's level of impulsivity is likely to predict risk behavior throughout the life-course. How impulsive you are at an early age predicts how impulsive you are at a later age (Caspi et al., 2003). Additionally, that level of impulsivity is predictive of risk-taking behavior across the life-course. Scholars have examined these psychometric constructs with an eye toward examining stability and change over time (Monahan, Steinberg, Cauffman, & Mulvey, 2009; Steinberg, Cauffman, and Monahan, 2015). If someone becomes less impulsive over time, it may

predict less involvement in risky activities. Understandably, this has propelled research into how people change in their levels of impulse control, self-control, and other variables, especially psychosocial maturity.

There is also a question of whether juveniles have less impulse control, or whether the amount of impulse control they have is more relevant to decision-making while they are adolescents. Small differences are somewhat well documented. As will be detailed below, these differences raise problems for punishment policy. The main problem is deciding what amount of a difference is enough. Another path to inform policy is to explore whether there is empirical evidence that whatever amount of impulse control (or, more broadly, psychosocial maturity) a person has is *more* relevant at younger ages (Galvan, 2010). That is, whether psychosocial maturity is a stronger predictor of delinquent and criminal behavior.

One implication of this research has gone untested. It is reasonable to infer, based on the age-crime curve, neuroscience, and psychometric variables, that heightened reward sensitivity in adolescence contributes to criminal decision-making. Further, this may occur not just because adolescents are more sensitive to rewards from taking risks, but phrased another way, the risk-taking propensity a person has matters more in adolescence. Untested, however, is whether those variables matter more for decision-making during some developmental period. This should be observable as an empirical interaction effect between age and psychosocial maturity.

Interaction effects are central to theories of crime. The effect of one variable on another may change depending on the value of a third variable. In this sense, psychosocial maturity and age can both be thought of as internal mechanisms that influence behavioral outcomes. Typically, we might think mechanisms as actions that bring about change on particular entities. Those entities have properties that may influence the change brought about (Hedström, 2009;

Machamer, Darden, & Craver, 2000). Psychosocial maturity and age might usually be thought of as properties of entities (people), but in this case, we are concerned about the properties as pieces of the explanation that bring about predictable changes in behavior. Here, that change is in criminal behavior.

To be more specific, we might think of psychosocial maturity as some constellation of factors (M) that have a positive correlation with criminal behavior, our outcome (Y). Age (A), at least within a certain window, influences the relationship between M and Y such that as A increases from adolescence to adulthood, the strength of the correlation between M and Y is attenuated.

To be sure, this is a bare abstraction of mechanistic relationships. In the ideal, mechanisms should be specific, and should consistently bring about change. For example, M could be an instance of a person with high susceptibility to peers. Their perception of the importance of how they believe their peers view them leads them to take an opportunity to increase status among their peers. In this case, when peers are present an opportunity to settle a dispute by winning a physical fight may be taken. If the peers were not present, it would have been ignored. However, this level of detail is not typically available for measurement. A person cannot be measured with an fMRI during the decision to fight in front of peers. A solution is to measure general susceptibility to peer influence in place of the presence, actions, and desires of peers, assume the opportunity for a fight is exists within a specified measurement period, and collect some outcome, such as a count of the number of events (fights) that have occurred. Knowing someone's age, then, alters how often we expect them to take the opportunity to fight, given the presence of peers and their level of susceptibility to peer influence.

The lack of attention to an interaction between psychosocial maturity and age is surprising given the importance of interactions in other lines of research on crime. The age-graded nature of crime predictors is relevant for understanding crime and intervening appropriately (Laub & Sampson, 1993; Sampson & Laub, 2003). It is surprising given the relationship between age and various outcomes, including crime in general (Farrington, 1986; Sweeten, Piquero, & Steinberg, 2013).

In addition, the neuroscience models increase the suspicion that psychosocial maturity should be a stronger predictor of crime during adolescence. The dual systems model posits that the cognitive control system becomes functional after the socio-emotional system. The result is that avoiding risky (and criminal) behavior is more difficult for juveniles. When psychosocial maturity is thought to represent these capacities for judgment, one would expect that if psychosocial maturity is only relevant for juveniles, there would be an effect of psychosocial maturity in adolescence that disappears as individuals age into adulthood.

Research Question(s)

Each year in the United States hundreds of thousands of juvenile cases move through the juvenile court systems. In 2017 an estimated 800,000 cases were referred to juvenile courts. Of these, about a third resulted in adjudication (Hockenberry & Puzzanchera, 2019). A critical question is what amount of punishment is just and appropriate. In an ideal world every individual who transgressed the rules of society would be punished the correct amount. If a society connects culpability with rationality, any factor that even slightly diminished culpability might result in proportionally decreased punishment. This decreased punishment is the mitigation mentioned above. But while the idea that juveniles are different is arguably a cornerstone belief in our

society, the empirical measurement and application of these variables to policy remains a new endeavor.

In various opinions the Court has recognized that an ideal world would bring highly individualized punishment appropriate for the amount of harm caused and the culpability of the individual. Insofar as being more mature makes an individual more culpable, more mature individuals should get more punishment and vice versa. If juveniles are less mature, they should get less punishment.

Recently, legal scholars have extended the logic of the Court by applying psychosocial maturity and the accompanying dual-systems model to argue for diminished punishment for gang members (Breen & Mills, 2015; Kellogg, 2014). Maroney (2009) in particular, has noted that reasoning for mitigated punishment is relevant for juveniles at all stages of processing and punishment. Others have called for special courts for young adults up to age 24, or to at least raise the age of waiver to 24 (Farrington et al., 2012) (though several recommendations, from individualized sentencing to risk assessment to guide evidence-based treatment, are similar to many reform suggestions for the adult system).

Despite the recent attention on psychosocial maturity and calls for categorically mitigated punishment for juveniles, key questions have not been addressed. These calls may for change be premature based on the state of the evidence surrounding growth in psychosocial maturity. In her dissent from Roper (Roper v. Simmons, 2005), Justice O'Connor argued that the differences between juveniles and adults are not "universal enough and significant enough" to justify categorical punishment changes.

Morse (1997; 1999) raised a related issue. What do we do with adults who have capacities closer to the average child than the average adult? In terms of psychosocial maturity,

what do we do with an adult who has the psychosocial capacity of a child? The logic that says psychosocial *im*maturity should be a mitigating factor is based on how social factors are particularly powerful for the immature individual. If some adults exhibit the same tendencies, should they also be subjected to less punishment? As Morse (1997) stated, "why don't we have a similar obligation to those unfortunate adults whose life experiences have prevented them from outgrowing or receiving help for similar problems" (p. 59).

Given the discussion above, this dissertation will focus on one research question: is there evidence that psychosocial variables are more important for predicting behavior during a period of adolescence? Stated differently, is there evidence that their influence is more pronounced during adolescence? Finally, restated again, do psychosocial variables have a stronger relationship with criminal behavior in adolescence?

A finding that psychosocial factors are more relevant for criminal decision-making during a developmental window would be important for discussions of juvenile punishment policy. An interactive effect of age on the strength of a relationship between psychosocial maturity and crime would side-step issues of deciding what proportion of juveniles need to be mature before we should consider all of them mature. Alternatively, a null finding would also have important implications. A null finding would reinforce that although there are marginal differences in psychosocial maturity between juveniles and adults, those variables influence decision-making in identical ways. Although psychosocial variables are presented as factors that influence decision-making only during a certain window of development, this idea has not been thoroughly evaluated.

Chapter two will begin with an examination of which factors the Supreme Court has discussed in rulings on punishment of juveniles. It will then discuss how psychosocial maturity

offers the most consistent overlap with factors discussed in Court rulings. After examining some limitations with using psychosocial maturity to inform policy, it will argue that psychosocial maturity should have an age-graded effect on crime.

Chapter 2

Developmental Research and the Supreme Court

The justification for punishing juveniles differently than adults is incomplete without a discussion of the legal precedent for mitigated punishment in the Supreme Court. Much of the evidence used in the court has not changed since the 1980s, though the tone of the rulings has. Psychosocial maturity has emerged as a lens for interpreting and applying legal precedent to juvenile punishment policy. Below is a justification for focusing on psychosocial maturity, beginning with identifying areas where scientific research has been referenced in Court decisions.

Just over three decades ago the Supreme Court ruled the death penalty was prohibited for juveniles younger than 16 when the crime was committed (Thompson v. Oklahoma, 1988). A year later the Court affirmed that the death penalty was allowed for offenders sixteen or older (Stanford v. Kentucky, 1989). For nearly two decades the distinction of the death penalty disallowed for defendants under age 16 at the time of the offense remained the status quo. The court used social science research to extend the death penalty prohibition to age 18 (Roper v. Simmons, 2005), then to life without parole (LWOP) sentences for non-homicide crimes (Graham v. Florida, 2010) and then to mandatory LWOP sentences (Miller v. Alabama, 2012).

In 2005 the pendulum swung back. Stanford v. Kentucky (1989) was reversed and juveniles under 18 were exempted from the death penalty (Roper v. Simmons, 2005). Of interest here is the developmental research from the social sciences referenced in the Court's opinions. Quotes from court decisions on juvenile punishment are common in policy discussions of the differences between juveniles and adults (e.g. Breen & Mills, 2015; Kellogg, 2014). Since the law builds on precedent, the scientific factors recognized in the law are more likely to be

compelling to the judiciary, and more likely to endure. Therefore, it is important to keep an eye on the overlap between factors relevant to punishment recognized by the Supreme Court and those measured by researchers.

One starting point is the mitigating factors listed in Eddings v. Oklahoma (1982). The court ruled that the trial judge erred in precluding consideration of mitigating factors. The mitigating factors that should have been given consideration included that the defendant was raised without proper guidance (his parents were divorced, his mother was an alcoholic and his father physically abused him), and according to a psychologist he had sociopathic or antisocial tendencies that were treatable with extensive therapy. Citing a report on juvenile sentencing, the plurality wrote that minors "especially in their earlier years, generally are less mature and responsible than adults." The plurality also referenced an earlier decision in which juveniles were noted for their lack of experience, perspective, and judgment expected of adults (Bellotti v. Baird, 1979).

In Thompson v. Oklahoma (1988) the lessened maturity of juveniles under age 16 was presented as a simple fact "too obvious to require extended explanation" (p. 835). Citing Eddings v. Oklahoma (1982), the Court declared that juveniles "particularly in the early and middle years, are more vulnerable, more impulsive, and less self-disciplined than adults."

Writing for the majority in Roper v. Simmons (2005), Justice Kennedy argued three differences between juveniles and adults diminish culpability and render the death penalty unconstitutional. He cited Johnson v. Texas (1993), noting that juveniles have a "lack of maturity and an underdeveloped sense of responsibility" that results in "impetuous and ill-considered actions and decisions" (p. 569). In addition, they are vulnerable or susceptible to negative influences and outside influences, including peer pressure. He also cited Erickson's (1968)

theory of identity development to note that juveniles have unformed and unstable identities. Kennedy also listed the lessened ability of juveniles to consider risks, which reduces the deterrent effect of capital punishment. Five years later the Court saw no reason to reconsider these factors. Evidence of differences between juveniles and adults in the structure of the brain was added as support for the core argument of mitigated punishment (Graham v. Florida, 2010). In Graham v. Florida (2010) the Court more explicitly cited the unformed characters of juveniles as relevant to their ability to make pro-social decisions and likelihood to reform. The plurality also brought "difficulty in weighing long-term consequences" to the fore. That is, the decision placed a heavier emphasis on the idea that juveniles cannot understand the long-term harms of victimization.

The list of reasons for punishing juveniles differently, according to the Supreme Court, includes a neglectful environment, increased susceptibility to the environment, less responsibility, more impulsiveness and impetuousness, less ability to appreciate future consequences and the resulting incomplete cost-benefit analyses that follow, unformed character or identity, and differences in brain structure. These core factors were used to argue for lessened culpability and recur in later court cases and academic publications.

Psychosocial Maturity

As described previously, the belief that juveniles are different in ways that lessens their culpability has deep roots in the theory of punishment. Despite these beliefs, only recently have there been efforts to identify the particular ways in which the diminished capabilities of juveniles should influence the appropriate amount of punishment for violating laws.

Psychosocial maturity and neuroscience have potential to be used to inform policy and process decisions at every stage of the juvenile justice system. If juveniles have diminished

decision-making ability, this premise could alter when they should be able to waive Miranda rights, confess, waive counsel, or be considered capable of forming *mens rea* (Maroney, 2009, pp. 111-115). Such calls for reform that pivot on psychosocial maturity are common. For example, Miller v. Alabama (2012) barred juveniles from being mandated to life without parole based on the crime. Based on the psychosocial maturity arguments underlying this conclusion, Kellogg (2014) argued that the STEP Act in California, which enhances sentences for juveniles tried in the adult system who committed their crime as part of a street gang, should also require appellate review.

The theory of psychosocial maturity provides an opportunity to fill four important gaps in the theory of juvenile punishment. First, nearly every factor commonly related to culpability can be found under the umbrella of psychosocial maturity. For example, a recent report stated that features of adolescent development include poor self-control, sensitivity to peers, preference for immediate rewards, and a failure to consider long term consequences. The report also described areas where juveniles are identified as less functional than adults. Examples included a juvenile's "capacity for self-regulation in emotionally charged contexts," sensitivity to environmental influences, and lessened ability to make judgments. These factors influence a preference for risky decisions among juveniles (National Research Council, 2013).

In a similar tone, a recent review of the juvenile court described a developmental "maturity gap." The maturity gap posits that adolescents are less mature in areas of risk perception, appreciation of consequences, impulsivity and self-control, sensation seeking, and compliance with peers. The gap closes as brain development solidifies (Feld, 2017). A common refrain is that juveniles place more weight on the rewards of behavior (Figner, Mackinlay, Wilkening, & Weber, 2009) and are more susceptible to peer influences (Gardner & Steinberg,

2005). Puberty, brain development, and a host of closely related psychometric factors (impulsivity, self-control, sensation-seeking, resistance to peer influence, responsibility) intertwine to create a picture of development emphasizing processes that explain immature behavior in adolescence (Lamb & Sim, 2013). Another summary described how "deficits in psychosocial maturity may explain a great deal of the increased risk-taking and criminal behavior observed in the second decade of life" (Cauffman, Cavanagh, Donley, & Thomas, 2016, p. 100).

In any description of adolescent development, the psychometric component plays an important role by identifying *what* is supposed to improve. Psychosocial maturity has already been cited by the Court, and it provides a comprehensive framework for identifying this development.

Second, the Supreme Court has offered no guidance on which of the mitigating factors they list are most important (Denno, 2005; Feld, 2007) or how the factors should be weighed in sentencing decisions. For example, Eddings v. Oklahoma (1982) lists factors that might sway a judge to mitigate punishment but does not describe which factors were the most convincing. Psychosocial maturity offers a conceptual and empirical bridge between the legalese and social science research. For example, one argument in Graham v. Florida (2010) is that juveniles are less capable of weighting long-term consequences of their actions. In the social sciences, this falls under the broad category of future orientation. The Consideration of Future Consequences scale (Strathman, Gleicher, Boninger, & Edwards, 1994) is designed to evaluate the ability of respondents to consider immediate and future consequences.

A third reason to focus on psychosocial research is the problematic nature of some of the Court's reasoning for diminished punishment. The central claim is that juveniles are different, as

"any parent knows" (Roper v. Simmons, 2005). The majority opinion has frequently listed the heightened risk-taking behavior of adolescents as evidence of their lessened responsibility and increased impulsivity. Evidence of a different prevalence of risky behavior points to differences in culpability. But increased involvement in risky behavior is not enough to know culpability is diminished.

This reasoning is insufficient because it could be applied with equal force to adult criminals. It is well established that a small portion of offenders commit more than their share of crime (Wolfgang, Figlio, & Sellin, 1987). Precision policing and focused deterrence strategies take this truth about adult offenders as a starting point for fighting crime. The increased criminal activity of prolific offenders has never been proposed as a reason to punish them less. To the contrary, a history of criminal behavior is a sufficient argument for more punishment.

Fourth, there is a general need for objective standards. A common criticism in law is the arbitrary nature of the divide between juvenility and adulthood. In large part, psychosocial maturity represents an attempt to quantify the societal presumption that children and adolescents are different from adults. A belief that children are different and deserving of protection underlies the foundations of the juvenile justice system. As science continues to play an important role in society, researchers have begun formalizing and testing beliefs about maturity.

While psychosocial maturity does not provide a diagnostic tool, it is reasonable to assume that further refinement of the measure and its application is a useful venture because a scientific measure will advance law beyond the current arbitrary use of age to determine culpability. An objective measure of maturity that is more precise than age would allow progression beyond the limitation of using age as a strict culpability boundary. This might occur on a diagnostic level, where a person can be identified as immature, or it may occur at the aggregate, where differences

in age groups may become clearer with more refined measurement. In addition, the Court's opinions have been critiqued for using outdated science (for example, see Denno, 2005). Since the law builds on precedent, this flaw is, to a degree, built into the system. While the social sciences are by no means immune to a critique that progress occurs slowly, contemporary measures can offer some advancement over less precise language used in legal rulings. For example, Denno observed that court ignored more modern findings, that they cited character development research from the 1960s, while contemporary research on character development is more nuanced (Denno, 2005).

Psychosocial maturity provides an opportunity to resolve these problems (but, as argued below, there are substantial barriers to the solution). Psychosocial maturity explicitly denotes that the capacity to make good decisions changes with age and that some factors underlying maturity cause the differences in behavior, leading to a conclusion that differences among those factors between juveniles and adults justifies categorically separate punishment rules.

Following earlier research, this study will focus on three domains of psychosocial maturity, each with two sub-domains. *Responsibility* uses a combination of the responsibility subscale from the Psychosocial Maturity Index (Greenberger & Sorensen, 1974) combined with the Resistance to Peer Influence scale (Steinberg & Monahan, 2007). *Temperance* is assessed using a scale of impulse control and one measuring suppression of aggression. *Perspective* is measured using the Future Outlook Inventory and the Consideration of Others scales. These scales tap into the degree to which a respondent considers the future, and how they consider the effect of actions on others. In addition, *resistance to peer influence* will be assessed.

The Relevance of Psychosocial Maturity

Differences Between Juveniles and Adults in Psychosocial Maturity

The core evidence that psychosocial maturity should influence punishment policy comes from two areas. The first is evidence that establishes differences between juveniles and adults in the levels of psychosocial maturity. Second, and important to claims that psychosocial maturity should be related to culpability, is the connection between psychosocial maturity and criminal decision-making.

Differences in psychosocial maturity between juveniles and adults are reasonably well established. For example, Cauffman and Steinberg (2000) examined psychosocial maturity in a sample of adolescents and adults that ranging from age 12 to 48. Psychosocial maturity was assessed using three constructs. Responsibility was measured using the Psychosocial Maturity Index Form D (PSMI-D), perspective was measured by combining the Consideration of Future Consequences (CFC) and Consideration of Others scales, and temperance was measured using two subscales – impulse control and suppression of aggression – from the Weinberger Adjustment Inventory. An overall psychosocial maturity scale was created using z-scores from each of the three constructs and normalizing the scale to range from $0 – 5$, where a score of 5 indicates high psychosocial maturity. The constructs were assessed in five age groups comprised of 8th, 10th, and 12th graders, young adults (under 21 years old), and adults (21 and over).

Looking at this combined scale, psychosocial maturity scores were higher in adulthood (from an average of 2.84 in 8th grade to 3.45 in adulthood). Adults scored significantly higher than 8th, 10th and 12th graders, but not differently from young adults (college students under 21).

In a sample of 136 male and female delinquents in boot camps, increases in age predicted increases in responsibility and perspective, though not temperance (Cruise et al., 2008). Modecki

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(2008) provides additional evidence of age-related changes. In an analysis of 632 adolescents, college students, young adults, and adults, the oldest two groups scored higher in measures of responsibility and perspective than adolescents, and adults scored higher than all other groups on a measure of temperance.

One takeaway from Modecki's (2008) results is age differences may be inconsistent across the various subconstructs of psychosocial maturity. There were differences in responsibility and perspective between young adults and adolescents, but no differences in temperance. Inconsistencies in the existence of differences is a limitation of using psychosocial maturity to inform punishment, since they make delineating age boundaries for punishment difficult.

Identifying consistent age boundaries is also difficult because the conceptualization and operationalization of the constructs changes over time. Taking peer susceptibility as an example, earlier studies favored categorizing susceptibility to peers into deviant, pro-social, and neutral behaviors. An alternative approach is to measure susceptibility in different settings. For example, Sim and Koh (2003) tested susceptibility across four domains – family involvement, school involvement, peer involvement, and misconduct. In their sample of 311 students in Singapore aged 13-17, the age trends of susceptibility differed across domains. Susceptibility to misconduct was slightly higher for 15-year-olds, where susceptibility to family and school involvement was lower for 15 and 17-year-olds.

Using another operationalization of susceptibility, Steinberg and Monahan (2007) evaluated cross-sectional differences and longitudinal growth in four samples from three research projects, The MacArthur Juvenile Competence Study, the MacArthur Juvenile Capacity Study, and Pathways to Desistance. Respondents ranged from 10-30 years old, though only one

sample (the MacArthur Juvenile Capacity Study) had respondents older than 24. The resistance to peer influence scale used ten items that required respondents to choose what type of behavior reflected their tendency. For example, they were given an option "Some people go along with their friends just to keep their friends happy" but "Other people refuse to go along with what their friends want to do, even though they know it will make their friends unhappy." Participants chose which option was "Really True" or "Sort of True" for them. Responses were scored on a 4-point scale so high scores indicate more resistance to peer influence.

They found significant growth in resistance to peer influence was isolated to increases from ages 14-18. That is, differences in the average resistance to peer influence from 10-14 and 18-30 were not statistically significant. Examining the average differences from 14-18 more closely, across the combined sample resistance to peer influence increased from an average of 2.91 at 14 to 3.23 at 18. The standard deviations at each age hovered around 0.55.

The pattern of increases has also been documented in longitudinal research. Using the Pathways to Desistance sample, Monahan, Steinberg, Cauffman, and Mulvey (2013) found a quadratic effect of age on psychosocial maturity. On average, individuals increase in psychosocial maturity as they get older, but at a declining rate. They also observed significant differences in the intercepts and rates of change in psychosocial maturity. That is, individuals vary in their starting points of psychosocial maturity and the rate of change of psychosocial maturity. This is also supported in other research (Knight et al., 2012). Figure 1 demonstrates this trend of average increases with the Pathways data (utilized below). In figure 1, small increases in psychosocial maturity with age are apparent. However, there is clearly variation at any age, and circles indicating adults who score low on the temperance scale are apparent.

Figure 1: Plot of Temperance Change by Age
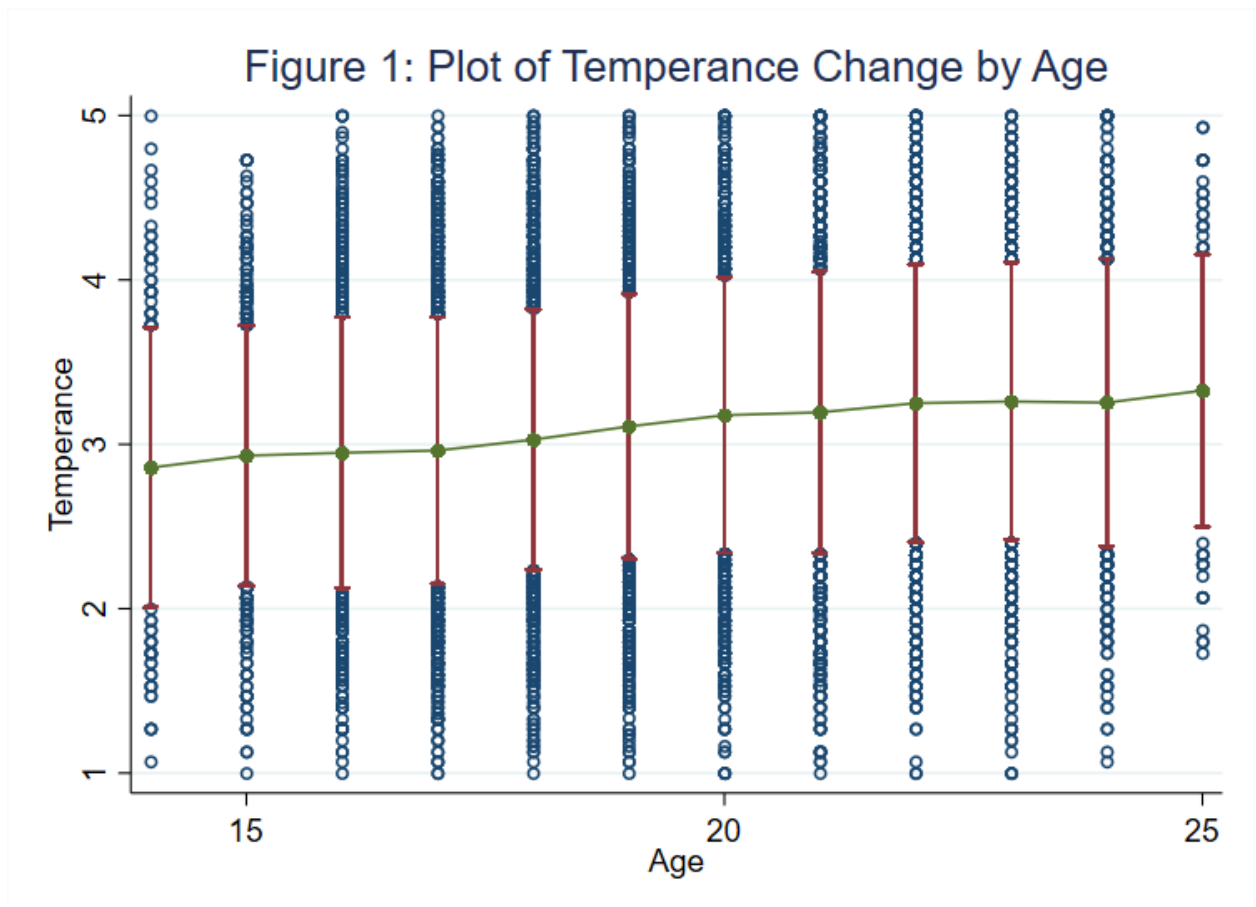
The Dual Systems Model and Supporting Evidence from Neuroscience

Neuroscience findings bolster claims of juvenile immaturity and decision-making differences. The typical juvenile's brain is accused of any number of deficits, from general cognitive functioning, to decision-making, to incomplete structural development.

There is a growing body of evidence from neuroscience detailing differences between juveniles and adults in connectivity, structure, and activity in the adolescent brain (Blakemore & Robbins, 2012; Galvan, 2010; Spear, 2000). These studies demonstrate that under certain

conditions – especially those with social cues – juveniles are more error-prone (for examples, see Gardner & Steinberg, 2005; Grosbras et al., 2007). The researchers look for differences in brain activation and connectivity. From a region-based approach, some differences in activation in areas of the brain thought to be associated with reward sensitivity exist between juveniles and adults.

Steinberg (2008) connected psychosocial variables to the dual systems model of development. The dual systems model suggests that an underdeveloped prefrontal cortex and active amygdala explain risky behavior in juveniles. Drawing on the "two systems" simplification of brain activity from behavioral economics (Tversky & Kahneman, 1974), it posits the existence of a socio-emotional and cognitive control systems. In adolescents, the socio-emotional system develops before the cognitive control system. A similar model for explaining adolescent brain development, the imbalance model, emphasizes a circuit-based perspective (as opposed to a region-based perspective) to explain the development of the cognitive control system in late adolescence (Casey et al., 2008; Casey, Galvan, & Somerville, 2016). Both models explain juvenile risk-taking through an underdeveloped control system that does not reign in heightened reward sensitivity.

Recent evidence supports the dual-systems interpretation of neurodevelopment, particularly the evidence of increased likelihood of activity in reward-related regions of the brain (Silverman et al., 2015). There is evidence from neuroscience that teens perform more poorly in tasks when a peer is present (or they believe one is), while the presence of a peer has no effect on adults. Breiner et al. (2018) used a go/no-go task in a convenience sample of 198 participants aged 13-25 gathered from Los Angeles and New York City. The go/no-go task was the Cognitive Control Under Emotional (CCUE) task, conducted previously with the adults in this sample in

other studies (Cohen, Breiner et al., 2016; Cohen, Dellarco et al., 2016). The CCUE requires participants to click (or refrain from clicking) when a face with a designated expression appears on a screen. The trials occur while brain activity is recorded using fMRI imaging. During one set of trials, participants are told to click when a happy face appears (a happy cue). During another, participants click for a scared face, and during a third, for a neutral face. The face that appeared was laid over a solid color background. One background color, they were told, indicated that during this phase of the experiment they might receive a reward of up to $100. They were informed getting the reward did not depend on performance (the "reward state"). In reality, the reward occurred near the end of the segment. Another background color indicated nothing.

Breiner et al. (2018) added a twist. For half of the participants, they were informed that a peer was watching them complete the CCUE task. The voice of the peer was only a recording that played while the participant was about to begin. Therefore, Breiner et al. (2018) could test how the presence of a peer influenced accuracy of participant clicks.

When a happy cue was used during the reward condition, adolescent participants (age 13-17) scored significantly differently when they thought a peer was watching. For young adult (18-21) and adult (22-25) age groups, the presence of a peer did not significantly alter scores. Results from the fMRI revealed significantly increased orbitofrontal activity during the peer condition for adolescents, but not for young adults or adults. In short, this study demonstrates that the presence of a peer is enough to alter task performance in a sample of adolescents aged 13-17, but not young adults or adults aged 18-25.

Other studies have found increased activity in the ventral striatum when adolescents were in a reward-state and a peer was watching, while adults in the same reward state with a peer watching showed no regional increases in brain activity (Smith, Ashley R., Steinberg, Strang, &

Chein, 2015). Other studies have found similar increased brain activity in the striatum, though the study did not contain an adult comparison group (Smith, Rosenbaum, Botdorf, Steinberg, & Chein, 2018). Researchers have found a higher discount rate in delay discounting tasks when adolescents were in a peer condition compared to an alone condition (Weigard, Chein, Albert, Smith, & Steinberg, 2014), and only adolescents had functional coactivation between the ventral striatum and dorsal striatum in go/no-go trials when a happy cue was used (Somerville, Hare, & Casey, 2011).

Based on these results researchers postulate that the increased activity works against juvenile decision-making (or judgment) ability realms outside the laboratory (Albert & Steinberg, 2011). Relevant here is risk taking behavior, especially criminal risk-taking behavior.

Psychosocial Maturity and Criminal Behavior

One of the reasons to focus on psychosocial maturity is its potential to provide an avenue for understanding possible differences in the etiology of juvenile and adult criminal behavior. Therefore, a promising line of research is to examine the relationship between psychosocial maturity and criminal behavior (e.g. Cauffman & Steinberg, 2000). Much of the evidence focuses on psychosocial influences on decision making, not criminal behavior (Figner et al., 2009; Gardner & Steinberg, 2005; Modecki, 2008; Steinberg, Cauffman, Woolard, Graham, & Banich, 2009).

Decision-making may be an appropriate proxy in some circumstances, such as when criminal behavior measures are not feasible or available. Yet relying only on decision making is problematic. First, when concerning punishment, there is no punishment for considering committing a crime. Second, it may not be prudent to trust that results which demonstrate average differences in decision making generalize to criminal behavior. For example, the number

of cards someone flips over in a task where flipping more cards over increases the chance of flipping a card that indicates a loss is understood to be a proxy for risky preference (Figner et al., 2009), but criminal behavior is only a subset of possibly risky behaviors. Therefore, it is preferable to examine the relationship between psychosocial maturity and criminal behavior. A finding that psychosocial maturity influences thinking about criminal behavior should be considered separately from a finding that incomplete psychosocial development is linked to an increase in criminal behavior.

Self-reports of behavior provide a more direct route to establishing the relationship between psychosocial maturity and crime. Some studies have found support for the theory that psychosocial maturity predicts increased delinquent and criminal behavior. The Pathways data (described below) have consistently shown that increased psychosocial maturity is associated with decreased variety scores of criminal behavior (Rocque, Beckley, & Piquero, 2019). In a summary of the Pathways findings, researchers noted that individuals who are less psychosocially mature are more likely to report higher levels of self-reported offending, and are more likely to be persistent offenders (Monahan, Steinberg, Cauffman, and Mulvey, 2009; 2013; Steinberg, Cauffman, and Monahan 2015).

Additional studies have found similar results (Allen, Porter, & McFarland, 2006; Cazzell, 2009; Chen & Dornbusch, 1998; Clinkinbeard, 2014; Dielman, Butchart, Shope, & Miller, 1991; Knight et al., 2012; Little & Steinberg, 2006; Sim & Koh, 2003), though a few studies found no support. For example, in a study of 1,170 6th and 7th grade students, Flannery, Vazsonyi, Torquati, and Fridrich (1994) found impulsivity was not correlated with substance use. Other studies have also found impulse control does not predict misbehavior and delinquency (Ezinga, Weerman, Westenberg, & Bijleveld, 2008) or aggression (McMurran, Blair, & Egan, 2002), or

that time perspective and susceptibility to peer vignettes do not predict criminal decision-making (Fried & Reppucci, 2001). In their convenience sample of juvenile delinquents, temperance, but not responsibility or perspective, predicted a decline in self-reported delinquent behaviors (Cruise et al., 2008).

Another option is to look at antisocial and delinquent behavior as an outcome. This is typical with younger subjects when researchers are concerned with status offenses. With deviant behavior as an outcome, Dielman and several colleagues conducted a handful of studies demonstrating that 5th and 6th graders with higher susceptibility to peers – measured by answers to seven hypothetical questions about peers offering or daring them to engage in delinquent activities – are more likely to report alcohol, cigarette and marijuana use (Dielman, Campanelli, Shope, & Butchart, 1987). In another study, they found the 40% of respondents who reported being most susceptible to peers were more likely to overindulge in alcohol (meaning they had gotten drunk, drank more than planned or gotten sick to their stomachs) (Dielman, Shope, Butchart, Campanelli, & Caspar, 1989).

Other studies report mixed results. For example, in a study of 183 youth ages 14-19, temperance (measured by the Weinberger Adjustment Inventory scales for impulse control and suppression of aggression) predicted antisocial behavior, but future orientation and consideration of others did not (Cauffman, Elizabeth, Steinberg, & Piquero, 2005). Similarly, Modecki (2009) found the Future Outlook Inventory did not predict self-reported criminal behavior, but resistance to peer influence did (i.e., youths more resistant to peers reported less criminal behavior). In a sample of 117 adolescents age 14-17, high delinquency compared to low delinquency respondents differed in temperance and perspective, but not in responsibility (Modecki, 2008). In an older sample drawn from the general population and two universities (the

full sample was between ages 18 and 29), present time perspective predicted substance use, but future time perspective did not (Duangpatra, Bradley, & Glendon, 2009).

The support for a correlation between psychosocial maturity and crime is modest, albeit with inconsistencies across sub-constructs. Despite these inconsistencies, there is enough evidence to tentatively move forward under the assumption some correlation exists.

The Unique Place of Psychosocial Maturity

The Importance of an Age-Graded Effect

The section above describes problems that limit the viability of using psychosocial maturity to inform punishment policy. However, psychosocial influences have a unique theoretical attribute. The place of psychosocial variables is that they offer an explanation of offending behavior unique to adolescence and young adulthood.

For psychosocial maturity to be relevant for punishment, a minimum threshold is that psychosocial maturity predicts criminal behavior. The perspective here emphasizes that psychosocial maturity should be *more* relevant for juveniles than it is for adults. This should reveal itself as an interaction effect between psychosocial maturity and age predicting criminal behavior. As age increases the strength of maturation variables to predict criminal behavior outcomes should diminish.

In fact, this age-graded effect of psychosocial maturity is built into the dual-systems model. The neuroscience evidence purports to show how a juvenile's brain makes him or her more susceptible to negative influences caused by developmental immaturities. The age-graded influence of psychosocial variables is a key component when drawing out the implications of psychosocial maturity and punishment. The concept of adolescence being a unique time for

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development rests on the idea that some factors – especially those involved in regulating perceptions of risk – operate differently for adolescents.

In its simplest form, the position of advocates of using psychosocial maturity to inform punishment is that while juveniles are capable of rational decision making, they are less psychosocially mature, and this makes them less capable of choosing to avoid risky but potentially immediately gratifying behavior (Steinberg & Scott, 2003). Since criminal behavior is a subset of instantaneously gratifying behaviors, juveniles are less capable of choosing to avoid criminal behavior. This effect may not exist for carefully considered crimes but does exist for crimes that use "hot" cognition: quick, spontaneous decisions, especially those where the person perceives some sort of status reward by doing the action (Steinberg et al., 2009).

However, if a direct effect of psychosocial maturity is the linchpin of this chain of causality, it follows that the effect should be moderated with age. Psychosocial maturity should not exert as strong of an effect on adults and explains why they are not so reward-seeking and inclined toward criminal risk. One way to understand this claim is to hypothesize that psychosocial maturity should have a stronger relationship with delinquent behavior during the developmental window of adolescence and young adulthood.

If the effect of psychosocial maturity on crime is constant between adolescents and adults, the comments by Morse and Justice O'Connor, asking what to do with similarly situated (i.e., immature) adults, come into sharp focus. If there is *not* an age-graded effect of psychosocial maturity, those adults with low psychosocial maturity apparently have the same mechanisms negatively influencing their decision-making ability.

This makes an age-graded effect of psychosocial maturity critical for punishment policy. A finding that psychosocial maturity is more relevant for adolescents would solidify its relevance

for punishment policy for juveniles and young adults. Even though there are certainly immature adults, their immaturity may not be a cause of criminal behavior. This would also be evidence in support of the dual systems model. For adults, decreased relevance of psychosocial maturity in the etiology of criminal behavior may indicate completed development of the cognitive control systems that are not fully functional in adolescence. Without such a finding, we would be left with significant differences in maturity between juveniles and adults. These would only tell us that a juvenile selected at random is only slightly less likely than an adult to score at the average adult level of maturity. If psychosocial maturity predicts equally between juveniles and adults, the question of how to appropriately deal with immature adults and mature juveniles takes a central role.

The relationship between psychosocial maturity, age and crime has come into the purview of recent research. An important step is to determine the most appropriate and theoretically suitable methods for assessing the relationship.

Age, Psychosocial Maturity, and Criminal Behavior

There are multiple theoretical methods available to consider and model the interrelationships between age, psychosocial maturity and criminal behavior. On the one hand, age is a conceptual antecedent that could influence both psychosocial maturity and criminal behavior. In the aggregate it is well established that age predicts increases in criminal behavior in adolescence, and decreases afterward (Farrington, 1986). Dichotomizing age is common in the risk factor literature, where individuals over a certain age are slightly less likely to reoffend (Andrews and Bonta 2010). Thus, age is expected to have a quadratic effect on crime, such that as age increases, the predicted amount of criminal behavior increases, but at a breaking point, increases in age should start to predict decreases in criminal behavior.

From this point the task is to specify how the relationships between age, psychosocial maturity, and criminal behavior are expected to play out. Psychosocial maturity could mediate the effect of age on criminal behavior. Some effort has gone into identifying whether the effect of age is diminished when theoretically relevant time-varying covariates of criminal behavior are accounted for (Sweeten et al., 2013). Conceptually it was similar to a mediation analysis (Baron & Kenny, 1986), though did not formally test the indirect relationship. If psychosocial maturity explains the age crime curve, it might be argued that the increases in psychosocial maturity and subsequent decreases in criminal behavior captures the process of aging.

The relationship between age and psychosocial maturity on crime could also be specified as a moderating effect of age on psychosocial maturity. In this case we would think that age alters the relationship between psychosocial maturity and crime, a classic moderator model (Baron & Kenny, 1986). However, there is no expectation that at one age the relationship between psychosocial maturity and criminal behavior will be inverse (more psychosocial maturity, less criminal behavior) but for another age it will be positive (more psychosocial maturity, more criminal behavior). The presumption is that at some point, increased age should attenuate the relationship between psychosocial maturity and criminal behavior. An attenuated effect of psychosocial maturity on criminal behavior as age increases implies that mechanistically, psychosocial maturity is less important in the explanation of criminal behavior as age increases.

This moderation effect could take several different functional forms. The simplest would be if at some cutoff point for age, the nature of the relationship between psychosocial maturity and criminal behavior appreciably changed. On the other hand, given that age has a quadratic effect on psychosocial maturity and criminal behavior, there may be a more complex interaction. A

moderation analysis is more appropriate due to the nature of the question being asked. Does the effect of psychosocial maturity change over time? Necessarily, this asks whether as age increases, the effect of psychosocial maturity changes.

Mediating the Effect of Age

One route researchers have pursued to establish the age-relevant effects of psychosocial maturity is to claim psychosocial maturity explains the age-crime curve. The age-crime curve has been described as a key "fact" of criminology that requires explanation (Braithwaite, 2007; Farrington, 1986). A mediation approach could specify the causal chain of age to psychosocial maturity to criminal behavior. This assertion is explicit in Cauffman and Steinberg (2000), who argue that "developmental differences between adolescents and adults in *non-cognitive* realms…account for age differences in behavior" (Cauffman & Steinberg, 2000 p. 744, emphasis original). This implication is that because age has a curvilinear relationship with crime (where increasing age predicts more involvement in crime until a point where increasing age predicts less involvement in crime) if psychosocial maturity mediates this effect, it has explained away the age effect.

The well-known age-crime curve peaks for most crimes in the late teens. Cauffman and Steinberg reason that if age becomes a nonsignificant predictor of delinquency when psychosocial maturity is added to their model, psychosocial maturity explains the age-crime curve. By explaining the curve, psychosocial maturity explains why there is a spike in delinquent offending that peaks in late adolescence. It is reasonable to conclude that psychosocial maturity is particularly relevant for adolescents and young adults. In their model, psychosocial maturity does reduce the effect of age below the threshold of a significant correlation. Sweeten et al. (2013) also pursued this idea, finding the relationship between age and crime is diminished when

psychosocial maturity is added to the model. Similar analyses on variables that mediate the effect of age have been conducted for other variables. For example, self-reports of risk perception and social anxiety mediate the relationship between age and risky behavior (Reniers, Renate, Murphy, Lin, Bartolomé, & Wood, 2016).

Looking for psychosocial maturity to wipe out the influence of age is one approach to explaining the age-crime curve. Since age has a consistent effect on crime, it is reasonable to posit that a variable that attenuates the effect of age explains away the effect of age. In fact, it is arguable that this is a selling point for the importance of psychosocial maturity in adolescence. The age-crime curve peaks for most offenses in the late teens. From there, a reasonably steep decline is observed. It is tempting to see the age-crime curve, evidence of growth in psychosocial maturity, evidence of brain maturation, and conclude that maturity is a cause of the decline in crime rates observed in early adulthood.

However, efforts to identify mediation in this way suffer from several limitations. First, although a mediated relationship is hypothesized, it is not fully tested. For example, several studies have examined the effect of age on involvement in criminal behavior in one model, then added psychosocial maturity in a second model. Observing the disappearance of an age effect on behavior, they suggest this may be due to the mediating effect of psychosocial maturity. From the standpoint of describing a causal chain, these approaches have not specified the age effect on psychosocial maturity. That is, it is simply not a complete mediation analysis.

A more important limitation from a conceptual standpoint is that a mediation model is not the most appropriate model to evaluate the correlations between age, psychosocial maturity, and criminal behavior. The evidence described above suggests that psychosocial maturity does not

mediate the effect of age, but that age alters the strength of the effect on psychosocial maturity, a moderating effect.

There are several problems with this application of the age-crime curve. First, the age-crime curve peaks for some offenses later than others (Klenowski & Dodson, 2016). Second, aspects of brain maturation variously occur mostly in early adolescence or continue into young adulthood, well after the peak of the age-crime curve (Maroney, 2009). Thus, while the brain is continuing to rapidly develop into the twenties, the age-crime curve begins its decline in the late teens. These two limitations suggest an increased need to specify what kinds of crimes are most likely to be influenced by psychosocial maturity. Third, it may be that rather than desist from crime, many individuals shift into committing different types of crime (Massoglia, 2006).

Evidence of an *Age x Psychosocial Maturity* Effect on Behavior

A More Appropriate Approach?

An alternative approach to searching for mediation – and one better suited to discussion of punishment – is to examine whether the strength of the predictor varies with age. This is more important than a potential mediating effect because the inference created by the dual systems model suggests psychosocial variables are stronger predictors of behavior with age.

Survey Evidence

A few studies have examined an interaction of age and psychosocial variables. Ozkan (2016) used the Pathways data to predict time to reoffend. Reoffending was captured by any self-reported offenses since the last measurement period, divided into violent offending behavior and income-based offending behavior. Across multiple models, perspective and temperance consistently predicted self-reported variety scores. There was an interaction between age and

temperance, indicating that as age increases the relationship between temperance and violent offending attenuates.

In another example, Modecki (2009) gathered a sample of adolescents, young adults, and adults. Adolescents were recruited from an urban high school, young adults were recruited from a college, and the adult sample was collected by offering credit to the college students to obtain parent participation. Psychosocial maturity was assessed using the Future Outlook Inventory, the Risk Perception Scale, the Arnett Inventory of Sensation Seeking, and an adjusted Resistance to Peer Influence scale. Instead of reflecting a pair of conflicting options, as described in the example above, participants were given a question like "Some people go along with their friends just to keep their friends happy" and indicated how true the item was of them on a 4-point scale. Criminal behavior was assessed using 36 illegal behaviors from Elliot and Ageton's (1980) scale.

The Future Outlook Inventory was not a significant predictor of criminal behavior for any age group. However, resistance to peer influence was significant for the adolescent and young adult groups, but not for the adult group. Sensation seeking was a significant predictor of criminal behavior only for the adolescent group.

In another example, with a convenience sample combined from a community sample (n = 353) and college students (n = 254), researchers measured sensation seeking, peer pressure, and present and future time perspective, along with five dependent variables, risk behavior, substance use, sexual behavior, and an overall recklessness scale. Only future time perspective interacted with age to predict risk behaviors. The results are difficult to interpret because future time perspective was not a significant predictor of risk behavior. When interacted with age there was a weak negative relationship (Duangpatra et al., 2009). Had future orientation been a significant predictor, the expected direction would be negative, so increased future time perspective

predicted less risk behavior. The negative interaction would then imply that as age increased, future orientation had a stronger effect. With no significant relationship on which to build an interaction, the result of a significant interaction effect is uninterpretable (Fox, 2008).

Experimental Evidence

Psychosocial variables have not been evaluated in experiments. Part of this is because researchers cannot randomly assign levels of psychosocial maturity. However, the influence of peers, which is thought to drive some of the psychosocial decision-making processes, can be evaluated, at least indirectly, in experiments. Evidence from experiments on decision making can manipulate the presence of peers and evaluate the effect of peers on various outcomes. For example, Gardner and Steinberg (2005) evaluated risk-taking with three measures: a computerized game, a risky decision-making questionnaire (Ford, Wentzel, Wood, Stevens, & Siesfeld, 1989), and a risk preferences scale (Benthin, Slovic, & Severson, 1993). First, younger participants took more risks during the computer game and selected riskier actions in the first questionnaire. There were not age differences in responses to the risk preferences scale. Second, they found that presence of peers during the computerized task increased risk taking, resulted in riskier choices in the decision-making questionnaire, and resulted in more risk preferences. Third, they found the strength of the peer effect depended on the age group. As the age group increased, the strength of peers on risk taking and risky decisions decreased (though the responses to risk preferences did not).

As another example, Chein et al. (2011) used fMRI scans to examine brain activity underlying risk-taking (the stoplight task). In a convenience sample of 40 adolescents, young adults, and adults, they found the presence of peers in the driving task increased brain activity in adolescents in the right ventral striatum and orbitofrontal cortex. In addition, only adolescents

exhibited significantly more risky decisions when peers were present. Perhaps important to this result, which shows only adolescents respond to peers, is the fact that they chose which peers to bring to the trial.

In a similar vein, Figner et al. (2009) tested the dual-systems model by examining risk taking using the Columbia Card Task (CCT). In four samples of around 100, individuals were broken up into age groups (13/14-16, 17-19, and 20+) and performed both "hot" and "cold" tasks. The CCT is based on flipping over any of 32 cards. Between 1-3 cards represented a loss while the rest represented a gain. Once a loss card is flipped the experiment stops, and the total gain is calculated. Risk-taking was indicated by flipping over a higher number of cards. They tested decision-making in two conditions. In the hot condition participants were given immediate feedback of how much each card was worth along with a running total. Once they elected to stop, or a loss card was flipped, the series restarted. In the cold condition participants chose the number of cards they wanted flipped.

Figner et al. (2009) found significant average differences in the "hot" condition between adults and adolescents, where on average those age 14-16 turned over about 25 cards, those 17-19 turned over 26, and those aged 20+ turned over 2[1]. A more conservative significant estimate (Tukey's HSD) suggested the only significant difference was between 17 to 19-year-olds and adults 20+. Thus, it appears that younger individuals are less susceptible to changes in decision-making due to the presence of peers. One piece to hold in mind, however, is that while adults (Figner et al., 2009), are *less* susceptible to hot conditions, they still appear to have some degree of susceptibility. This provides a reason for wondering if "hot" systems influencing decision-making is not unique to adolescence, but may be marginally more relevant.

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[1]The exact numbers of cards turned over were not reported. These numbers are estimates based on the graphs provided on page 716.

The Importance of Interaction Effects

The lack of research on an interaction effect with age is surprising given the importance of moderation effects between other contemporary variables and criminal behavior. Despite the standard practice of inputting independent variables as main effects, a main-effects-only model neglects important mediating and moderating effects between variables (Winship & Elwert, 2010). This neglect of effect heterogeneity causes issues interpreting the regression coefficient. When effect heterogeneity exists, the regression coefficient provides a conditional variance-weighted average of individual-level effects, not the simple average individual-level effect (Brand & Thomas, 2013). This becomes especially relevant if a starting assumption is that most relationships between two variables might vary depending on the presence or absence of a third variable (Hedström, 2009). The question here is whether the effect of psychosocial maturity on criminal behavior is also conditioned, in this case by age.

In addition, a hypothesis that psychosocial maturity is more relevant at certain ages touches on important debates within criminology. It circles the age-invariance thesis posed by Gottfredson and Hirschi (1983). Tittle and Ward (1993, p. 4) observe that Gottfredson and Hirschi's "most provocative" claim was the invariance of the age-crime curve, but their most important claim was that the causes of crime are constant across age. One implication of this claim is that "age does not interact with other explanatory or correlative variables in the crime equation" (Shavit & Rattner, 1988, p. 1459). If true, this obviates a need for longitudinal research, since the correlates observed at any age will be constant through the life-course.

The irony that results is that Gottfredson and Hirschi's assertion that longitudinal research is unnecessary is most appropriately tested *with* longitudinal research. For example, a claim that the effect of social bonds is constant over time would best be tested by looking at an

individual's social bonds and their relation to crime through the life-course. And of the research

exists, both cross-sectional and longitudinal, the samples are not of delinquent populations, or are

cross-sectional (Tittle & Ward, 1993). This raises the concern that findings may not generalize to

a population of serious delinquents, the very population that is most relevant for this discussion.

Since the debate over age-invariance, theories of age-graded criminal behavior have

come to the fore. Laub and Sampson (1993) theorized that while bonds are related to crime over

the life course, the type of bond depends on age. Likewise, Moffitt (1993) postulated that

delinquent social influences at the onset of puberty are particularly relevant for creating

adolescence-limited offenders.

Aside from the question of age interacting with criminal behavior, interaction effects are

important for understanding the etiology of criminal behavior. For example, increased

susceptibility to peers has a stronger relationship with delinquency when the person has

delinquent peers (Allen et al., 2006; Miller, 2010), and the first delinquent peer someone has

influences their criminal propensity more than later delinquent friends (Rees & Zimmerman,

2016). The influence of future orientation on delinquency is moderated by low self-control

(Clinkinbeard, 2014).

Other examples can be found for co-offending and burglary (Lantz & Barry Ruback,

2017) and ethnic identity and discrimination (Williams, Aiyer, Durkee, & Tolan, 2014). For

example, Miller (2010) highlighted the importance of susceptibility to peer influence on the

effect of delinquent peers. In a longitudinal sample of 1,633 9th – 12th graders in Texas, those

with higher susceptibility and more delinquent peers in the second wave of data collection were

more likely to engage in serious delinquency in the third wave. In a smaller longitudinal sample

of 177 7th and 8th grade students, Allen et al. (2006) found adolescents who are more susceptible

to peer influence are at an increased risk of experimenting with alcohol and marijuana when their friends experiment use alcohol and drugs. Future orientation has been found to interact with self-control to predict delinquency (Clinkinbeard, 2014). The direction of the interaction indicated that increased future orientation decreased the magnitude of the relationship between low self-control on delinquency. The effect of future orientation on cannabis use has also been found to be mediated by perceptions of cannabis use (Apostolidis, Fieulaine, & Soulé, 2006).

Monahan et al. (2013) conducted a relevant analysis of the moderating effect of age on the relationship between employment and delinquency. They found the inverse relationship between school involvement and self-reported antisocial behavior was stronger at younger ages. In addition, youth employed more than twenty hours a week with irregular school attendance self-reported committing more income-related antisocial behaviors (for example, buying something they knew was stolen). The effect of this relationship also depended on age. Employment with irregular school attendance predicted these antisocial behaviors for adolescents, but not adults.

Monahan, Dmitrieva, and Cauffman (2014) found males who have a deviant romantic partner have higher levels of delinquency, but the amount of deviance they are engaged in declines over time. They concluded that having a deviant partner has a diminishing effect on delinquency over time. In a conceptually similar study, moral disengagement mediated the relationships of resistance to peer influence and peer delinquency on self-reported criminal behavior (Walters, 2018).

In a sample of 270 burglars who committed 442 burglaries, the age at first offense significantly moderated the effect of experience on co-offending. Older first-time offenders were less likely to have a co-offender in their next burglary than young offenders (Lantz & Barry

Ruback, 2017). In an example from a separate domain, stronger ethnic identity moderated the effects of discrimination on antisocial behavior (Williams et al., 2014). Clearly, interaction effects are important for understanding behavior, and interactions between variables with age is an important area for research.

Based on the lack of studies examining an interaction of psychosocial maturity with age predicting crime, the potential relevance of an interaction with age, and the need for using criminal outcomes as the dependent variable, this study will contribute to the literature by filling those empirical gaps. Questionable generalizability of neuroscience results highlights the need for studies that measure criminal outcomes.

Limitations of Current Research Using Psychosocial Maturity and Brain Sciences to Inform Policy

Limitations of Psychosocial Maturity Research

Differences in maturity between juveniles and adults are important, and there is a somewhat well-established relationship between psychosocial maturity and criminal behavior. These form core components of the argument for juveniles being punished differently than adults. However, there are several reasons to be cautious about using this evidence as a basis for various policy proposals.

There are a range of criticisms related to what statistically significant differences and trends of average growth do *not* tell us. The average provides only one point of comparison, and attention must be given to the dispersion of psychosocial maturity scores around that average. Significant differences in psychosocial maturity scores indicate it is unlikely that the gap between the averages of psychosocial maturity between juveniles and adults exists due to a fluke in sampling. Yet the significance test alone does not reveal information about the size of the gap

between the average juvenile and adult, nor the amount of overlap in scores between the two groups. More succinctly, knowledge of differences between juveniles and adults provides no information on the magnitude of those differences (Maroney, 2009). The issue of interpreting significant results is common across criminology (Maltz, 1994) and is by no means unique to the discipline (Wasserstein & Lazar, 2016).

Suggestions that young adults are also not fully mature and should therefore receive less punishment (Farrington et al., 2012) underscore the limits of focusing solely on statistical significance. Despite the empirical knowledge that scores increase, where to set a threshold for culpability has not been resolved. Decision making capabilities of juveniles are described as "significantly diminished" well into adulthood (Cauffman, 2012, p. 73; Farrington et al., 2012), but there is no explanation of how to interpret "significantly diminished." Stated differently, psychosocial maturity does not provide thresholds one must pass to be considered fully culpable (Aronson, 2007). Another way to view the problem is to observe that significant differences do not offer guidance on diagnosing diminished culpability (Fondacaro, 2014), or that they do not delineate distinct age boundaries for punishment (Cauffman, 2012).

This is conceptually similar to the limitation discussed earlier that led us to use psychosocial maturity as an indicator of culpability in the first place: the different behavior of juveniles is not, on its own, enough to justify different punishment policy. Similarly, a marginal difference in average levels of psychosocial maturity does not provide information crucial to developing punishment policy.

There are also methodological limitations in the current psychosocial maturity research. Much of the research used to declare juveniles substantially different relies on maturity increases in samples that only contain juveniles (Fondacaro, 2014). Another sampling issue pervades

psychosocial maturity research. Much of the research cited above relies on the Pathways to Desistance sample, a sample of juvenile offenders convicted of serious crimes. While this is perhaps the best sample documenting longitudinal increases in psychosocial maturity, it lacks a comparison of non-offending juveniles.

The issue of marginal differences, mentioned above, is also a reason to be cautious in the application of psychosocial maturity to policy. Another way to envision the problem of marginal differences – like the gap of 2.84 to 3.45 between juveniles and adults in Cauffman and Steinberg (2000) – is to note that they may mask relatively stable trajectories. That is, some individuals may not mature as much as their peers. Adolescents who are more mature than peers in their cohort might, for the purposes of punishment, be mature enough to be held fully accountable.

This limitation revolves around whether psychosocial maturity research requires more research into individual differences (Gibson & Krohn, 2012). Imagine a juvenile low on psychosocial maturity. Low impulse control, high susceptibility to peers, and a lack of consideration of the future make the juvenile prone to criminal behavior. As the juvenile becomes a young adult, then an adult, if s/he remains psychosocially immature compared to peers, the immaturity may continue to influence criminality even into adulthood. In this case, psychosocial maturity would not provide a reason to punish this individual less as a juvenile than an adult. It is reasonable to consider that psychosocial maturity continues to exert an effect on behavior. If low psychosocial maturity predicts criminal outcomes in adulthood, the reasoning that suggests psychosocial maturity should mitigate punishment should be applied with equal force to immature adults.

Some empirical evidence supports the idea that maturation is not uniform. Littlefield, Sher, and Steinley (2010) used mixture modeling to identify five groups based on trajectories of changes in impulsivity over time. In a longitudinal study of 489 college students, impulsivity was assessed seven times using six items from the Tridimensional Personality Questionnaire (Sher, Wood, Crews, & Vandiver, 1995) and four items from the Eysenck Personality Inventory (Eysenck & Eysenck, 1968). Participants were 35 years old at the final assessment. Littlefield et al. (2010) found two groups had no significant changes in impulsivity from age 18 to 35. These two groups, the highest scoring and lowest scoring groups, made up 21% of the sample. In addition, they found that one group (9% of the sample) declined rapidly from age 18-25. This group, along with the other two groups, showed declines in impulsivity over the course of the study.

The possibility that growth in psychosocial maturity is relatively stable is reinforced by literature on a similar construct, low self-control. In 2005, Cauffman, Steinberg, and Piquero noted that the psychosocial construct of future orientation has important overlaps with low self-control as conceptualized by Gottfredson and Hirschi (1990). Part of their conceptualization included a tendency to prefer immediate gratification and a lack of future planning. Similarly, there is a strong overlap between low self-control and temperance, which has been partially measured by impulse control. Impulse control and low self-control have several similar questions between the two scales, including items that ask about making decisions without thinking (Grasmick et al., 1993; Fine, Steinberg, Frick, & Cauffman, 2016). For example, an impulse control question from the Weinberger Adjustment Inventory asks respondents if they stop and think before they act, while a self-control question asks the extent to which respondents do things without giving them enough thought (Fine et al., 2016; Weinberger & Schwartz, 1990). There

are two important notes here. The first is the overlap between psychosocial maturity and low self-control reinforces the notion that psychosocial maturity is related to deviant behavior, as low self-control is an important predictor in criminology literature (Pratt and Cullen, 2000).

The second observation is that low self-control has a wide literature examining the stability of the trait. First, Gottfredson and Hirschi (1990) theorized that low self-control is a stable trait that, once developed, remains constant over the life-course. At a minimum, they theorized rank-order stability, so if there are changes, a person will remain stable in their level of self-control relative to their peers over time. Research suggests low self-control is heritable (Beaver, Wright, DeLisi, and Vaughn 2008). In addition, evidence suggests low self-control is somewhat stable, and correlations between low self-control at different time points are similar to those observed in psychosocial maturity (Fine et al., 2016; Hay & Forrest 2006). On the other hand, Ray, Jones, Loughran, and Jennings (2013) observed that individual trajectories of low self-control can be divided into six groups, where around 74% of the sample has stable levels of self-control, and the other 25% falls into increasing or decreasing patterns. To the extent that psychosocial maturity overlaps with self-control, similar patterns of stability and change may be expected within psychosocial maturity.

Empirical evidence has been amassed to support this assertion. In a subset of 3,793 children from the National Longitudinal Survey of Youth 1979, 80% of the sample exhibited stable levels of self-control. About 16% of the sample exhibited changes in levels of self-control after age 10 (Forrest & Hays, 2016). In the same sample, Turner and Piquero (2002) found that individuals in the top quartile of low self-control consistently remained in the top quartile. Further, a genetic component of self-control has been identified in the Add Health twin sample. Genetic effects accounted for 64% of the variation in low self-control in Wave 1 of the sample

and 53% in Wave 2. This evidence was supplemented by the finding of a strong (r = 0.64)

correlation between self-control between the waves (Beaver, Wright, DeLisi, & Vaughn, 2008).

We essentially have two possible starting points. On the one hand, we might state that the

average adult is developmentally mature. This raises the question of what to do with the

juveniles who are empirically at that level of maturity. On the other hand, we might assume that

the average 10 or 12-year-old is not developmentally mature. This raises the question of what to

do if they remain immature as they grow up.

Figure 2 captures the extent of this problem. Figure 2 uses Cauffman and Steinberg's

(2000) data as a starting point to simulate psychosocial maturity data. The simulation samples

1,000 cases from each of five age groups: 10-12, 13-15, 16-18, 19-21, and 22-24 with

psychosocial maturity set at the means and standard deviations reported by Cauffman and

Steinberg.

Figure 2: Pyschosocial Maturity: Below Average 12-year-old, Above Average Adult
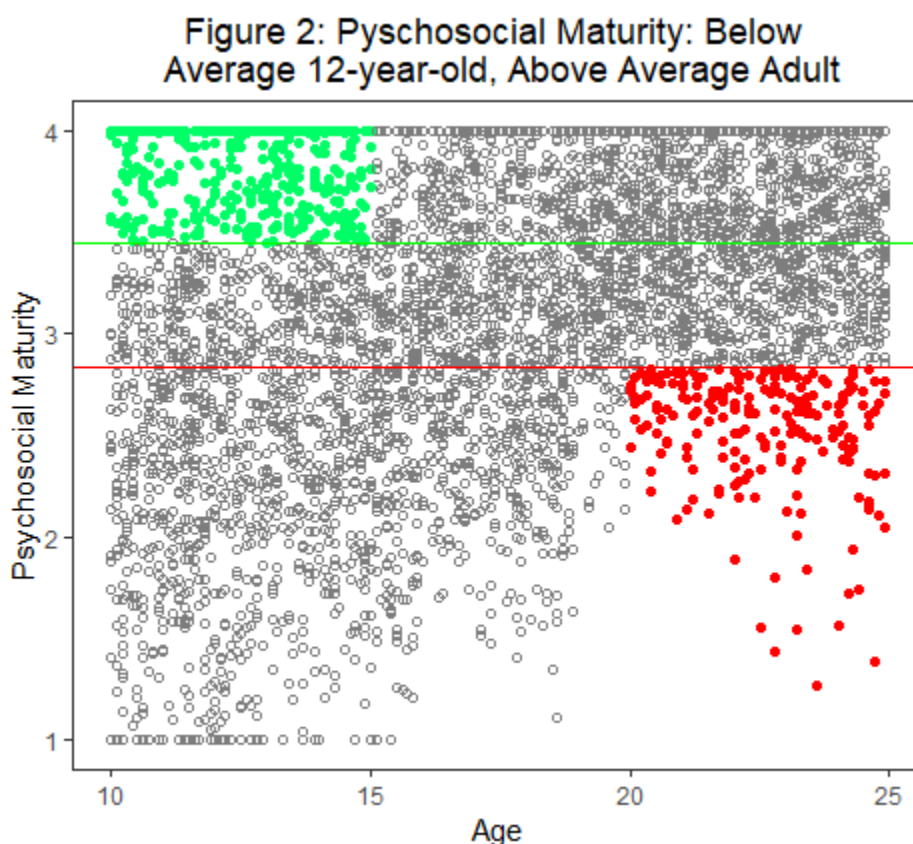
In Figure 2 the threshold for "immature" is set at the average of the 12-year-olds (the tenth grade group from Cauffman and Steinberg). A threshold for mature is set using the adult age group. Red dots fall below the mean for 12-year-olds, while green dots are above the average for adults. Age increases from left to right, and as expected, there is a lower density of red dots (i.e., individuals) on the lower right quadrant of the figure. That indicates the decreasing likelihood that a randomly sampled adult has a level of psychosocial maturity lower than that of the average 10-12-year-old. However, this portion of older individual continue to fall below the average 13-15-year-old.

In the upper left quadrant of Figure 2 there is a substantial concentration of green dots. These dots indicate individuals who fall above the average adult in psychosocial maturity. Thus, concerns about punishment based on maturity-as-culpability must rationalize the handling of

those cases where juveniles are similar in psychosocial maturity to adults, and where adults are similar to juveniles. Wherever a threshold for culpability is set, policy will need to specify how to handle immature adults and mature juveniles.

This is not to suggest that psychosocial maturity is the only factor that should predict the length and type of punishment someone should receive for violating the law. Adult criminals who are psychosocially immature have, in all likelihood, had multiple contacts with the criminal justice system. Prior criminal record is an established reason for increasing the severity of punishment (Von Hirsch, 1976). Some may not find their level of psychosocial maturity relevant, or may argue that psychosocial immaturity is less relevant when experience should guide behavior.

In addition, it may be that a person's level of psychosocial maturity does not change in large amounts, relative to where they started, but the amount of maturity could matter less to their behavior. Low psychosocial maturity may appear to predict crime, but the reasons a person commits crime at older ages may change. For example, the experience component mentioned above may matter. A less responsible (i.e., mature) person may make the same decisions at 17 and 27, but at 27 there is a host of experience that comes along with the decision. They may still be irresponsible, but the decision could be framed as a more thought-out action. This hints at the idea that they have a more developed character, and the decision is a product of who they are, not their immaturity.

However, the logic of using psychosocial maturity extends from the idea that psychosocially immature juveniles are less capable of making good decisions, and that lack of a capacity is not viewed as their fault. It is a small leap to think that any diminished capacity for making decisions may also be relevant to how likely someone is to learn from negative outcomes

from bad decisions. This has a basis in deterrability literature, which postulates that individuals differ in their likelihood to respond to sanctions (Piquero, Paternoster, Pogarsky, & Loughran, 2011; Pogarsky, 2002). Though some evidence suggests that individuals inconsistently respond to sanctions across different crime types (Bouffard, Exum, & Niebuhr, 2018), it may be that maturity of judgment is connected to responsiveness to crimes.

There is an instinctive belief that children and adolescents are less culpable than young adults. Psychosocial maturity provides a promising area of research to support or disconfirm cultural opinions on the culpability of juveniles. However, interpreting the current results of psychosocial maturity research raises issues. Chief among these issues is determining the point at which there is a large enough gap to determine different levels of culpability. Following from this is the problem of what to do with early-maturing juveniles and late-maturing adults.

Dissenting from Roper v. Simmons, Justice O'Connor recognized the problem created by immature adults and mature juveniles, arguing "that at least *some* 17-year-old murderers are sufficiently mature to deserve the death penalty in an appropriate case" (p. 600). Examining the evidence cited by the court in Roper, O'Connor argued that the court failed "to establish that the differences in maturity between 17-year-olds and young "adults" are both universal enough and significant enough to justify a bright-line prophylactic rule against capital punishment of the former." Several years earlier Morse identified this issue, noting that juveniles may be less responsible as a class and should be treated differently than adults, but fairness would dictate that "adults with the same responsibility diminishing characteristics should be treated equally" (Morse, 1997, p. 61). In light of these limitations, a finding of significant differences between age groups is insufficient for answering these questions.

Limitations of Brain Sciences

To bolster the evidence of marginal differences in psychosocial maturity, many turn to neuroscience. Studies in this field provide a compelling layer of evidence, especially in the form of visually pleasing images, there are several issues with connecting neuroscience, psychosocial maturity, and criminal behavior to inform culpability.

Maroney (2009) noted that differences in brain structure are ill-suited for diagnosing culpability. Another line of critique notes that while changes in brain structure are often cited as evidence that the juvenile brain is still developing, there is no definitive link between brain structure and behavior (Aronson, 2007, p. 115).

In addition, two related assumptions should be validated if the neuroscience of risk-taking is to inform punishment policy. The first is an assumption behind neuroscience studies. To draw policy implications from neuroscience studies, the reader must assume that differences in behavioral performance on laboratory tasks generalize to real-world behavior. A second assumption is that brain regions that govern choice in a laboratory task operate similarly in a real-world risk scenario. This is an assumption that the differences in the brain identified in decision tasks – which should explain riskier choices in the decision tasks – are relevant to actual risk-taking behavior.

To test the first assumption, those who make riskier decisions during a laboratory task that identifies risk preference should also prefer more risks outside the lab. Or, for stronger evidence, the activity regions identified as more or less active, for example, the ventral striatum, should also correlate with real-world risk-taking (particularly delinquent and criminal) behavior. However, while there is some evidence that decision tasks are correlated with real world

behavior (Modecki, 2008), there is less evidence that areas where the brain operates differently in adolescents are consistently correlated with deviant or criminal behavior.

It is tempting to make the cognitive leap to infer that group differences in cognition are also responsible for differences in risk behavior. While differences in risk preference must exist somewhere in the brain, there is less evidence that regions of interest where cognitive differences between juveniles and adults exist are the same ones that govern real-world risk-taking. Another way to look at this limitation is to note that most neuroscience studies report activation differences in regions of interest between juveniles and adults. These areas of activation frequently are not correlated with real-world outcomes, such as self-reported behavior. In one study, increased activity in the nucleus accumbens was positively correlated with perception of positive consequences for risky behavior juveniles *and* adults (Galvan, Hare, Voss, Glover, & Casey, 2007). That something different is going on in a juvenile's brain does not necessarily mean it affects the juvenile's ability to consider and make criminal decisions.

Sherman, Steinberg, and Chein (2018) reviewed twenty-three studies that examined brain responsivity and risk-taking. Eleven contained measures of real-world risk-taking and laboratory risk-taking, but there was a significant correlation in only two of the studies. In addition, results from *f*MRI scans did not reveal any region consistently correlated with risk-taking (Sherman et al., 2018). For example, one study found no regions of interest related to risks in laboratory tasks were correlated with sensation seeking or impulsivity, though resistance to peer influence was predicted by activity in the ventral striatum (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011). The problem is that regions that identify differences in functionality between adults and juveniles do not consistently differentiate risk-prone and risk-averse individuals. Sherman et al. (2018) observe that small sample sizes and inconsistent measurement may be behind the lack of

correlations, but to date, regions of interest for patterns of development have not been correlated with real-world risky behavior.

If the areas that show average differences in activation levels and functionality between juveniles and adults also predict risk-taking behavior, this would be strong evidence in support of policy oriented toward treating juveniles differently. Indeed, this is the assumption made when researchers refer to "hot" and "cold" systems and infer that results from *f*MRI scans bring science closer to understanding risky decision-making. However, another possibility is individual differences drive differences in behavior, and average group differences in brain activity and function between juveniles and adults explain little or nothing of the differences in risk-taking (Bjork & Pardini, 2015; Pfeifer & Allen, 2012). It might be that baseline individual differences in brain activity are exacerbated in certain situations. If this is the case, it is less clear how this information should inform policy. For example, an individual differences model could be interpreted to support early intervention in the form of treatment, or it could support early intervention in the form of extended sentencing. The corrections literature grapples with this question, often favoring early intervention. Alternatively, rehabilitation of the most high-risk individuals is a pillar of Risk-Need-Responsivity model (Andrews & Bonta, 2010). Most important, an individual differences model would suggest that changes in brain activity, functionality or structure that occur normally in the transition from adolescence to adulthood are related to risk-taking may take a conceptual backseat to baseline individual differences in risk preference. To date, evidence can support both interpretations.

In addition, sanctions for committing serious crimes are unlikely to drastically change due to concerns about an individual's level of psychosocial maturity. The Supreme Court has made extreme punishments illegal, but that is different from arguing for a youth discount for a

16-year old who commits armed robbery. In cases where serious punishment is not required due to the severity of the offense or the long history of the offender – most cases in the system – psychosocial maturity may provide relevant additional information for policy.

A further question is whether the "hot" and "cold" systems argument is relevant to juvenile justice policy. While the apparent difficulty of juveniles to regulate themselves under "hot" conditions has been hypothesized, there is no accompanying theory about what sorts of crimes are done under "hot" conditions. A broad change in sentencing policy (i.e., a youth discount) based on how juveniles function under certain conditions does not make sense for crimes where those conditions are not met.

Future research may overcome the missing empirical gap by establishing differences between the average adult and juvenile brains in risk-taking regions are connected to risk-taking and criminal behavior. Sherman et al. (2018) point out that inconsistent measurement techniques may cause conflicting results. They suggest that more whole-brain analyses are needed. But to date the evidence points toward no correlation. This important limitation throws into question whether the science of adolescent neurodevelopment is advanced and precise enough to inform policy on juvenile punishment. While the dual-systems theory clearly describes processes specific to juvenile development, the limitation described above shows the evidence from neuroscience is lacking.

Hypotheses

Based on the limitations of previous research, the reasons for presuming an age-graded relationship between psychosocial maturity and crime exists, and the importance of an age-graded relationship for punishment policy, the following hypotheses are presented.

1. Increased psychosocial maturity will predict decreased criminal behavior.

2. There will be a curvilinear relationship between age and crime.

3. The relationship between psychosocial maturity and criminal behavior will attenuate as age increases.

Chapter 3

Methods

As the previous chapter explains, psychosocial maturity plays an important role in the policy arguments about why juveniles should be handled and treated differently by the justice system. It offers empirical verification of assumptions long held as obvious fact by the general public. However, the research identifies small significant differences between juveniles and adults that are difficult to translate into policy. On a related note, any attempt to base a decision of treatment or punishment on a level of psychosocial maturity would necessarily create numbers of adults who are of diminished culpability and numbers of juveniles who are not.

Broadly speaking, three types of samples and analysis plans could be used to test the interactive effect of psychosocial maturity on criminal behavior. One is to gather a large cross-section of participants and evaluate whether the coefficients are larger between the variables of interest at certain age ranges (Tittle & Ward, 1993). A second method, exemplified by Gardner and Steinberg (2005), is to conduct an experiment in which the participant's exposure to some psychosocial variable is manipulated and the researchers evaluate whether the variable has an effect for one age group but does not for another. The third is through a longitudinal design in which a person's level of psychosocial maturity can be observed at multiple time points and the relationship between psychosocial maturity and some outcome can be observed to attenuate or remain stable over time. A longitudinal design has distinct advantages for evaluating this question. Continued measurements allow participants to act as their own controls. This helps answer the question of how much someone matures over time. The person-level measures over time allow examination of the most compelling question for this research: does someone's level of psychosocial maturity matter more (more strongly predict behavior) when they are in

adolescence versus adulthood? A large cross-sectional design would allow a comparison of the strength of variables for adolescents and adults, but it would be incapable of revealing whether an individual person's average relationship between psychosocial maturity and delinquency changes over time.

The relationship between psychosocial maturity and delinquent behaviors in this sample has already been established (Sweeten et al., 2013). The hypothesis of this study is that the strength of any relationship between psychosocial maturity and delinquency should depend on the age of the subject. The first place to look is in a sample of delinquents. In a general population sample the relationship between psychosocial maturity and delinquency may be attenuated, as psychosocial maturity should be a stronger predictor of adolescent behavior than adult behavior. Therefore, a sample of serious delinquents followed from adolescence to adulthood provides the maximum chance to find any changes in a relationship between psychosocial maturity and crime.

The Pathways to Desistance sample is comprised of 1,354 serious juvenile offenders from Philadelphia, Pennsylvania and Phoenix, Arizona. Participants were between 13 and 17 years old when the baseline interview data was collected in 2000. Eleven waves of data collection ended in 2010. Youth were selected based on a review of court files. Participants were adjudicated delinquent for felony offenses (not including less serious property crimes) or misdemeanor sexual assault or misdemeanor weapons offenses. Because a disproportionate amount of felony cases for this age group consists of drug offenses, drug offenses were capped at 15% of the sample. Adolescents adjudicated for misdemeanor weapon and sex offenses were also deemed eligible for participation.

Of 3,807 youth adjudicated for an eligible charge, 2,008 were contacted for participation. Reasons an otherwise eligible youth was not contacted included practical concerns regarding the caseload of interviewers, as well as sample concerns such as keeping the proportion of drug offenders capped at 15%. Of those contacted, 1,354 were enrolled and 655 were not enrolled.

After obtaining consent, a baseline computer-assisted interview was conducted. Questions were read aloud, and for questions that divulged personal information (for example, victimization) respondents used a covered keypad. Collateral information was also collected from an adult (usually the parent). Data was collected at 6-month intervals for the first three years. From that point, four more waves were collected at yearly intervals. Interviews were conducted at home or in secure facilities with few exceptions (Schubert et al., 2004). The interview process was divided into two 2-hour sessions. Participants were paid $50 for the baseline interview except where facilities did not allow payment. Payment for interview participation increased to $150 at the last wave of data collection (Cauffman, Fine, Thomas, & Monahan, 2017), and just over 63% of the sample completed all ten follow-up interviews (Pathways, n.d.).

The Pathways to Desistance provides a rich longitudinal dataset well suited to testing for an interactive effect of psychosocial maturity and age. The applicability of this data is partially demonstrated by the heavy use it has seen for probing questions on juvenile delinquency (Dmitrieva, Monahan, Cauffman, & Steinberg, 2012; Monahan, Steinberg, Cauffman, & Mulvey, 2009; Monahan et al., 2013; Monahan et al., 2013; Mulvey et al., 2010; Schubert, Mulvey, & Pitzer, 2016; Schubert et al., 2010; Schubert, Mulvey, Hawes, & Davis, 2018; Steinberg & Monahan, 2007).

Some have criticized policy that applies maturity to punishment by arguing that while many juveniles might engage in risks during adolescence, few become involved in serious delinquent behaviors. That is, the psychosocial maturity to crime research may be not be generalizable to a population of serious delinquents, the very individuals of concern when discussing the existence of a juvenile justice system and the threshold between juvenile and adult punishment. That is, a 14-year-old staying out past curfew does not raise a question of whether they should be punished less than an adult. But when a 14-year-old commits armed robbery, this question is relevant.

A second reason the sample of serious delinquents in the Pathways sample is appropriate is because if there is an interaction effect between age and psychosocial maturity on delinquency, we would expect it to exist in a serious delinquent sample. This is simply because most criminal behavior is rare, so a sample comprised mostly of nonoffenders will reduce the statistical power available to test complex relationships between serious delinquency and psychosocial maturity. On the other hand, it may be that serious offenses are caused by factors wholly unrelated to psychosocial maturity. For example, a simple assault caused during a fight between peers may be relevant to social status. On the other hand, an armed street robbery that occurs at night and is kept secret from others would confer no such status. In the street robbery, the influence of peers is not relevant. To the extent that this is true of more serious crimes, this sample may be less likely to pick up on effects of psychosocial maturity. Either result would be relevant for policy, though could not be evaluated in this sample, which contains only individuals involved in some form of serious delinquency. Participants in this study were convicted of a felony (or other serious crime), which necessarily means the population is specifically one that has been tracked

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through the very developmental period researchers have been most focused on, and were engaged in the criminal behaviors of concern for the justice system.

Another argument for using the Pathways sample is that it may provide a high-water mark for the effect of psychosocial variables on offending. The expectation from research calling on psychosocial maturity to mitigate gang-related crimes (Kellogg, 2014) supports the idea that psychosocial factors will be most likely to be discovered in a group of delinquents. On the other hand, a failure to discover such relationships in this sample would have important implications. The failure to find psychosocial maturity affects offending differently over time in a sample of delinquents might suggest that the most serious offenders are the ones likely to be impacted by low psychosocial maturity even into adulthood. The very criminals and delinquents whose cases have shaped policy might be the ones for whom the argument does not apply.

For example, Christopher Simmons (Roper v. Simmons, 2005) was convicted of a planned murder. His actions may have been influenced by peers (he reportedly bragged about the crime) but it was also orchestrated by Simmons. That is, it was not a case of getting "caught up" in a moment of poor decision-making. Nor was it an impulsive action. It was a premeditated murder. In cases of severe criminal activity, it could be that psychosocial maturity is less likely to play an important role in causing the behavior, and therefore for the most serious delinquents it would provide little reason to mitigate punishment.

In addition, measures of psychosocial maturity and criminal behavior were assessed at eleven time points, resulting in a rich longitudinal dataset that can tap into individual changes in psychosocial maturity, criminal behavior, and the strength of the relationship between the two at different time points.

Measures

Dependent Variable

Self-reported Offending. Offending was captured using 22 self-report items from the Self-Report of Offending Scale (Huizinga, Esbensen, & Weiher, 1992). Responses were coded to create a variety score that represented the proportion of offenses the participant had engaged in. This method is less susceptible to recall bias than measures that require respondents to estimate frequencies of behavior (Monahan & Piquero, 2009; Sweeten, 2012). Particularly in a sample of offenders already adjudicated of a serious offense, the variety of antisocial behaviors is a more reliable and valid than frequency counts of antisocial behaviors. Variety scores are not susceptible to high frequency counts of criminal behaviors. At the baseline interview participants reported lifetime involvement in the behaviors. At later interviews the respondents reported their involvement since the last interview.

Independent Variables

Psychosocial Maturity. Psychosocial Maturity was assessed using the three subscales, temperance, responsibility, and perspective, defined in Cauffman and Steinberg (2000). The procedure for constructing the subscales closely follows Ozkan (2016). Temperance was assessed using impulse control and suppression of aggression, two subscales of the Weinberger Adjustment Inventory, responsibility through the psychosocial maturity index, and perspective was assessed with the consideration of others and consideration of future consequences subscales. Resistance to peer influence was also assessed.

Temperance was assessed by combining two scales from the Weinberger Adjustment Inventory. Impulse control was assessed with eight items in which participants scored how their behavior matched the statement (1 = False, 5 = True). For example, participants were asked to

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rate how true it was of them that "I say the first thing that comes into my mind without thinking enough about it." Suppression of aggression was created by using the mean of seven items scored on the same scale as impulse control. For example, "People who get me angry better watch out." Temperance was fit using a second-order confirmatory factor analysis where suppression of aggression and impulse control comprised the first-order factor and temperance was the second-order factor (α=0.84; NFI=0.91; NNFI=0.91; CFI=0.93; RMSEA=0.06).

Responsibility used the psychosocial maturity inventory (PSMI, Greenberger et al., 1975), which assesses thirty items (for example, "If something more interesting comes along, I will usually stop any work I'm doing"). Overall responsibility is assessed using the mean of the thirty items scored so higher scores indicate more responsibility. The mean was computed if 22 of 30 items contained a score. A single factor model was fit to the data at baseline (α=0.89; NFI=0.823, NNFI=0.856, CFI=0.866, and RMSEA=0.044).

Perspective was assessed by examining two scales. The future orientation inventory is scored with the mean of fifteen items combined from three different scales, the Life Orientation Task, the Zimbardo Time Perspective Scale, and the Consideration of Future Consequences scale. Items were scored 1-4 so those who gave greater consideration to the future had higher scores. A one-factor model was fit to the scale (α=0.68; NFI=0.96; NNFI=0.96; CFI=0.97; RMSEA=0.03). The second scale is the consideration of others scale from the Weinberger Adjustment Inventory, which used seven items scored 1-5. An example item asked respondents to score whether it was false or true that "Doing things to help other people is more important to me than almost anything else." Data in four of seven items was required to calculate the mean, and a single-factor model was fit to the scale (α=0.73; NFI=0.98; NNFI=0.98; CFI=0.99; RMSEA=0.04).

Previous researchers (Monahan et al., 2013; Ozkan, 2016) have suggested that perspective be evaluated by combining the two subscales just mentioned. To investigate the feasibility of doing this, a factor analysis between the two aggregated scales was conducted. For the factor analyses, the eigenvalues for the first factor ranged between 0.51 in the fifth wave to 0.70 in the third wave. Most were somewhere in the high 0.50 range. The second factor consistently had eigenvalues of -0.24. The factor loadings were between 0.54 and 0.60, and the uniqueness was between 0.64 and 0.75. This drove the decision to evaluate each scale independently.

Previous research has used a susceptibility to peers measure in combination with the psychosocial maturity inventory (Monahan et al., 2013), following the theorizing from earlier research on the conceptualization of psychosocial maturity, where being less susceptible to peers indicated more responsibility (Cauffman & Steinberg, 1996).

Resistance to peer influence was assessed by using the mean score across ten items rated 1-4, where high scores indicate more resistance to peers. Questions presented participants with conflicting scenarios. For example, a question would say "Some people go along with their friends just to keep their friends happy" and "Other people refuse to go along with what their friends want to do, even though they know it will make their friend unhappy." Respondents chose which scenario reflected their typical behavior by indicating which one was "sort of true" or "really true" of them. Items assessed going along with friends, fitting in with friends, changing their mind due to what a friend thinks, doing something wrong, hiding their opinion, breaking the law, changing how they act, taking risks, saying things you don't believe, and going against the crowd (Appendix A). The measure demonstrated good reliability and confirmatory factor analysis at each time of measurement revealed the data fit a one-factor model (α=0.73, Normed

Fit Index=0.92; Non-Normed Fit Index=0.92; Comparative Fit Index=0.94; Root Mean Square

Error of Approximation=0.04, Monahan & Steinberg, 2007).

Control Variables

Age. Participants reported their age at each wave of the interview.

Time spent in secure settings. The proportion of time since the previous interview that a

respondent had spent in a secure facility was recorded as a proportion. Following previous

research (Ozkan, 2016), the time youths spent in secure settings between each interview is added

as a control variable. This is the only control variable added to the fixed effects models. Other

controls are not added because they would be too difficult to interpret meaningfully if their

effects are significant. For example, a series of variables perceive risk. On the one hand, if this

variable was significant and eliminated effects found in the uncontrolled models, there is the

argument that how respondents perceive risk is a more proximal effect to decision-making than

psychosocial maturity. But how someone evaluates risk is exactly the effect psychosocial

maturity is theorized to have. Whether risk evaluation mediates any effect of psychosocial

maturity is an interesting but separate research question from the topic of this paper.

Early behavioral problems. Early onset of behavioral problems was indicated by the

count of the variety of behavior problems the respondent got in trouble for before age 11.

Options included fighting, stealing, being drunk or stoned, disturbing class, or cheating.

Analysis Plan

The general plan is to test whether age interacts with psychosocial maturity to predict

criminal behavior. After this relationship has been assessed, control variables will be added to

examine whether the relationship remains after controlling for theoretically relevant variables.

Mentioned above, the shapes of the relationships between two sets of variables, age and crime

and psychosocial maturity and crime, influence the interactions expected to exist in the between age, psychosocial maturity, and crime.

The relationship between psychosocial maturity and criminal behavior will be assessed while accounting for the effect of age on behavior. Each subconstruct of psychosocial maturity (and resistance to peer influence) will be examined separately. This is a necessary precursor for evaluating the research question. As described above, a negative correlation between psychosocial maturity and criminal behavior is essential to support the position that psychosocial maturity influences culpability. Finally, age should moderate the impact of psychosocial maturity on delinquent behavior such that as age increases, the relationship between psychosocial maturity and behavior should attenuate. Ozkan (2016) evaluated the possibility of time-varying developmental effects by using repeated failure models. Rather than assessing the dependent variable, criminal behavior, as a failure (i.e., reoffending or recidivism), it will be evaluated as a continuous outcome. Due to the skewed nature of the variety offending score, the log-linear outcomes will be used.

Following previous practice, the sub-components of psychosocial maturity will be analyzed in separate longitudinal models. The connection between each subconstruct of psychosocial maturity (responsibility, temperance, and perspective) and delinquency will be individually modelled, followed by the relationship between resistance to peer influence and delinquency. The main analyses will consist of a series of multilevel models that assess whether the average strength of psychosocial maturity as a predictor of criminal behavior changes in over time. In each model the effect of the sub-component on criminal behavior will be established. For each component, the following model will probe for the existence of a moderating effect of age and psychosocial maturity on criminal behavior.

The waves of data collection in the Pathways occurred at six-month intervals for the first three years, and at one-year intervals for the following four years. To facilitate ease of interpretation in the longitudinal models, the waves were recoded to represent one-year follow-up intervals, an approach following other research utilizing this dataset (e.g., Ozkan 2016). This allows for slightly simpler analysis, as each time interval is standard (Singer & Willet 2003), and also has the benefit of increasing responses. For time-varying variables (for example, psychosocial maturity variables and self-reported offending), the six-month and one-year follow-up were combined by taking the mean of the two waves. The same process was done for the eighteen-month and two-year follow-ups, as well as the thirty-month and three-year follow-ups. If data was missing at one of the two waves that were combined, the value for the non-missing year was used. This maximized data for analysis and resulted in fewer missing cases in variables of interest. For each of the variables of interest, the number of missing cases was reduced by about half for the waves that were combined. For example, in waves three and four, temperance had 125 and 126 missing cases. When the waves were combined, the number of missing cases was reduced to 66. After restricting the data to the analytic sample, a long data file of 1,266 individuals with valid measurements for at least four waves was used for analysis. Since five independent variables are modelled separately, the number of observations in the panel data ranges from 8,398 to 8,412. Tables 1A and 1B present summary information with cases that are missing values for time spent in secure settings removed. This provides a sample that varies only slightly in size as the analysis proceeds.

A logged version of the self-reported offending variety score is always the dependent variable. The relationship between age and offending behavior in the analytic sample will be established. This will evaluate the second hypothesis (a curvilinear relationship between age and

offending). In separate models for each psychosocial variable, a psychosocial variable will be added, followed by an omnibus interaction between the psychosocial variable and age. This provides insight into the first (increased psychosocial maturity predicts less offending) and third (the strength of the psychosocial-offending relationship attenuates with age) hypotheses. Then the interaction will be visualized by plotting the predicted regression lines for three different ages. Finally, the interaction will be further probed to determine whether there is an age boundary after which the psychosocial variable coefficients predicting offending are significantly larger or smaller, adding more insight to the third hypothesis.

The first stage of analysis will consist of running two longitudinal models to verify that the hypotheses above can be tested in this dataset. The first step will be the unconditional means model (equation 1.1), in which we can verify that there is sufficient variability in the outcome, self-reported offending variety. At each wave, self-reported offending variety is heavily skewed to the right, with most respondents reporting they engage in a small proportion of the available offenses. Therefore, the variable will be transformed into the log of offending variety (adding 0.01 to those with a value of 0, so the log can be computed).

$$\gamma_{ti} = \beta_{0i} + \alpha_i + \varepsilon_{ti} \qquad\qquad (1.1)$$

$$\gamma_{ti} = \beta_{0i} + \beta_1 AGE_{ti} + \beta_2 AGE^2_{ti} + \alpha_i + \varepsilon_{ti} \qquad\qquad (1.2)$$

Once variability in the means is verified, a time component to model the hypothesized age and age-squared curvilinear relationship with offending will be added for the second model (equation 1.2). This will allow meaningful inspection of the variance components, which will inform how much of variation in self-reported offending over time exists between-individuals versus within-individuals (Singer & Willett, 2003). Given the nature of self-reported offending

and the well-known changes in offending behavior over time, it is expected that most of the variation in offending over time exists within individuals.

$$\gamma_{ti} = \beta_{0i} + \beta_1 AGE_{ti} + \beta_2 AGE^2_{ti} + \beta_3 PSM_{ti} + \alpha_i + \varepsilon_{ti} \qquad (1.3)$$

$$\gamma_{ti} = \beta_{0i} + \beta_1 AGE_{ti} + \beta_2 AGE^2_{ti} + \beta_3 PSM_{ti} + \beta_4 AGE_{ti} \times PSM_{ti} + \alpha_i + \varepsilon_{ti} \qquad (1.4)$$

The next stage of the analysis will consist of adding each psychosocial variable in a separate model predicting offending over time (five separate sets of models, equations 1.3 and 1.4). This stage will test whether there is a significant relationship predicting offending that could change in nature over time. If any psychosocial variable does not predict offending at all, it no longer makes sense to ask if the nature of that relationship changes over time, since the variable does not predict changes in offending over time at all.

$$\gamma_{ti} = \beta_{0i} + \beta_1 AGE_{.i} + \beta_2 PSM_{ti} + \beta_3 AGE_{.i} \times PSM_{ti} + \alpha_i + \varepsilon_{ti} \qquad (1.5)$$

The third stage involves turning the time variable into a dummy variable and multiplying it with each psychosocial variable in a fixed effects model (equation 1.5). In this way, the coefficients for the interactions will represent the change in the size of the coefficient compared to time = T_0 (Allison, 2009). Finally, the models will be estimated with time-varying covariates (equation 1.5).

In the fourth stage, the proportion of time spent in secure settings will be added as a control variable, indicated by Z in equation 1.5. A further difference in equation 1.5 is any time-invariant variable α_i is assumed to have a normal distribution with a mean of 0, constant variance, and is uncorrelated with other variables in the equation.

$$\gamma_{ti} = \beta_{0i} + \beta_1 AGE_{.i} + \beta_2 PSM_{ti} + \beta_3 TIME_{.i} \times PSM_{ti} + \beta Z_i + \alpha_i + \varepsilon_{ti} \qquad (1.6)$$

The next step will be to evaluate a random effects model to compare the fit of the fixed

effects and random effects models. The Hausman test will provide some indication of whether

the more efficient random effects model is a better fit than the less biased fixed effects model.

Chapter 4

Results

Before delving into longitudinal results, it is prudent to examine measures of central tendency and dispersion for key variables. Table 1 presents these terms for the merged long-format data. The control variable of time spent in secure settings has fewer cases, which reduces the analytic sample size. The analytic sample was created by removing cases with missing values for time spent in secure settings. Notably, the independent variables are all scaled between 1-4 and 1-5, with overall average scores ranging from 2.6 to 3.6 and standard deviations hovering from 0.45 to 0.84. Further, logged self-reported offending variety has a mean near 0 and a standard deviation of 0.12. This is noted to facilitate interpretation of the model results below. The between and within components of the table give some indication of whether there is more variation between or within respondents across the panel data for the key independent variables and the dependent variable. For responsibility, future orientation, consideration of others, and resistance to peer influence, there is a roughly equal amount of variation between and within respondents. For temperance, there is slightly more variation between individuals than within (standard deviation of 0.68 between and 0.47 within). The within-person variation is similar for resistance to peers, future orientation, and responsibility (around 0.40). There was more within-person variation for temperance (0.47) and consideration of others (0.51).

It is useful to examine the means at each wave for the independent variables (Table 2). For each of the psychosocial measures, the average increased by about 0.20 points to a full point over the course of the study. The changes were smaller for temperance, responsibility, and future orientation (all increasing by around 0.20 over the course of the study) and larger for consideration of others (an increase of 1.07). Standard deviations remained stable from wave to

wave. For example, the standard deviation for temperance remained between 0.76 and 0.85 across the entire study. For time spent in secure settings, the average decreased from 0.45 to 0.30, indicating participants spent a lower proportion of their time in a secure facility.

T-tests were conducted to examine whether the analytic sample differed in key measures from the full sample (Appendix C). The analytic sample had significantly lower scores on all psychosocial maturity measures, which of course threatens the generalizability of the longitudinal results that restrict to the analytic sample for the sake of comparison. All independent variables included in interaction terms are grand-mean centered to aid interpretation.

Table 1: Descriptive Statistics

Variable	n	Mean	Std. Dev.	Min	Max
Self-reported offending variety (logged)	8,599	-0.04	0.12	-0.60	0.45
Between			0.06		
Within			0.06		
Age	8,599	19.92	2.56	14.00	26.00
Temperance	8,591	3.15	0.83	1.00	5.00
Between			0.68		
Within			0.47		
Responsibility	8,580	3.22	0.44	1.10	4.00
Between			0.33		
Within			0.29		
Future Orientation	8,576	2.64	0.53	1.00	4.00
Between			0.40		
Within			0.35		
Consideration of Others	8,591	3.69	0.77	1.00	5.00
Between			0.58		
Within			0.51		
Resistance to Peer Influence	8,578	3.31	0.53	1.00	4.00
Between			0.40		
Within			0.35		
Time Spent in Secure Settings	8,599	0.32	0.40	0.00	1.00
Early Onset Problem Behaviors	8,599	1.51	1.19	0.00	5.00

Table 2: Means over Time

	Wave 1			Wave 2			Wave 3			Wave 4			Wave 5			Wave 6			Wave 7		
	Mean	S.D.	n	Mean	S.D.	n	Mean	S.D.	n	Mean	S.D.	n	Mean	S.D.	n	Mean	S.D.	n	Mean	S.D.	n
Self-reported offending	-0.20	0.14	1,302	-0.16	0.08	1,264	-0.13	0.07	1,251	-0.13	0.08	1,191	-0.01	0.10	1,151	-0.01	0.09	1,133	-0.01	0.08	1,081
Temperance	3.02	0.76	1,305	3.03	0.79	1,288	3.11	0.80	1,271	3.18	0.83	1,213	3.20	0.85	1,204	3.25	0.86	1,179	3.28	0.86	1,131
Responsibility	3.09	0.42	1,305	3.14	0.43	1,287	3.19	0.43	1,270	3.24	0.45	1,212	3.27	0.45	1,202	3.31	0.44	1,175	3.28	0.42	1,129
Future Orientation	2.50	0.51	1,305	2.59	0.49	1,287	2.65	0.50	1,270	2.66	0.55	1,209	2.69	0.54	1,175	2.71	0.54	1,129	2.70	0.56	1,305
Consideration of Others	2.70	0.56	1,305	3.50	0.76	1,288	3.60	0.73	1,271	3.65	0.73	1,213	3.77	0.78	1,204	3.81	0.77	1,179	3.77	0.75	1,131
Resistance to Peers	3.10	0.50	1,304	3.18	0.50	1,287	3.28	0.50	1,270	3.34	0.53	1,212	3.39	0.53	1,202	3.43	0.52	1,174	3.44	0.51	1,129
Time Spent in Secure Settings (proportional)	0.45	0.40	1,305	0.33	0.38	1,288	0.29	0.38	1,272	0.28	0.39	1,215	0.28	0.39	1,207	0.28	0.39	1,179	0.30	0.41	1,133

The results of the unconditional means model and the model with age are summarized in Table 3. The significant unconditional means model coefficient of 0.06 indicates there is variation in the log of self-reported offending across respondents. The variance components indicate a small proportion of the variance exists between people ($\hat{\sigma}_0^2 = 0.0029$) and within individuals ($\hat{\sigma}_\varepsilon^2 = 0.043$). Since both variance components are significant, there is possible value in adding predictors to explain the variance between and within individuals, though the focus here is variance within individuals. A quick calculation of rho, $\rho = \frac{\hat{\sigma}_0^2}{\hat{\sigma}_0^2 + \hat{\sigma}_\varepsilon^2}$ provides a result of 0.40, indicating that 40% of the variation in self-reported offending is due to differences between individuals, and 60% of the variation is due to differences within individuals (Singer & Willett, 2003). That is, when predicting changes in self-reported offending, it will be fruitful to examine how an individual changes over time, and how those changes are connected to offending.

In the second model, with age added into the equation, there is a significant decline (-0.02) in self-reported offending variety over age. This result is expected, given the average decrease in offending that occurs into adulthood. The age-squared component is not significant. Inspection of the variance components reveals a small decrease in within-person variance, $\hat{\sigma}_\varepsilon^2$ decreases from 0.043 to 0.0041. This suggests about 5% of the within-person variation of self-reported offending variety is accounted for by age and age-squared.

Table 3. Longitudinal Models for Logged Self-Reported Offending Variety on Temperance

	Model 1: Unconditional		Model 2: with Time		Model 3: with Temperance		Model 4: Temperance X Age	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Constant	0.06***	0.0016	0.06***	0.0018	0.06***	0.0016	0.06***	0.0018
Age			-0.004***	0.0004	-0.002***	0.0004	-0.002***	0.0004
Age-squared			0.00	0.0001	0.00	0.0001	0.00	0.0002
Temperance					-0.03***	0.0012	-0.04***	0.0018
Age X Temperance							0.003***	
$\hat{\sigma}_0^2$	0.0029	0.0002	0.0029	0.0002	0.0022	0.0001	0.0021	0.0001
$\hat{\sigma}_\varepsilon^2$	0.0043	0.0001	0.0041	0.0001	0.0038	0.0001	0.0037	0.0001
Log-likelihood	10,107.93		10,167.00		10,564.26		10,569.90	
n(t)	8,412(7)		8,412(7)		8,412(7)		8,412(7)	

*** p < 0.001

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Increases in age predict significant decreases in offending (b = -0.004, p < 0.001). There is a negative relationship between temperance and the log of self-reported offending variety (b = -0.06, p < 0.001). Thus, a one-point increase on temperance predicts an average decrease of 0.03 in logged self-reported offending variety. Given the standard deviation of self-reported offending (0.12) this is a substantively weak predictor of offending behavior. A small decrease in the within-person variance ($\hat{\sigma}^2_\varepsilon$ = 0.0038) indicates just over 7% of the remaining variation in predicted self-reported offending is accounted for by changes in temperance ((0.0041 – 0.0038) / 0.0041 = 0.073).

Next, the model with an interaction with age is evaluated. A first reasonable step is to obtain a baseline idea of any interaction between age and temperance. Therefore, both variables are entered in their continuous form. The coefficient of 0.007 (p < 0.001) for the interaction indicates that with each increase of a year in age, the relationship between temperance and self-reported offending is expected to increase from the baseline by 0.003. That is, the negative relationship between temperance and self-reported offending, such that increases in temperance predict decreases in offending, is expected to attenuate for the average respondent as age increases. Additionally, adding the interaction accounts for a difference of four percentage points of variance explained $\hat{\sigma}^2_\varepsilon$ moves from 0.0038 to 0.0037). This justifies further searching for where that interaction exists and be subjected to substantive interpretation.

To begin that search, the regression equation can be calculated for different values of age. At this point, the question arises of what ages to use to estimate different regression equations. Values of the overall mean age along with one standard deviation above and below the mean were chosen. This is justified simply because there are not clinical thresholds for age, at which the relationship between a third psychosocial variable and offending is understood to change.

Indeed, discovering if such a relationship exists is the point of the current analysis. One matter of importance for interpreting the interaction coefficients is the distribution of ages in the sample. Estimates for 26-year-olds are omitted because only one respondent ever reported being 26. The rest of the age categories have at least one hundred respondents, though the most robust estimates will be from ages 17-22, when 11%-12.5% of respondents fall into each age category (Figure 3). Examining the standard errors for the age-25 by temperance interaction, the standard error increases, whereas it varies less for the other age categories. This pattern repeats though all the dummied-interaction models, and generally invites more skepticism on regarding how reliable any single dummy-variable estimate is. The mean age across the entire sample and all waves is 19.54 with a standard deviation of 2.56.

Figure 3: Frequency of Age Across Full Sample
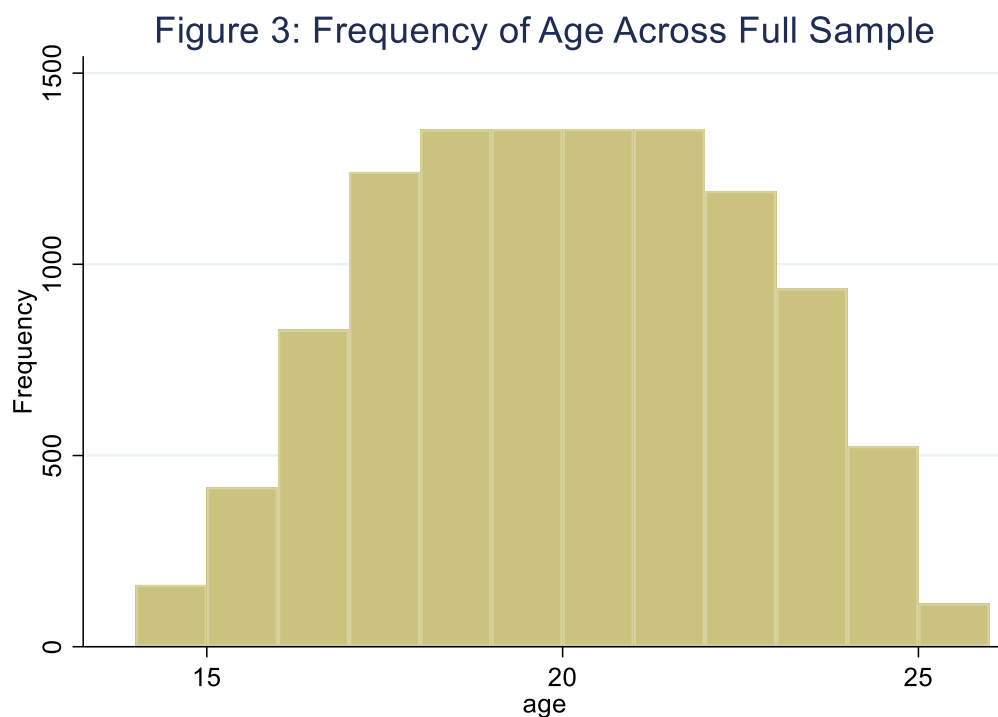
Figure 4 visualizes the interaction between age and temperance. The black line is the predicted average slope of the 17-year-olds, the red dashed line represents the average age of 19.5, and the green line represents the predicted line for those a standard deviation above the average age. The first apparent pattern reinforces a standard finding: at older ages, the intercept is lower (though interpreting the intercept itself is not meaningful, as the scores for temperance do not start at 0). In addition, the slightly different directions of the lines are in line with expectations. The line is steepest (i.e., a stronger relationship between temperance and offending) for the youngest age group. The relationship is a third as strong for the average 21-year-old (b = -0.02, down from b = -0.06 for the typical 17-year-old.

Further examination reveals that all three slopes are statistically significant ($p < 0.001$). Aiken and West (1991, pp. 19-21) provide a method of calculating the significance of each regression equation. A t-test of the difference between slopes is calculated by $t = \dfrac{d}{s_d} =$ $\dfrac{(Z_H - Z_L)b_3}{\sqrt{(Z_H - Z_L)^2\, s_{33}}} = \dfrac{b_3}{\sqrt{s_{33}}}$, where s_{33} is the standard error of the slope, and Z_H and Z_L represent the high and low values of Z (age).

Figure 4: Self-Reported Offending on on Temperance at Selected Ages

Legend:
- Age: 17, y = -0.06x + 0.13
- Age: 19.5, y = -0.04x + 0.08
- Age: 21, y = -0.02x + 0.03
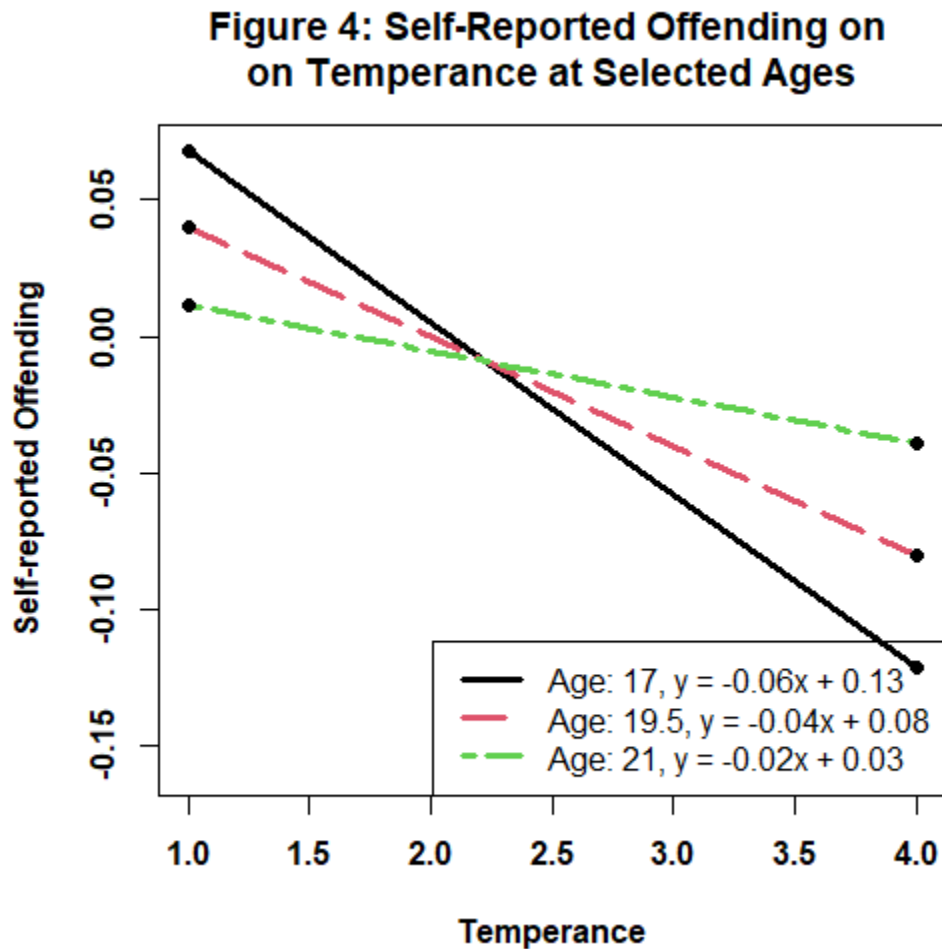
Table 4 further probes the interaction between age and temperance. An age of fourteen was used as the reference point because it was the typical age of respondents when data collection began. Two important results stand out. First, with the 14-year-old respondents as the reference category, the coefficients for age indicate significantly less self-reported offending once adolescents reach 17 years of age, as would be expected when age has an overall significant negative relationship with self-reported offending. The coefficients increase slightly in magnitude (from -0.01 to -0.04) and significance (from $p < 0.05$ to $p < 0.001$).

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The second important result is the series of interactions between temperance and age. The interaction between temperance at age 14 is the reference category. Age is set up as a dummy variable. The interpretation is of whether the coefficients for temperance predicting self-reported offending changes in strength as age increases. Compared to the relationship between temperance and offending at age 14, the coefficients at ages 15 and 16 are not significantly different. At age 19 the coefficient is over the significance threshold ($b = 0.02$, $p < 0.01$). This indicates the coefficient at age 19 is slightly larger than the initial coefficient, which is negative. That is, the coefficient represents how much age moderates the relationship between temperance and offending compared to the average correlation of temperance for a 14-year-old respondent. This trend continues and grows in magnitude and significance as age increases. From ages 20 to 25, the coefficients are all significant at $p < 0.01$, and are larger than the initial coefficient by 0.02 at age 20, increasing to 0.04 at age 24. The coefficient for the interaction at age 25 and temperance is not significant, but given the reduction in responses (because few respondents were ever measured at 25) and the increase in standard errors, this insignificant coefficient should likely be ignored given the trend of the rest of the coefficients.

Table 4. Longitudinal Models for Logged Self-Reported Offending
Variety on Temperance

	Model 5: Dummied Temperance X Age		Model 6: Dummied Temperance X Age with Controls	
	Coefficient	Std. Error	Coefficient	Std. Error
Constant	0.07***	0.0055	0.08***	0.0057
Temperance	-0.05***	0.0076	-0.05***	0.0076
Time in Secure Setting			-0.02***	0.0026
Age-15	-0.01	0.0062	-0.01	0.0062
Age-16	-0.01	0.0059	-0.01	0.0059
Age-17	-0.01*	0.0058	-0.02**	0.0058
Age-18	-0.01*	0.0058	-0.02**	0.0058
Age-19	-0.02**	0.0059	-0.02***	0.0059
Age-20	-0.02**	0.0059	-0.02***	0.0059
Age-21	-0.02**	0.0060	-0.02***	0.0060
Age-22	-0.03***	0.0062	-0.03***	0.0062
Age-23	-0.03***	0.0066	-0.03***	0.0066
Age-24	-0.04***	0.0092	-0.04***	0.0092
Age-25	-0.01	0.0684	-0.01	0.0681
Age-15 X Temperance	0.01	0.0085	0.01	0.0084
Age-16 X Temperance	0.01	0.0080	0.01	0.0080
Age-17 X Temperance	0.01	0.0079	0.01	0.0079
Age-18 X Temperance	0.01	0.0079	0.01	0.0078
Age-19 X Temperance	0.02**	0.0079	0.02**	0.0078
Age-20 X Temperance	0.02**	0.0079	0.02**	0.0078
Age-21 X Temperance	0.02**	0.0080	0.02**	0.0080
Age-22 X Temperance	0.03***	0.0081	0.03***	0.0081
Age-23 X Temperance	0.03**	0.0085	0.03**	0.0085
Age-24 X Temperance	0.04***	0.0114	0.04**	0.0114
Age-25 X Temperance	-	-	-	-
rho	0.42		0.44	
n(t)	8,412(7)		8,412(7)	

* p < 0.05

** p < 0.01

*** p < 0.001

Note: some categories omitted due to collinearity; age 14 is the reference
category

The second model in Table 4 is the fixed effects model with controls added to the equation. The effect of temperance remains significant ($b = -0.05$, $p < 0.001$). The effect of age is consistent with the uncontrolled model. Time in secure setting is significant, with more time spent in secure settings predicting a small reduction in the logged self-reported offending variety ($b = -0.02$, $p < 0.001$). The rho statistic increases to 0.44 in this model from 0.42 in the uncontrolled model, indicating a 2% difference in the variation explained. The interactive effects of age and temperance are appreciably different than the uncontrolled model. The coefficients indicate age moderates the effect of temperance on offending for ages nineteen through twenty-four ($b = 0.02$, $p < 0.01$ at age 19, and $b = 0.04$, $p < 0.01$ by age 24), consistent with the uncontrolled model.

Finally, the Hausman test between the two models with controls was statistically significant, indicating the coefficients in the random effects model are somewhat different than the coefficients in the fixed effects model. This suggests the more efficient estimates from the random effects model may be biased. However, the Hausman test between the uncontrolled models is not statistically significant ($p > 0.05$). The random effects models are presented in Appendix B.

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Table 5 summarizes the initial results for self-reported offending regressed on responsibility. The first columns on the left have been kept for consistency and contain the same information as Models 1 and 2 in Table 3.

Moving to the right, Model 3 of Table 5, a similar line of coefficients is seen. Increases in responsibility predict decreases in offending ($b = -0.02$, $p < 0.001$). A one-point increase in responsibility predicts a 0.02 decrease in offending variety. The variance components are also similar. In the fourth model, the interaction between age and responsibility is statistically significant, indicating the relationship between responsibility and offending behavior attenuates from a coefficient of -0.02 ($p < 0.001$) by 0.003 ($p < 0.001$) for each year increase in age. Adding the interaction results in a pseudo-R^2 of 0.07, indicating the model explains an additional 7% of the variance ($\hat{\sigma}^2_\varepsilon$ decreases from 0.0042 to 0.0039).

Table 5. Longitudinal Models for Logged Self-Reported Offending Variety on Responsibility

	Model 1: Unconditional		Model 2: with Time		Model 3: with Responsibility		Model 4: Responsibility X Age	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Constant	0.06***	0.0016	0.06***	0.0018	0.06***	0.0004	0.06***	0.0017
Age			-0.004***	0.0004	-0.003***	0.0004	-0.002***	0.0004
Age-squared			0.00	0.0001	0.00	0.0001	0.00	0.0001
Responsibility					-0.02***	0.0022	-0.02***	0.0022
Age X Responsibility							0.003***	0.0010
$\hat{\sigma}_0^2$	0.0029	0.0001	0.0029	0.0001	0.0028	0.0001	0.0028	0.0001
$\hat{\sigma}_\varepsilon^2$	0.0043	0.0001	0.0041	0.0001	0.0042	0.0001	0.0039	0.0001
Log-likelihood	10,096.45		10,167.00		10,208.91		10,247.12	
n(t)	8,402(7)		8,402(7)		8,402(7)		8,402(7)	

*** p < 0.001

Following the procedure from above, the significant interaction is probed for further differences. Substituting age at standard deviation above the mean, at the mean, and a standard deviation below the mean yields three regression equations visualized in Figure 5. Inspection of the variance-covariance matrix reveals each regression equation is statistically significant ($p < 0.001$). The intercept is lower as age increases, and the slopes of the lines appear closer to a null relationship as age increases.

Figure 5: Self-Reported Offending on on Responsibility at Selected Ages
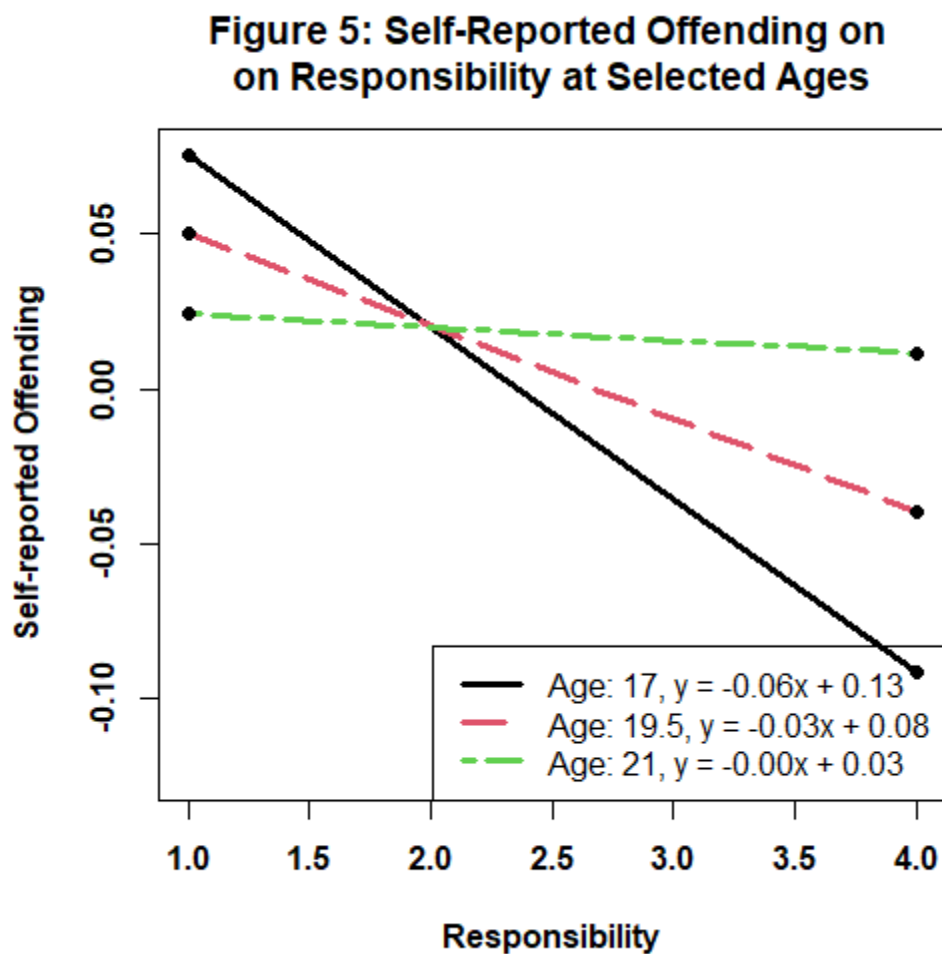
Table 6 summarizes the results from two multilevel models. In the first column, the fifth set of models contains the interaction between responsibility and a dummied version of age. For the effect of age, a similar story unfolds as with temperance. Offending at older ages decreases. The size of the decreases in offending increase in size and significance (larger coefficients and lower p-values) as age increases.

A different story is apparent regarding the interaction between age and responsibility. Contrary to the previous models, the interaction effect of responsibility predicting offending more or less robustly at different ages is not compelling. Only two coefficients are significant, and they occur sporadically as age increases. The coefficients seem to creep to 0.03 at ages 20 and 21, which triggers a significant interaction effect ($p < 0.05$), suggesting that the coefficients of responsibility on offending are slightly larger than for the typical 14-year-old. As a set, it seems clear there is a significant effect of age, and there is not a consistent significant effect for an age by responsibility interaction resulting in significantly different coefficients at any single age.

In the next model the control variable is added. The effects of age and the interaction of age and responsibility disappear once the predictive time in secure settings ($b = -0.02$, $p < 0.001$) is accounted for. The rho statistic increases to 0.48 from 0.47 in the model without controls, indicating a one percentage point difference in variance explained from the addition of controls. There are fewer ages where a significant difference from the typical 14-year-old are found. Following down the line to the interaction between age and temperance, only one coefficient is significant (at age 21, $b = 0.03$, $p < 0.05$). The Hausman test for both the uncontrolled and

controlled models was significant (p < 0.001 for the comparison of uncontrolled models, and p <

0.05 for the controlled models).

Table 6. Longitudinal Models for Logged Self-Reported Offending Variety on Responsibility

	Model 5: Dummied Responsibility X Age		Model 6: Dummied Responsibility X Age with Controls	
	Coefficient	Std. Error	Coefficient	Std. Error
Constant	0.07***	0.0059	0.19***	0.0389
Responsibility	-0.04**	0.0128	-0.03**	0.0127
Time in Secure Setting			-0.02***	0.0027
Age-15	-0.01	0.0066	-0.04	0.0449
Age-16	-0.01	0.0063	-0.02	0.0423
Age-17	-0.01*	0.0062	-0.04	0.0413
Age-18	-0.01*	0.0062	-0.05	0.0413
Age-19	-0.02**	0.0062	-0.04	0.0412
Age-20	-0.02**	0.0062	-0.10*	0.0413
Age-21	-0.02***	0.0064	-0.12**	0.0420
Age-22	-0.03***	0.0065	-0.09*	0.0433
Age-23	-0.03***	0.0070	-0.09	0.0479
Age-24	-0.04***	0.0095	-0.11	0.0643
Age-25	-0.03	0.0700	-0.03	0.0697
Age-15 X Responsibility	0.01	0.0147	0.01	0.0146
Age-16 X Responsibility	0.00	0.0138	0.00	0.0137
Age-17 X Responsibility	0.01	0.0135	0.01	0.0134
Age-18 X Responsibility	0.01	0.0135	0.01	0.0134
Age-19 X Responsibility	0.01	0.0134	0.01	0.0133
Age-20 X Responsibility	0.03*	0.0134	0.02	0.0134
Age-21 X Responsibility	0.03*	0.0136	0.03*	0.0136
Age-22 X Responsibility	0.02	0.0140	0.02	0.0139
Age-23 X Responsibility	0.02	0.0153	0.02	0.0153
Age-24 X Responsibility	0.03	0.0200	0.02	0.0200
Age-25 X Responsibility	-	-	-	-
rho	0.47		0.48	
n(t)	8,402(7)		8,402(7)	

* p < 0.05
** p < 0.01
*** p < 0.001
  Note: some categories omitted due to collinearity; age 14 is the
  reference category

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In Table 7 the series of models is run with future orientation. Coefficients remain similar for age and the intercept (-0.003, p < 0.001 and 0.06, p < 0.001). The significant relationship between future orientation and self-reported offending is -0.02 (p < 0.001). The variance components indicate variation in future orientation accounts for 5% of the variation in offending behavior (0.0041down to 0.0039).

Continuing to mimic earlier results, the interaction between future orientation and age is statistically significant and positive (b = 0.002, p < 0.001), indicating the negative relationship between future orientation and self-reported offending variety attenuates as the cohort ages. The variance components indicate the interaction does not account for additional variation in offending behavior. Inspection of the variance components revealed all three interaction equations are statistically significant. Figure 6 demonstrates the same pattern of results, where steeper slopes are predicted at younger ages.

Table 7. Longitudinal Models for Logged Self-Reported Offending Variety on Future Orientation

	Model 1: Unconditional		Model 2: with Time		Model 3: with Future Orientation		Model 4: Future Orientation X Age	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Constant	0.06***	0.0016	0.06***	0.0018	0.06***	0.0017	0.06***	0.0017
Age			-0.004***	0.0004	-0.003***	0.0004	-0.003***	0.0004
Age-squared			0.00	0.0001	0.00	0.0001	0.00	0.0001
Future Orientation					-0.02***	0.0004	-0.02***	0.0018
Age X Future Orientation							0.002***	0.0007
$\hat{\sigma}_0^2$	0.0029	0.0001	0.0029	0.0001	0.0028	0.0001	0.003	0.0001
$\hat{\sigma}_\varepsilon^2$	0.0043	0.0001	0.0041	0.0001	0.0039	0.0001	0.0072	0.0001
Log-likelihood	10,096.92		10,155.93		10,230.55		10,235.47	
n(t)	8,398(7)		8,398(7)		8,398(7)		8,398(7)	

*** $p < 0.001$

Figure 6: Self-Reported Offending on on Future Orientation at Selected Ages
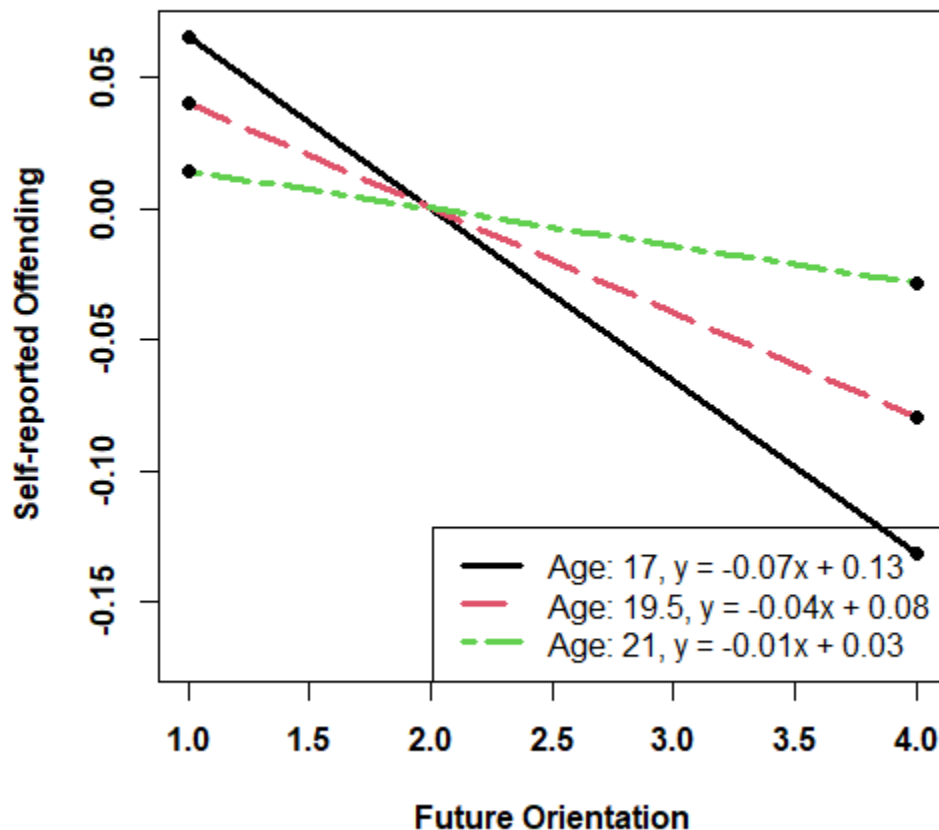
In Table 8, coefficients are examined for changes relative to the typical 14-year-old with an average level of future orientation. The decreases in offending relative to the reference category remain significant for age, with increases in age predicting decreases in offending. However, only one coefficient for an age x future orientation interaction is significant (at age 16, $b = -0.03$, $p < 0.05$). This indicates that the strength of the predictive relationship between future orientation and offending are not significantly different at different ages. This immediately conflicts with the omnibus interaction which indicated a significant interaction across all time points. In the model controlling for time spent in a secure setting, the interaction at between

future orientation and age at age 16 increases in significance, but not magnitude. In summary, future orientation does not appear to be a strong predictor of behavior, nor is it a better predictor at some ages than others. The Hausman test was significant in both the uncontrolled model comparison and the controlled model comparison ($p < 0.001$).

Table 8. Longitudinal Models for Logged Self-Reported Offending Variety on Future Orientation

	Model 5: Dummied Future Orientation X Age		Model 6: Dummied Future Orientation X Age with Controls	
	Coefficient	Std. Error	Coefficient	Std. Error
Constant	0.08**	0.0287	0.08**	0.0285
Future Orientation	0.00	0.0114	0.00	0.0114
Time in Secure Setting			-0.02***	0.0027
Age-15	0.02	0.0328	0.01	0.0326
Age-16	0.07	0.0310	0.07*	0.0309
Age-17	0.03	0.0304	0.03	0.0302
Age-18	0.02	0.0304	0.02	0.0303
Age-19	0.01	0.0303	0.01	0.0302
Age-20	0.00	0.0303	0.00	0.0301
Age-21	0.00	0.0307	0.00	0.0306
Age-22	-0.02	0.0315	-0.02	0.0313
Age-23	-0.02	0.0333	-0.01	0.0331
Age-24	-0.05	0.0471	-0.05	0.0469
Age-25	-0.04	0.0699	-0.04	0.0696
Age-15 X Future Orientation	-0.01	0.0130	-0.01	0.0130
Age-16 X Future Orientation	-0.03*	0.0123	-0.03**	0.0122
Age-17 X Future Orientation	-0.02	0.0120	-0.02	0.0120
Age-18 X Future Orientation	-0.01	0.0120	-0.02	0.0120
Age-19 X Future Orientation	-0.01	0.0120	-0.02	0.0119
Age-20 X Future Orientation	-0.01	0.0119	-0.01	0.0119
Age-21 X Future Orientation	-0.01	0.0121	-0.01	0.0120
Age-22 X Future Orientation	-0.01	0.0124	-0.01	0.0123
Age-23 X Future Orientation	-0.01	0.0130	-0.01	0.0129
Age-24 X Future Orientation	0.00	0.0176	0.00	0.0175
Age-25 X Future Orientation	-	-	-	-
Rho	0.47		0.48	
n(t)	8,398(7)		8,398(7)	

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Note: some categories omitted due to collinearity; age 14 is the reference category

The consideration of others models begins with a negative statistically significant relationship between how much individuals report considering the effects of their actions on others and self-reported offending behavior (b = -0.01, p < 0.001), such that increases in how much a person reports considering the effects of their actions on others predicts lower self-reported offending values. Again, the effect is small given the scale and standard deviation of the dependent variable. The variance components indicate a pseudo-R^2 of 0.048, indicating just under 5% variation in offending behavior is predicted by consideration of others ($\hat{\sigma}_\varepsilon^2$ changes from 0.0041 to 0.0039). Age continues to have a significant negative relationship on offending behavior (b = -0.003, p < 0.001).

Moving to model 4 in Table 9, the continuous interaction between age and consideration of others is added. There is a substantively small but significant positive interaction (b = 0.006, p < 0.001), indicating the negative relationship between consideration and offending gets slightly weaker as age increases in the sample. Analyzing the variance-covariance matrix allows inspection of regression equations at different values of age. Figure 7 visualizes these equations.

Table 9. Longitudinal Models for Logged Self-Reported Offending Variety on Consideration of Others

	Model 1: Unconditional		Model 2: with Time		Model 3: with Consideration of Others		Model 4: Consideration of Others X Age	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Constant	0.06***	0.0016	0.06***	0.0018	0.06***	0.0017	0.06***	0.0017
Age			-0.003***	0.0004	-0.003***	0.0004	-0.003***	0.0004
Age-squared			0.00	0.0001	0.00	0.0001	0.00	0.0001
Consideration of Others					-0.01***	0.0012	-0.01`***	0.0013
Age X Consideration of Others							0.002***	0.0005
$\hat{\sigma}_0^2$	0.0029	0.0001	0.0029	0.0001	0.0027	0.0001	0.0027	0.0001
$\hat{\sigma}_\varepsilon^2$	0.0043	0.0001	0.0041	0.0001	0.0039	0.0001	0.0039	0.0001
Log-likelihood	10,107.93		10,167.00		10,249.22		10,256.03	
n(t)	8,412(7)		8,412(7)		8,412(7)		8,412(7)	

*** $p < 0.001$

Figure 7: Self-Reported Offending on on Consideration of Others at Selected Ages

Legend:
- Age: 17, y = -0.03x + 0.13
- Age: 19.5, y = -0.02x + 0.08
- Age: 21, y = -0.01x + 0.03

Self-reported Offending (y-axis)

Consideration of Others (x-axis)
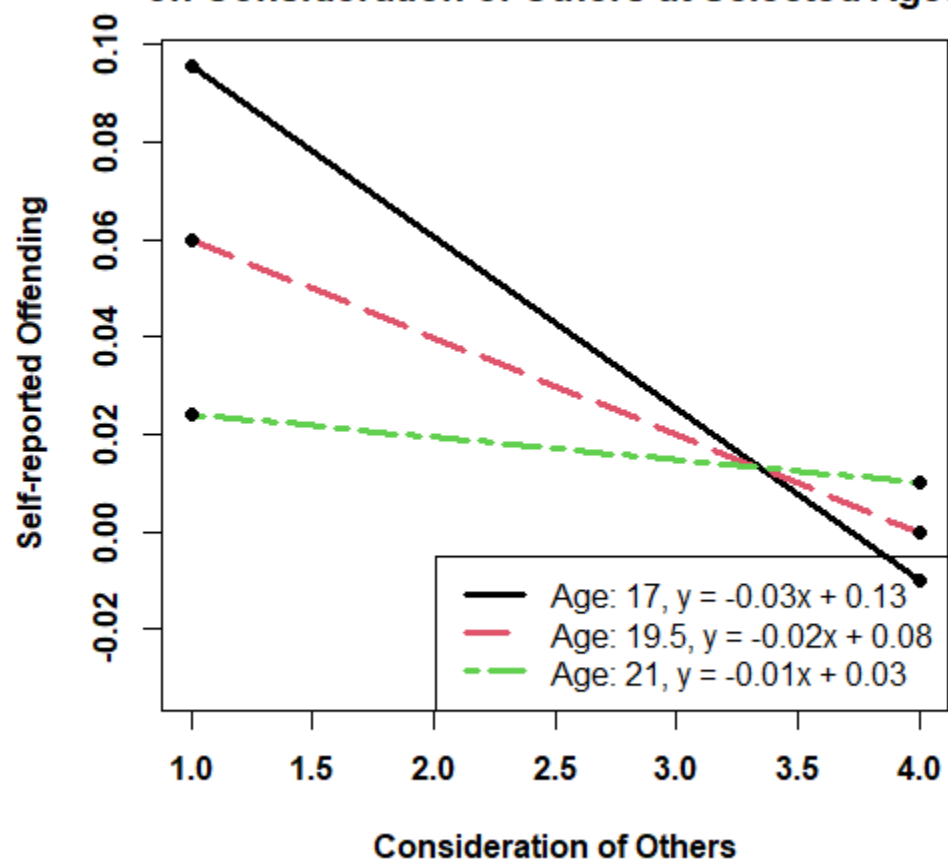
In the first model of Table 10 the interaction is probed with age as a dummy variable. By age seventeen the coefficients for age on offending are significantly different (and slightly larger), ranging from 0.02 to 0.05, with p-values of at least $p < 0.01$. The evidence for an interaction effect of age and consideration of others is not compelling. One coefficient at age twenty-four pops as significant ($b = 0.03$, $p < 0.05$), but the rest of the coefficients are not significant. In the controlled model a similar patten of results emerges. The one-off coefficient for the interaction between consideration of others at age twenty-five remains significant at the same magnitude, and increases in age predict slight decreases in offending behavior, with the coefficients getting more robust as age increases. Similar to previous models, more time spent in secure settings continues to predict decreases in offending behavior ($b = -0.02$, $p < 0.001$). Adding the control variable results in a two-percentage point difference in rho, from 0.46 to 0.48. The Hausman test was significant for both model comparisons ($p < 0.001$).

Table 10. Longitudinal Models for Logged Self-Reported Offending Variety on Consideration of Others

	Model 5: Dummied Consideration X Age		Model 6: Dummied Consideration X Age with Controls	
	Coefficient	Std. Error	Coefficient	Std. Error
Constant	0.08***	0.0057	0.09***	0.0058
Consideration of Others	-0.02**	0.0077	-0.02**	0.0076
Time in Secure Setting			-0.02***	0.0027
Age-15	-0.01	0.0064	-0.01*	0.0064
Age-16	-0.01	0.0061	-0.01*	0.0060
Age-17	-0.02**	0.0060	-0.02**	0.0060
Age-18	-0.02**	0.0060	-0.02***	0.0060
Age-19	-0.02***	0.0060	-0.03***	0.0060
Age-20	-0.02***	0.0060	-0.03***	0.0060
Age-21	-0.03***	0.0062	-0.03***	0.0062
Age-22	-0.03***	0.0063	-0.04***	0.0063
Age-23	-0.03***	0.0067	-0.04***	0.0067
Age-24	-0.05***	0.0095	-0.05***	0.0095
Age-25	-0.03	0.0701	-0.03	0.0698
Age-15 X Consideration of Others	0.01	0.0087	0.01	0.0087
Age-16 X Consideration of Others	0.01	0.0082	0.01	0.0082
Age-17 X Consideration of Others	0.01	0.0081	0.01	0.0080
Age-18 X Consideration of Others	0.01	0.0080	0.01	0.0080
Age-19 X Consideration of Others	0.01	0.0080	0.01	0.0080
Age-20 X Consideration of Others	0.02	0.0080	0.01	0.0080
Age-21 X Consideration of Others	0.02	0.0082	0.02	0.0081
Age-22 X Consideration of Others	0.01	0.0084	0.01	0.0083
Age-23 X Consideration of Others	0.01	0.0088	0.01	0.0088
Age-24 X Consideration of Others	0.03*	0.0136	0.03*	0.0136
Age-25 X Consideration of Others	-	-	-	-
Rho	0.46		0.48	
n(t)	8,412(7)		8,412(7)	

* p < 0.05

** p < 0.01

*** p < 0.001

Note: some categories omitted due to collinearity; age 14 is the reference category

In the final set of models the effects of resistance to peer influence are assessed and probed for an interaction with age. In the third model where resistance to peers is added, there is a significant negative effect ($b = -0.02$, $p < 0.001$) and the effects of age remain significant ($b = -0.02$, $p < 0.001$). The variance component value of 0.0039 is a decrease from 0.0041, resulting in a pseudo-R^2 of 0.049, indicating 5% of the variation within individuals can be attributed to changes in resistance to peer influence.

Table 11. Longitudinal Models for Logged Self-Reported Offending Variety on Resistance to Peers

	Model 1: Unconditional		Model 2: with Time		Model 3: with Resistance to Peers		Model 4: Resistance to Peers X Age	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Constant	0.06***	0.0017	0.06***	0.0018	0.06***	0.0018	0.06***	0.0018
Age			-0.003***	0.0004	-0.03***	0.0004	-0.003***	0.0004
Age-squared			0.00	0.0001	0.00	0.0001	0.00	0.0001
Resistance to Peers					-0.02***	0.0019	-0.01***	0.0019
Age X Resistance to Peers							0.002***	0.0007
$\hat{\sigma}_0^2$	0.0029	0.0001	0.0029	0.0001	0.0029	0.0001	0.0029	0.0001
$\hat{\sigma}_\varepsilon^2$	0.0043	0.0001	0.0041	0.0001	0.0039	0.0001	0.0039	0.0001
Log-likelihood	10,093.68		10,152.57		10,207.06		10,212.24	
n(t)	8,401(7)		8,401(7)		8,401(7)		8,401(7)	

*** $p < 0.001$

In the fourth model of Table 11 the continuous interaction between resistance to peers and age is assessed. The coefficient for age is unchanged, and there is a significant positive interaction (b = 0.002, p < 0.001) between resistance and age. Paralleling the trend seen in previous models, the strength of the negative relationship between resistance to peers and offending behavior attenuates slightly on average as respondents age.

Following the steps in previous models, three interaction equations for low, medium, and high values of age are compared. Further inspection of the variance-covariance matrix reveals all three equations are statistically significant. Figure 8 visualizes these results.
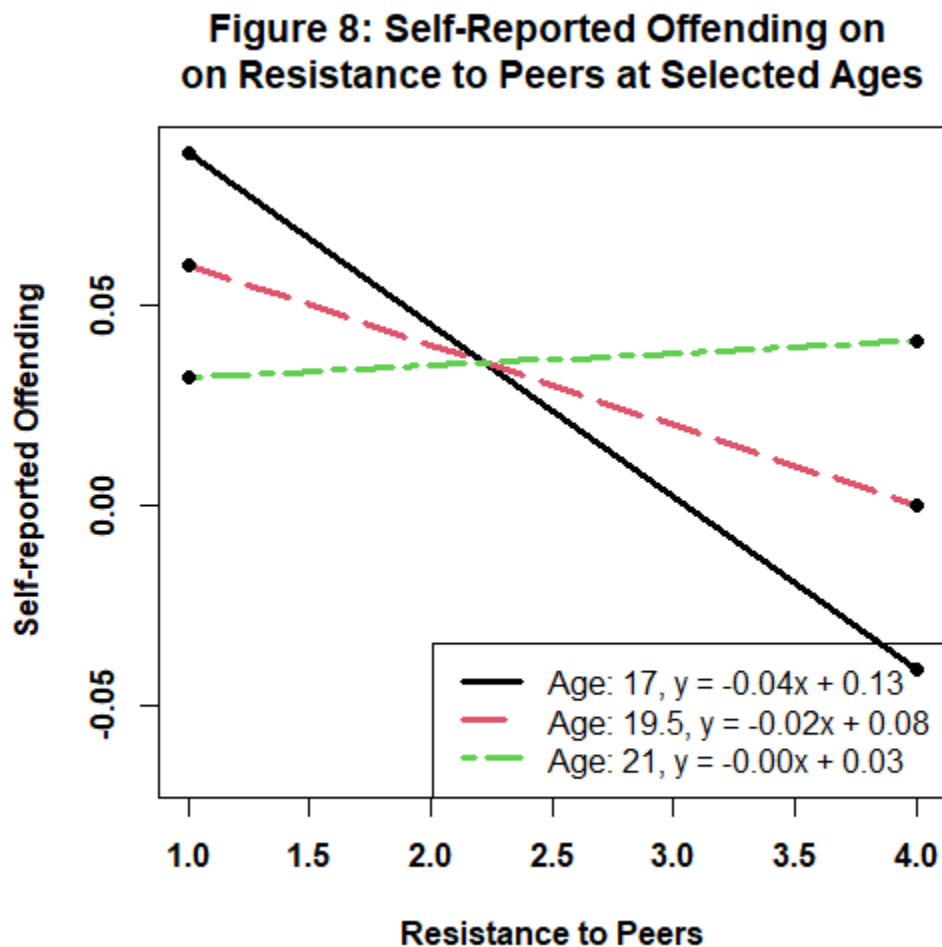

Figure 8: Self-Reported Offending on on Resistance to Peers at Selected Ages

Table 12. Longitudinal Models for Logged Self-Reported Offending Variety on Resistance to Peers

	Model 5: Dummied Resistance X Age		Model 6: Dummied Resistance X Age with Controls	
	Coefficient	Std. Error	Coefficient	Std. Error
Constant	0.08***	0.0062	0.09***	0.0063
Resistance to Peers	-0.01	0.0110	-0.01	0.0109
Time in Secure Setting			-0.02***	0.0027
Age-15	-0.01	0.0069	-0.01*	0.0069
Age-16	-0.01*	0.0066	-0.01*	0.0065
Age-17	-0.02*	0.0065	-0.02**	0.0065
Age-18	-0.02**	0.0065	-0.02**	0.0065
Age-19	-0.02***	0.0065	-0.03***	0.0065
Age-20	-0.02**	0.0065	-0.03***	0.0065
Age-21	-0.03***	0.0067	-0.03***	0.0067
Age-22	-0.03***	0.0068	-0.04***	0.0068
Age-23	-0.03***	0.0073	-0.04***	0.0073
Age-24	-0.04***	0.0101	-0.05***	0.0100
Age-25	-0.04	0.0703	-0.04	0.0700
Age-15 X Resistance	-0.01	0.0126	-0.01	0.0125
Age-16 X Resistance	-0.02	0.0118	-0.02	0.0118
Age-17 X Resistance	0.00	0.0116	0.00	0.0116
Age-18 X Resistance	0.00	0.0116	-0.01	0.0115
Age-19 X Resistance	0.00	0.0116	0.00	0.0115
Age-20 X Resistance	0.01	0.0115	0.00	0.0115
Age-21 X Resistance	0.00	0.0118	0.00	0.0117
Age-22 X Resistance	0.00	0.0120	0.00	0.0119
Age-23 X Resistance	0.01	0.0128	0.01	0.0127
Age-24 X Resistance	0.00	0.0178	-0.01	0.0177
Age-25 X Resistance	-	-	-	-
Rho	0.47		0.48	
n(t)	8,401(7)		8,401(7)	

* p < 0.05
** p < 0.01
*** p < 0.001

Note: some categories omitted due to collinearity; age 14 is the reference category

The next step is to examine a model looking at the *age x resistance* coefficient using the coefficient for resistance on offending at age 14 as a reference point (Table 12). As expected, the dummied age variables indicate a decrease in the average amount of offending as age increases, and the magnitude of this difference increases as age increases (from b = -0.01 to b = -0.04). The interaction between age and resistance to peers is not significant. That is, at no age is the coefficient between resistance and offending different appreciably different than it is at age 14. This pattern is mimicked in the controlled model. More time spent in secure settings predicts decreases in criminal behavior (b = -0.02, p < 0.001), and the dummied interaction between age and resistance to peers is not significant at any age. Again, the Hausman test was significant in both model comparisons (p < 0.001).

In summary, a series of interesting results has been generated from this analysis. For each psychosocial variable a relatively simple scheme was followed. Demonstrate the relationship between the variable and offending, then examine and probe the interaction between the psychosocial variable and age to determine if the coefficient changes in size as individuals get older.

Each of the psychosocial variables presented evidence of an interaction effect with age. The results suggest that as age increases, the relationship between psychosocial maturity attenuates. While overall it seemed that there was a stronger relationship between psychosocial maturity and offending at younger ages, it was more problematic to delve into the interaction and discover at what, if any, ages the coefficients were different for someone in adulthood compared to when that person was an adolescent.

Chapter 5

Overview of the Psychosocial Maturity by Age Interaction

We have an intuitive idea that children are less deserving of punishment – that is, they are less culpable for their actions – than adults. As children enter adolescence the question becomes more complex. They exhibit reasoning skills that are often similar to the skills of adults (Grisso et al., 2003; Reyna & Farley, 2006). Yet there remains an impulse to protect juveniles. Here enters psychosocial maturity with the idea that while juveniles can reason like adults in some situations, they react differently to social pressures and rewards (Steinberg & Scott, 2003). Thus, they are cognitively capable of reasoning but are also susceptible to outside influences (Steinberg, 2008). In its simplest form, the argument would suggest that those who are less psychosocially mature should receive some sort of punishment discount. But this raises a host of problems. What to do about psychosocially immature adults (Morse, 1997)? Should they not be given the same discounts, if the processes underlying their behavior are the same? On the flip side, how should the system handle juveniles who are more mature than their contemporaries?

The purpose of the above analysis was to expand on our understanding of the interrelationships between age, psychosocial maturity, and offending behaviors. Specifically, I used the existing literature to argue that how well (i.e., strongly or robustly) psychosocial maturity predicts offending behavior should diminish with age. That is, the process underlying how psychosocial maturity affects behavior is *not* the same when comparing juveniles and adults. This has important implications for the growing literature which argues that psychosocial variables should be incorporated into policy to help determine when someone is less-than-fully-culpable for their actions, and should therefore receive diminished punishment compared to an

older and more mature person. Alternatively, the same evidence may be used to argue for an emphasis on treatment over punishment.

This research attempts to use a rich empirical dataset to inform complex moral legal questions. The ability of social science to impact moral issues is complicated, and this work is no exception. There is a desire for hard and fast answers to legal questions of culpability. Is this person culpable? Is their level of psychosocial maturity such that they need a "break" or a sentence discount? While concrete answers are comforting, they are not forthcoming (as described below). Still, this research represents an important attempt to use empirical data as a guidepost for moral legal questions. Cases and legal opinions could – and should – draw on this information. Psychosocial maturity is not going to make the system more diagnostic, but it can make it better.

While there are some inconsistencies, a generally clear picture emerges to capture the relationships between age, psychosocial maturity, and a measure of self-reported offending behavior (the variety score). The starting point is in line with what might be expected given the literature on psychosocial maturity (Steinberg, 2008) and age and crime (Farrington, 1980; Sweeten et al., 2013). As has been established in previous literature, the amount of offending in this sample decreases as age increases, and in uncontrolled models, nearly each psychosocial construct significantly predicts offending. For each sub-construct (and resistance to peers), increases in maturity are associated with declines in the variety of offending behavior. Coefficients ranged from -0.01 to -0.03, indicating that on average, a one-point increase in a psychosocial score results in a -0.01 to -0.03-point decrease in the predicted self-reported offending variety score, which ranges from -0.60 to 0.45. Further, for each variable there is a significant interaction with age such that increases in age result in the attenuation of psychosocial

effects on offending behavior. At once, this is important because the null hypothesis of no interaction can be rejected. If the null was not rejected, these data would present a problem for advocates of using psychosocial maturity to influence treatment and punishment. A null result would challenge the idea that psychosocial maturity is relevant only for teens or young adults. Instead, psychosocial predictors considered without controls are less predictive of offending behavior as age increases. Thus, the basic nature of the relationship between age, psychosocial maturity, and crime hypothesized earlier finds some support in these data.

Psychosocial maturity should have a stronger effect on behavior (particularly delinquent behavior, where the criminal justice system is concerned) for adolescents. The bounds of this window are debatable and will continue to be scrutinized. But it is safe to say that the mid-teen years when the transition to adulthood intensifies are those of heightened sensitivity to psychosocial immaturities. The effects of being psychosocially immature should have the strongest effect on behavior in these years. Later in life, a person may continue to be psychosocially immature, or may have improved in maturity only marginally. However, despite an only marginal increase in psychosocial maturity on average, the amount of psychosocial maturity a person has should matter less as they enter adulthood.

An important takeaway is the realization that one critique of applying psychosocial maturity may not be relevant. Aronson (2007) noted that while the literature establishes psychosocial maturity increases with age, the measurement of psychosocial maturity does not provide a cutoff score. A cutoff score would be useful to diagnose one offender as psychosocially mature and another as psychosocially immature. In addition, even if those cutoff scores existed, the question then harkens back to the dissent in *Roper* (2005) and critiques from

Morse (1998; 1999): what do we do about similarly situated (i.e., psychosocially immature) adults?

The application of the dual-systems model to generate the hypotheses above and the results that follow ends up bypassing those problems. The issue is not as much whether an individual is psychosocially mature, but in whether their psychosocial maturity is a cause of their offending behavior. The age interaction with psychosocial maturity, supported by each of the visualizations, suggests that as individuals get older, psychosocial maturity matters less in the etiology of their offending.

There are some seemingly disparate results that need to be considered. First, in each set of models, there is an overall interaction between the psychosocial variable and age on offending variety scores. Second, when this result is visualized for selected ages, different slopes are observed. The consideration of others model provides perhaps the most drastic visualized changes, where for the older age group the slope looks to be nearly zero. However, with the exception of temperance, the pattern of an age by psychosocial interaction on offending resulted in few ages where the coefficient was different (statistically) from the coefficient at the age of the typical 14-year old.

The question then is how to make these seemingly disparate results make sense. It is possible that more cases in each age group would make a noticeable difference. The models above pick up clear evidence of an interaction, but when a finer grain of analysis is used (examining the coefficients at each age) the results are less consistent. That is, there is an overall interaction, which is important, but there is not a hard line (or even a soft one) for any variable but temperance that shows some age range above which the effect of the psychosocial variable is statistically different.

These results find support for this idea across each psychosocial variable: temperance, responsibility, future orientation, and consideration of others. Despite not being part of the standard measurement of psychosocial maturity, the conceptually relevant resistance to peers demonstrated the same overall interaction. However, when attempting to pull apart the data to look at differences in each age category, the results only hold for temperance. The interaction models examined whether the size of the coefficient for the relationship between temperance and offending was different by around age nineteen compared to the coefficient for the typical fourteen-year-old. However, for each of the other constructs in the analytic sample (when those who had missing values for control variables were removed) at no specific age were psychosocial variables more or less predictive at older ages compared to the average fourteen-year-old.

It is worth speculating about the mechanisms through which the interactions found above may work. On the one hand, they may be indicative of neurological processes that change from adolescence to adulthood. The literature on the juvenile brain (e.g., Galvan 2010) is suggestive of this option. On the other hand, it is possible that the interactions found in this research reflect the changing opportunity structures of juveniles. As adolescents move from high school to adulthood their roles and expectations change. Differences in opportunity could be a cause of the age and psychosocial interactions found above. This option would mirror Moffitt's (1993) adolescence-limited trajectory, where differences in expected roles are part of the explanation for the age-crime curve.

Related to this, future research could examine whether psychosocial maturity has a relation to the frequency or seriousness of offending. This would further illuminate questions of

what types of samples (relatively serious delinquents, or general population) are most appropriate for examining the influence of psychosocial maturity on offending.

Applying the Results?

Where does this leave practitioners? The motivating question for this dissertation was whether the research on psychosocial maturity and the dual systems model could be further verified by identifying that psychosocial maturity predicts criminal behavior, but more importantly that it does not do so equally for all ages. In short, this question was answered and the hypotheses drawn from previous discussions of psychosocial maturity and the dual systems model found empirical support. But these interesting findings for the etiology of behavior and understanding of adolescent behavior fall short of providing concrete information to guide practitioners in the everyday decisions of the criminal justice system. There is much room for skepticism. Humans inherently are not good with uncertainty. There is an instinct to over-use information. Here, this would be done if, for example, a score of 2.9 for psychosocial maturity was used as a hard cutoff. Or if the relationship between psychosocial maturity and offending was used to imply that it exists in all crimes for all adolescents. These relationships did hold up but the strength of the prediction is weak. Practitioners must be careful in considering what the relationships mean for legal responses or programming decisions.

Each psychosocial construct demonstrated a significant interaction with age. However, in this sample, that significant interaction does not help discriminate a specific age when psychosocial variables are significantly more relevant to the etiology of offending behavior. Assuming for a moment that these data are perfectly representative of the population of serious-offense juveniles, any court actor from judges to probation officers to attorneys might be expected to look at these results and scoff in frustration, if not disgust.

It is possible that even given the robustness of the overall interactions between age and psychosocial variables, the impact will be minimal. Research has long found that the seriousness of the offense and criminal history are stable predictors of punishment time (Blumstein, Cohen, Martin, & Tonry, 1983). Psychosocial maturity is likely to influence punishment only after these salient factors are taken into account. This is not a problem, but a recognition that the impact of psychosocial variables may be minimal after factors that are typically considered more important are evaluated.

Further, there has also been discussion of whether psychosocial maturity *should* influence decisions in practice (Gibson and Krohn, 2012; Maroney, 2009; Aronson, 2009). This takes us back to the problems highlighted by Maroney (2009) and Gibson and Krohn (2012). Essentially, the law already uses the age of eighteen to designate a difference between juveniles and adults. Waiver into adult court for juveniles provides an exception to this rule. At least one goal while evaluating psychosocial maturity is to figure out if there is evidence that a different age boundary should be used. Perhaps the reasoning skills of juveniles around age sixteen imply they can be treated and handled as adults. Or maybe the phase of more rapid brain development that continues into the early twenties implies even young adults should be subjected to less harsh punishments (Cauffman, 2012). One question then is whether the results above advance these arguments.

Ultimately, it is important to understand behavior. But the law in action requires decisions in specific cases, and the understanding that generally, psychosocial immaturity may play a role in some cases is not the same as the specific claims that must be made in any individual case. So it seems unreasonable to think that a particular level of psychosocial maturity can be used in individual cases.

There are several ways to discuss how this research should impact practice. One is by asking how this research can orient the system. Broadly speaking, it supports the justification of dealing with juveniles differently, either in a separate system, or on a case-by-case basis. It supports the reasoning that juveniles are different and provides insight into how those differences are likely to impact criminal behavior. This is not a huge impact, but an additional reason in support of how practitioners and the public view the culpability of juveniles. Practitioners could use the constructs of psychosocial maturity to guide them. They could ask if a delinquent demonstrates a lack of understanding responsibility, or if the crime was an impulsive action. They could ask if not only if peers were involved, but attempt to assess whether the delinquent may be easily influenced by their peers.

So, one implication is it supports the broad orientation that juveniles deserve a "break" or some sort of a discount. Though the question remains, a discount from what? A discount from the severity of punishment an adult receives? In large part this already exists in the juvenile justice system (Kupchik, 2006). So this research would not have much of an impact. On the other hand, it may imply that within the juvenile justice system, those whose crimes are influenced by psychosocial maturity are less culpable and deserve a "break" from the typical punishment doled out in similar situations.

This may also turn into question of whether psychosocial maturity impacted the particular crime or delinquent act. This could be asked on a case-by-case basis by practitioners. Instead of seeking a diagnostic answer in the form of a level of psychosocial maturity, the question would be whether factors related to psychosocial maturity were present for the act the person is suspected of committing. The impact of this research is to orient practitioners to ask that type of question about younger offenders (or to justify the questions they already ask) and provides a

reason for not focusing this question on adult offenders. That is perhaps the most important takeaway. This dissertation began with a worry that similarly situated adults have the same etiological process behind their behavior as juveniles. If that was the case, the strong reasons to use psychosocial maturity to diminish the punishment of juveniles should also be available to those adults. But this research shows that perhaps the processes are different. So there is a reason to ask different questions of juvenile offenders than adult ones. This is a very important finding.

Finally, some assessment tools already contain components of psychosocial maturity. For example, the ORAS assessment for youth includes questions about peer influences (Andrews & Bonta, 2010; Latessa, Smith, Lemke, Makarios, & Lowenkamp, 2009). These types of risk assessment tools are generally used to assess the risk of recidivism or the level of supervision best suited for rehabilitation. The research on psychosocial maturity provides a bit of a word of warning for the risk assessment literature. Some of the factors in that literature may be relevant for predicting future behavior, but could also be used to assess whether the actor is fully culpable for their behavior.

In addition, while the null hypotheses about the overall interactions were rejected, statistically significant findings begin discussions rather than end them. The coefficients are all small, indicating a one-point increase (on a variable that is only scored 1-4 or 1-5) predicts around a 0.02 decrease in the predicted logged average of self-reported offending variety. That 0.02-point decrease is on a dependent variable with a standard deviation of 0.12. Thus, a one-point change in the independent variable typically results in a change in the dependent variable of 17% of one standard deviation. Thus, a four-point change (which for all but one measure is all that is possible) would predict a change in the dependent variable of 68% of one standard deviation. That translates to an increase of about 0.08 on the variety score (which ranges from 0-

1). Further, this hypothesized four-point change in the independent variable, representing the maximum predicted change in the dependent variable, is substantially larger than the typical increase seen in the data. For example, for consideration of others there is a 1-point increase over all waves. For other variables, the increase is smaller, around 0.20-0.30 points. The overall relationship is substantively weak. Said differently, psychosocial maturity is a significant predictor of criminal behavior, but not a good predictor (where a stronger relationship makes a better predictor).

Limitations

Several limitations must be mentioned. The methods used to select different ages for visualizations are exploratory, not based on population metrics established in the literature. That is, comparing the average to 2.5 years on either side is somewhat arbitrary compared to an ideal setting. In an ideal setting, there would be firm ages at which differences are expected. But maturation is more complex than this, happening at different rates for everyone. In addition, an overarching goal of this dissertation is to evaluate whether there are cutoff points that jump out of the data. When examining specific ages to compare the slopes of offending on psychosocial maturity, it made the most sense to allow the data to "speak for itself" and use recommendations of points a standard deviation above and below the mean age. This can be further justified by examining one age just under 18, one age above it, and one age in early adulthood.

On the one hand, I have argued the sample is ideal to search for this relationship. However, a critic could fairly point to statements made by other researchers, who note a gap in research has been a lack of samples that compare delinquents and non-delinquents (Maroney, 2009). However, as discussed earlier, this sample of delinquents provides a somewhat ideal sample to examine differences within a group of individuals convicted of a serious offense.

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Further, however, a critic could also argue that this sample is not restrictive enough. That is, that these are not serious enough delinquents. Getting convicted of a single serious offense does not mean the offender is doomed to a life of serious crime without intervention. Given prominent theories of crime, such as Moffitt's life-course persistent (LCP) offenders, perhaps the ideal sample would be one where all the participants are LCPs. Then my claim to be examining the effect of psychosocial maturity in a sample of serious persistent offenders would be more robust. However, restricting a group to LCPs presents a serious challenge. Namely, it is difficult to accurately assign who is a LCP offender before they become one.

This has important implications for future research on any interaction effects of age and psychosocial maturity. Establishing the best sample for study is an important step. The problem is arguments can be made for both positions. One position requests a group of non-offenders be present in the sample to be able to delineate whether the relationship of psychosocial maturity predicting delinquency – and the interaction with age – exists in a population of individuals with only minor delinquent acts to their names. On the other hand, the existence of the interaction in a sample of serious delinquents restricts the analysis to those most likely to be cases that are compared to adult cases (simply due to the more serious nature of the offense). In short, both arguments have merit, and this sample is only able to speak to a population of serious delinquents. But it is possible the results would look different in a sample of the general population, just as it is possible that the general population may exhibit a different interrelationship between age, crime, and psychosocial maturity. This is only to say that policy suggestions that rely on this specific analysis should be evaluated in other samples to ensure the results are robust. If the relationships found here do not generalize, the policy implications should not either.

Another limitation is the selection of age 14 as a reference category. The hypotheses driving this analysis may suggest a different benchmark is warranted. The age of majority suggests for any results that may influence policy, an analysis evaluating changes around the age seventeen or eighteen mark may be most practical. Future analyses could examine different ages as a reference category.

Among the most serious limitations of this analysis is the series of decisions around control variables. First, it is a limitation to not include more control variables. This calculated decision was made because of the conceptual overlap between psychosocial variables and available controls in the Pathways data. For example, there are measures of routine activities that are likely to tie in closely with criminal behavior. Arguably, if routine activities were accounted for and eliminated any psychosocial effect, perhaps psychosocial maturity is simply less important in the etiology of behavior than other practical variables. On the other hand, psychosocial maturity is intimately tied up with control variables. For example, there is a measure of peer delinquency available in the data. One could argue that peer delinquency measures need to be accounted for in addition to resistance to peer influence. But these measures are also significantly related to each other (Monahan & Steinberg, 2009). So the expectation would be that including a more proximal measure like peer delinquency would reduce or eliminate the effect of resistance to peer influence. But presumably this is because those with less resistance to peer influence with more delinquent friends will commit more delinquent behaviors. The argument is simply that adding control variables only ends up confusing the implications of the models. Further, psychosocially immature individuals may be more likely to hold different attitudes toward crime. The point is that these possible relationships should be explored, but to simply add variables into the analysis without considering the pathways would

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overcomplicate the models and prohibit arriving at interpretable results for the research questions that motivated this work.

Another limitation involves one of the control variables that was added. Early (and not presented) models found more consistent differences in the coefficient sizes at different ages for the psychosocial variables and offending. For example, more coefficients examining offending regressed on responsibility at different ages are significant in the full sample. Once the sample is restricted to the analytic sample, only two coefficients are significant. This highlights the tenuous nature of these results. Specifically, referring back to the first table, only 8,599 respondents had complete data for secure settings, while around 9,900 had complete data on psychosocial measures. At a minimum, this threatens confidence in the generalizability of these results. This issue is exacerbated slightly when cases were removed due to lacking data in too many waves (data for four waves was set as the threshold for analysis). The results are sensitive to small changes in how the analytic sample is structured. Further, the analytic sample differed significantly from the full sample, another clear threat to generalizability. It is also worth noting that models were run for each psychosocial variable, with age and age-squared, the interaction between the psychosocial variable and age, and time in secure settings. For each variable, all of the coefficients except age-squared were significant. That is, there is clear evidence in this sample of an interaction between age and psychosocial maturity on offending. But the data may not have enough power in terms of sample size to reveal precisely at what age the relationship between psychosocial maturity and age changes.

Finally, it should be noted that the reference category is age fourteen, chosen partially due to ease and partially to use an adolescent age as a comparison point to adult ages. But age-14 is also one of the ages with a smaller sample size. Thus, having more 14-year-olds might provide

a more solid reference category (though in supplemental analyses, the 14 and 15-year-olds were combined with no differences observed). The nonsignificant interaction between age-squared and offending is likely a product of the restricted offender sample in the Pathways. The trend is for there to be decreases in offending over time in this sample. It is simply worth noting that this sample did not follow expectations.

A final limitation pervades plenty of longitudinal research. Participants in the youngest age group when data was collected (14) are ideally set to examine the hypothesis of diminishing coefficient sizes. While they were followed for seven years, an even longer follow-up period would be beneficial to provide more data. The coefficients from the typical 14-year-old could be compared to adults well past the end of the cognitive developmental period that lasts into the mid-twenties. Even a younger sample could further verify that psychosocial maturity does *not* matter at early ages and only begins to matter in adolescence. Answering these questions was outside the scope of this data, but future projects may be able to close this gap.

Conclusion

In summary, there are encouraging and discouraging results from this analysis. Importantly, some time was spent early in this work arguing for a previously untested inference from the dual systems model and psychosocial maturity. Interpretations of the dual systems model (Crone & Dahl, 2012; Scott et al., 2018; Steinberg, 2008) suggest that the reward system of the brain comes "online" before the cognitive control system. If psychosocial maturity operates the way researchers have suggested, there is solid empirical ground to suspect that diminished psychosocial maturity is a better predictor of behavior in adolescence than in adulthood. Without that finding, the relevance of psychosocial maturity should come under harsh scrutiny. The problem of psychosocially immature adults forces a concern for whether immature

adults should be treated like immature juveniles. If the mechanistic process underlying their behavior is the same, excuses for immature juveniles should apply to immature adults. If the mechanisms are different, it provides a stronger reason for developing policy and practice specifically for juveniles.

Conceptually, these findings provide further support for the idea that adolescence is a unique period where individuals respond to unique pressures. In this sample, as adolescents became adults, their psychosocial maturity was a weaker predictor of behavior. Thus, while plenty of adults might score similar to a juvenile, that psychosocial maturity may not matter to the same degree when explaining their behaviors.

These results suggest researchers are on the right path for explaining adolescent behavior. While there are not precise cutoff ages at which psychosocial maturity matters less, the general picture is one where psychosocial maturity is a less important predictor as individuals get older. This is important for the general understanding of the types of youths coming into the justice system. According to these results, the typical serious adolescent offender is more susceptible to the effects of their level of psychosocial maturity in adolescence than in adulthood, even if their scores do not change much as they age. While conceptually these results support the idea that at some point psychosocial maturity matters less, they move the discussion no closer to diagnostic thresholds for policy. Further research with more cases followed over a longer period of time with more measurement points in late adolescence may provide more robust and concrete results.

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Appendix A

Self-Reported Offending Questions

Respondents were asked if in the last six months they had…

- Destroyed/damaged property
- set fire
- broke in to steal
- shoplifted
- bought/received/sold property
- used check/credit card illegally
- stole car or motorcycle
- sold marijuana
- sold other drugs
- carjacked
- drove drunk or high
- paid for sex
- forced someone to have sex
- killed someone
- shot someone bullet hit
- took by force with weapon
- beat up someone serious injury
- in a fight
- broke into a car
- went joyriding

Weinberger Adjustment Inventory

Respondents indicated whether their behavior in the past six months matched a series of statements (1 = False, 5 = True). Higher scores indicate more positive behavior.

- Doing things to help people more important to me than almost anything else
- I will try anything once even if it is not safe
- People who get me angry better watch out
- I should try harder to control myself when having fun
- I often go out of my way to do things for other people
- I can do things as well as other people can **not included
- I do things without giving them enough thought
- I enjoy doing things for people even when I do not receive anything in return
- If someone tries to hurt me I make sure to get even with them
- I like to do new/different things that many people would consider weird/unsafe
- I become wild and crazy and do things other people might not like
- If someone does something I really do not like, I yell at them about it

- Before I do something, I think about how it will affect people around me
- When doing something fun I tend to get carried away and go too far
- I say the first thing that comes into my mind without thinking enough about it
- I pick on people I do not like
- I try very hard not to hurt other people's feelings
- I lose my temper and let people have it when I am angry
- I make sure that doing what I want will not cause problems for others
- I stop and think things through before I act
- I say something mean to someone who has upset me
- I think about other people's feelings before I do something they might not like
- When someone tries to start a fight with me, I fight back
- Below reversed
- Kind of person try anything once
- Get me angry and watch out
- Try harder to control self
- Do things without thought
- Hurt me, I get even
- Like new and different things
- Become wild and crazy
- If I don't like, I yell at someone
- When partying, get out of control
- Say the first thing I think
- Pick on people I don't like
- Lose temper, let people have it
- Say mean things if upset
- Start fight, I fight back

Resistance to Peer Influence

Respondents were asked to pick whether one of two options was more like them, and a follow-up question asked whether their choice was "sort of true" of them or "really true" of them. "Really true" responses would be given a 1 or a 4, depending on whether the answer indicated higher or lower resistance to peer influence. Higher scores indicate more resistance to peer influence.

1. Some people go along with friends just to keep them happy but Other people refuse to go along with their friends
2. Some people think it's more important to be an individual but Other people think it is more important to fit in
3. Pretty easy for some people's friends to get to change mind but For other people it's pretty hard to change their mind
4. Some people would do something that they knew was wrong but Other people would not do something knew was wrong
5. Some people hide their true opinions from their friends but Other people will say their opinions to friends

6. Some people will not break the law because friends said to but Other people will break law if their friends said to
7. Some people change way they act with their friends but Other people act the same way when alone and with friends
8. Some people take more risks when with friends but Some people are just as risky when alone as with friends
9. Some people say things they don't really believe but Other people would not say things they don't really believe
10. Some people think it's better to be an individual but Other people think it's better to go along with crowd

Future Orientation

Respondents were asked to rank from 1 (Never True) to 4 (Always True) how true each of the following fifteen statements were about them.

- I keep working at difficult tasks if know they will help get ahead later
- I live each day as if it's my last
- I think about how things might be in the future
- I tend to get caught up in the excitement of the moment
- I make lists of things to do
- Before making a decision, I weigh the good vs the bad
- The future is very vague and uncertain to me
- I will give up my happiness now so that I can get what I want in the future
- I make decisions on the spur of the moment
- I would rather save money than spend it now on something fun
- I cannot really plan for the future because things change so much
- I always seem to be doing things at the last minute
- I do not plan, I take each day as it is
- I can see my life 10 years from now
- I usually think about the consequences before I do something

Appendix B

Appendix B: Random Effects Supplemental Models

Constant	Temperance Random Effects Models				Responsibility Random Effects Models			
	Random Effects Model		Random Effects Model with Controls		Random Effects Model		Random Effects Model with Controls	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Psychosocial Variable	0.23	0.0079	0.03	0.0608	0.25***	0.0084	0.03	0.0608
Time in Secure Setting			0.04***	0.0008			0.04***	0.0008
Early onset behavior problems			0.00	0.0021			0.004*	0.0021
Age-15			0.008***	0.0010			0.01***	0.0010
Age-16	-0.04***	0.0090	0.01	0.0610	-0.05***	0.0095	0.01	0.0621
Age-17	-0.06***	0.0084	0.00	0.0608	-0.07***	0.0089	0.00	0.0620
Age-18	-0.10***	0.0083	0.00	0.0608	-0.11***	0.0087	0.00	0.0619
Age-19	-0.15***	0.0082	-0.01	0.0608	-0.17***	0.0086	0.00	0.0619
Age-20	-0.17***	0.0082	-0.01	0.0608	-0.19***	0.0087	0.00	0.0619
Age-21	-0.18***	0.0083	-0.01	0.0608	-0.20***	0.0087	-0.01	0.0619
Age-22	-0.17***	0.0083	-0.01	0.0608	-0.19***	0.0087	-0.01	0.0619
Age-23	-0.18***	0.0084	-0.02	0.0608	-0.20***	0.0089	-0.02	0.0619
Age-24	-0.19***	0.0086	-0.02	0.0608	-0.22***	0.0091	-0.02	0.0619
Age-25	-0.20***	0.0092	-0.02	0.0608	-0.22***	0.0097	-0.02	0.0619
Age-15 X Psychosocial	-0.22***	0.0129	-0.03	0.0609	-0.24***	0.0133	-0.02	0.0621
Age-16 X Psychosocial	0.02	0.0105	-0.03**	0.0101	0.00	0.0194	-0.02	0.0177
Age-17 X Psychosocial	0.01	0.0097	-0.02	0.0085	0.01	0.0182	-0.01	0.0155
Age-18 X Psychosocial	0.02	0.0094	-0.02**	0.0081	-0.01	0.0178	-0.01	0.0147
Age-19 X Psychosocial	0.04***	0.0095	-0.02*	0.0079	0.02	0.0178	-0.01	0.0144
Age-20 X Psychosocial	0.05***	0.0094	-0.02*	0.0079	0.03	0.0178	-0.01	0.0143
Age-21 X Psychosocial	0.06***	0.0094	-0.01	0.0078	0.02	0.0177	-0.01	0.0142
Age-22 X Psychosocial	0.06***	0.0094	-0.01	0.0078	0.04*	0.0177	0.00	0.0142
Age-23 X Psychosocial	0.06***	0.0096	-0.01	0.0079	0.04*	0.0180	0.01	0.0143
Age-24 X Psychosocial	0.07***	0.0098	0.00	0.0080	0.03	0.0185	0.00	0.0146
Age-25 X Psychosocial	0.06***	0.0104	0.00	0.0082	0.03	0.0205	0.00	0.0155
Psuedo R-squared	0.08***	0.0149	-	-	0.03	0.0276	-	-
rho	0.23		0.28		0.27		0.30	
n(t)	8,412(7)		8,412(7)		8,402(7)		8,402(7)	

* p < 0.05
** p < 0.01
*** p < 0.001

Appendix B (continued): Random Effects Supplemental Models

	Future Orientation Random Effects Models		Consideration of Others Random Effects Models				Resistance to Peer Influence Random Effects Models	
	Random Effects Model		Random Effects Model		Random Effects Model with Controls		Random Effects Model	
Constant	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Psychosocial Variable	-0.04	0.0158	0.25***	0.0080	0.02	0.0620	0.25***	0.0080
Time in Secure Setting			-0.05***	0.0091	0.00	0.0099	-0.02502	0.0144
Early onset behavior problems					0.04***	0.0008		
Age-15	-0.06***	0.0099			0.00	0.0021		
Age-16	-0.08***	0.0091	-0.06***	0.0091	0.01***	0.0010	-0.05***	0.0106
Age-17	-0.11***	0.0089	-0.08***	0.0085	0.01	0.0622	-0.08***	0.0099
Age-18	-0.16***	0.0089	-0.11***	0.0083	0.00	0.0620	-0.11***	0.0097
Age-19	-0.19***	0.0089	-0.17***	0.0082	0.00	0.0620	-0.17***	0.0096
Age-20	-0.19***	0.0089	-0.19***	0.0083	0.00	0.0620	-0.19***	0.0097
Age-21	-0.19***	0.0090	-0.20***	0.0083	0.00	0.0620	-0.20***	0.0097
Age-22	-0.20***	0.0091	-0.20***	0.0083	-0.01	0.0620	-0.19***	0.0097
Age-23	-0.21***	0.0093	-0.21***	0.0085	-0.01	0.0620	-0.20***	0.0099
Age-24	-0.22***	0.0099	-0.22***	0.0087	-0.01	0.0620	-0.22***	0.0101
Age-25	-0.22***	0.0136	-0.23***	0.0093	-0.02	0.0620	-0.22***	0.0106
Age-15 X Psychosocial	-0.02	0.0179	-0.25***	0.0133	-0.02	0.0620	-0.24***	0.0145
Age-16 X Psychosocial	-0.03	0.0170	0.01	0.0107	-0.02	0.0621	0.00	0.0165
Age-17 X Psychosocial	-0.03	0.0167	0.01	0.0099	-0.02	0.0120	-0.02	0.0157
Age-18 X Psychosocial	0.00	0.0166	0.02	0.0098	-0.01	0.0107	-0.01	0.0153
Age-19 X Psychosocial	0.01	0.0167	0.03**	0.0098	-0.01	0.0104	0.02	0.0153
Age-20 X Psychosocial	0.02	0.0167	0.04***	0.0098	-0.01	0.0102	0.01	0.0154
Age-21 X Psychosocial	0.02	0.0166	0.03**	0.0098	-0.01	0.0102	0.02	0.0154
Age-22 X Psychosocial	0.02	0.0168	0.04***	0.0098	-0.01	0.0102	0.02	0.0153
Age-23 X Psychosocial	0.02	0.0171	0.04***	0.0099	-0.01	0.0102	0.02	0.0156
Age-24 X Psychosocial	0.02	0.0180	0.04***	0.0103	-0.01	0.0102	0.02	0.0159
Age-25 X Psychosocial	0.03	0.0246	0.04**	0.0110	-0.01	0.0103	0.02	0.0172
Psuedo R-squared	-		0.05**	0.0184	-0.01	0.0106	0.00	0.0246
rho	0.27		0.25		0.29	-	0.28	
n(t)	8,398(7)		8,412(7)		8,412(7)		8,402(7)	

* p < 0.05
** p < 0.01
*** p < 0.001

Appendix C

Appendix C: Comparison of analytic sample and missing cases

	Analytic Sample		Sample Missing on Secure Settings		
	Mean	n	Mean	n	p-value
Age	19.93	8,599	18.07	2,233	p < 0.001
Temperance	3.14	8,591	2.87	1,351	p < 0.001
Responsibility	3.21	8,580	3.02	1,346	p < 0.001
Future Orientation	2.64	8,576	2.33	1,346	p < 0.001
Consideration of Others	3.69	8,591	3.49	1,351	p < 0.001
Resistance to Peers	3.31	8,578	2.98	1,346	p < 0.001
Self-reported Offending	0.06	8,569	0.33	8,569	p < 0.001