

THE INTERSECTION OF FRIENDSHIPS, NETWORKS, AND CRIME:  
A DEVELOPMENTAL EXTENSION AND TEST OF SUTHERLAND'S DIFFERENTIAL  
ASSOCIATION THEORY

By

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To Ron Akers, a man to whom I owe so much.

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Sutherland's (1947) differential association theory has been, and will continue to be, one of the most influential theories to criminology. At the heart of Sutherland's theory is the hypothesis that deviant friends have a tremendous influence on criminal behavior. This hypothesis is also central to Akers's (Burgess and Akers, 1966; Akers et al., 1979) social learning theory, which incorporates Sutherland's theory into a more comprehensive set of theoretical statements. Overall, research strongly and consistently supports the notion that having deviant and delinquent friends is a robust correlate of criminal behavior (Pratt et al., 2010).

While researchers are certainly aware that the behavior of friends influences the behavior of actors, much less is known about whom the friends are that influence behavior, how this influence operates, and why this influence exists (Warr, 2002). Seeking to expand this knowledge, this dissertation draws on theoretical statements of Sutherland and Akers to provide a network-based, developmentally informed test of differential association theory.

Using almost ten years of developmental panel data from the Rochester Youth Development Study (e.g., Krohn et al., 2011), this study investigates relative change in crime across the three developmental periods of middle adolescence, late adolescence, and emerging adulthood. Measures of Sutherland's modalities of association, the construct of friend deviance, and controls are implemented in a series of structural equation models to predict a latent construct of 'crime proclivity,' which is a construct derived from item-response modeling. Longitudinal coefficient comparison tests are also implemented to investigate whether the theoretically derived predictors have significantly different relationships with crime over the three developmental periods.

Results demonstrate that higher amounts of friend deviance and informal multiplexity, operationalized as a measure of unsupervised time spent with three friends in an actor's personal network, are consistently related to higher proclivities for crime. Friend deviance and informal multiplexity also are age-graded constructs, as they have significantly stronger relationships with crime during adolescence than emerging adulthood. Other constructs, however, are found to not vary over the segments of the life-course investigated here, providing some support to the notion that the effects of theoretical predictors may function differently at various developmental stages. Overall, the results emphasize the importance of evaluating the empirical support of extant theories of crime in a comprehensive, developmental light.

## CHAPTER 1 INTRODUCTION

Friends hold a central role in theories of crime and deviant behavior. Drawing on precedent from Sutherland's (1947) theory of differential association, the approach many of these perspectives take centers on a hypothesized positive association between having friends who commit crime and an actor's own personal deviance. Empirical research on this 'deviant peers' construct overwhelmingly supports the premise that the behavior of friends strongly relates to the behavior of the individual. Two decades ago, Agnew (1991, p. 148) stated that "Next to prior delinquency, association with delinquent peers is the best predictor of delinquency." Agnew's statement still rings as true today as it did then. A recent meta-analysis by Pratt and colleagues (2010) located over 100 studies that have identified a positive relationship between peer deviance and actor deviance, making this relationship one of the most replicated findings in criminology. Accordingly, the state of knowledge on friends and crime is summarized by Warr (2002, p. 139): "there is every reason to suppose that peer influence is critical to understanding criminal conduct." Thus, peer deviance holds a dual role as both a critical theoretical concept and an empirically proven associate of criminal behavior.

Perhaps the most pressing need of any field of science is to strive to better understand empirical relationships (Nagin, 2007; Weisburd and Piquero, 2008). What exactly does the current understanding of the peer deviance-actor deviance relationship tell us about the nature of the influence that friends exert on an actor's crime? The succinct answer to this question is alarmingly little. What it does indicate is that 'friends matter.' It tells us nothing about how friends matter, why friends matter, or which friends

matter. Warr, himself a notable supporter of the peer deviance paradigm, has gone so far as to state that the term “peer deviance [is] used to hide an appalling lack of knowledge about how peers promote delinquency” (2002, p. 88-89). Specifically, Warr (p. 120) believes that research on the peer deviance-actor deviance relationship is pockmarked by overstated findings and empty speculation. It is difficult to completely refute his opinion upon a careful review of the literature. Much of the existing knowledge on the peer deviance-actor deviance relationship is superficial, and much has been made of the ‘surface-level’ findings.

Consider the analogy of a civil engineer being asked to evaluate the structural integrity of a skyscraper. Upon arriving at the structure, she would do a rudimentary walk around the structure and then proceed to evaluate its internal structural components, ultimately offering a well-informed opinion on the integrity of the building. In terms of peer deviance research, criminologists have only walked around the metaphorical building. It exists. We must now walk inside the building and understand why the peer deviance-actor deviance relationship is present. Thanks to the work of Akers, Kandel, Krohn, Haynie, and Warr, the front door is unlocked, and there is a rich potential for theoretical refinement and informed empirical testing.

While Warr’s critique is partially accurate, there are notable exceptions in the literature that seek to extend beyond the observation that ‘peers matter’ and move towards an understanding of why peers matter. For example, Akers’s research concludes that friends are important because they offer social reinforcement for behaviors (Akers and Jensen, 2006; Akers et al., 1979). Additionally, Kandel’s (1978a), Krohn’s (1986), and Haynie’s (2001) research emphasizes that the structure of the

actor's social networks has a substantive impact on the actor's deviance. And Warr's (1993; 2002) own research attempts to determine how friends influence behavior differently at various points of the life-course.

Chapter 1 of this dissertation begins by offering an overview of Sutherland's (1947) differential association theory and the reception it has received. Next, the status of peer-based theories of crime and deviant behavior is reviewed. Emphasis is given to the historical context of the peer influence construct and the current state of the knowledge on how friends influence crime. Following, I discuss the critical need for a more comprehensive knowledge of the relationship between friends and crime with the understanding that friends may exert different influences on individuals at different points in the life-course. I conclude Chapter 1 by providing a brief discussion of the goals of the dissertation and provide an outline of the project.

## **Differential Association Theory**

### **An Overview of Sutherland's Theory and Historical Contributions**

Edwin H. Sutherland, a student of the Chicago School, has been and will continue to be an instrumental figure to criminology. He is credited with founding the field of criminology in 1924 with his textbook entitled *Criminology* (Cullen, 2011), which contained the first micro-level theory of criminal behavior (see Cohen et al., 1956, p. 2-4). In 1934, this theory would take on a more developed form with formal hypotheses in the second edition of his textbook. On writing this text, Sutherland had not thought of his work as containing a 'theory' of criminal behavior (see Sutherland, 1942 [in Cohen et al., 1956]). Rather, this label was assigned by McKay in 1935 (see Sutherland, 1939) who noted that several pages of Sutherland's work resembled a "theory of criminal behavior" (Sutherland, 1942 [in Cohen et al., 1956, p. 15). Although "surprised" (p. 15-

16) by the label assigned by McKay, Sutherland embraced the branding. The third edition of his textbook (1939) would contain a chapter that proposed a 'theory' of criminal behavior. This theory, which was initially labeled a theory of 'differential association' in the third edition of Sutherland's textbook in 1939, appeared in its most developed form in the fourth edition of his textbook, written in 1947.

Clifford Shaw and Henry McKay, notable Chicago School theorists, had previously discussed peer influence in their gang and social disorganization research (e.g., Shaw et al., 1929; also Shaw and Becker, 1930 [1966]; Shaw and McKay, 1942). However, they had considered it a structural-level indicator of social disorganization, a point to which Sutherland adamantly disagreed (1942 [in Cohen et al., 1956, p. 21]; see 1947, p. 8-9). To remedy this misclassification, Sutherland proposed a micro-level theory that was centrally focused around the peer influence construct. Because Sutherland's perspective was the first to emphasize the importance of friends on crime, differential association is instrumental to the current project.

Sutherland's final version of differential association theory (1947) was centrally focused on explaining the process of learning criminal and non-criminal behavior. Drawing on a social interactionist perspective, Sutherland believed that crime was learned from an actor's participation in "intimate personal groups" (p. 6). The identity of the individuals in these intimate personal groups can vary tremendously depending on the relationships which the actor values the most; any person's intimate personal group could consist entirely or partially of parents and/or siblings (pertaining to the shared environment), or co-workers and/or teachers (pertaining to the non-shared environment). Obviously, these are only several of many potentially behaviorally-

influential associates. While the identity of the intimate others can vary per Sutherland's theory, the most frequent intimate associates that are captured in criminological research are friends (see Warr, 2002; Pratt et al., 2010). The current project adopts this perspective and treats friends as the focal differential associates. As such, I do not assess the potential behavioral influence of different intimate others on crime, which is somewhat of a shortcoming. Despite this, friends are well known to be quite influential for an actor's criminal behavior (e.g., Warr, 2002), and the current focus on friends is consistent with other writings based on differential association (e.g., Akers, 1998 [2009]).

At the heart of differential association theory are nine primary theses that build upon one another. Sutherland's theses are summarized below in his own words and using the same bullet-point format he did (1947, p. 6-7, emphasis in original):

1. Criminal behavior is learned. . . .
2. Criminal behavior is learned in interaction with other persons in a process of communication. . . .
3. The principal part of the learning of criminal behavior occurs within intimate personal groups. Negatively, this means that the impersonal agencies of communication . . . play a relatively unimportant part in the genesis of criminal behavior.
4. When criminal behavior is learned, the learning includes (a) techniques of committing the crime, which are sometimes very complicated, sometimes very simple; [and] (b) the specific direction of motives, drives, rationalizations, and attitudes.
5. The specific direction of motives and drives is learned from definitions of the legal codes as favorable or unfavorable. . . .
6. A person becomes delinquent because of an excess of definitions favorable to violation of law over definitions unfavorable to violation of law. This is the principle of differential association. It refers to both criminal and anti-criminal associations and has to do with counteracting forces. When persons become

criminal, they do so because of contacts with criminal patterns and also because of isolation from anti-criminal patterns. . . .

7. Differential associations may vary in frequency, duration, priority, and intensity. This means that associations with criminal behavior and also associations with anti-criminal behavior vary in those respects. "Frequency" and "duration" as modalities of associations are obvious and need no explanation. "Priority" is assumed to be important in the sense that lawful behavior developed in early childhood may persist throughout life, and also that delinquent behavior developed in early childhood may persist throughout life. . . "Intensity" is not precisely defined but it has to do with such things as the prestige of the source of a criminal or anti-criminal pattern and with emotional reactions related to the associations. In a precise description of the criminal behavior of a person these modalities would be stated in a quantitative form and a mathematical ratio would be reached. A formula in this sense has not been developed and the development of such a formula would be extremely difficult.
8. The process of learning criminal behavior by association with criminal and anti-criminal patterns involves all of the mechanisms that are involved in any other learning. . . .
9. Although criminal behavior is an expression of general needs and values, it is not explained by those general needs and values since non-criminal behavior is an expression of the same needs and values. . . .

The repeated emphasis on learning is critical in Sutherland's theory, and raises two points of discussion. First, learning will update and change over time, meaning it is a process instead of a one-time event. This means that definitions, peer associations, and modalities of association may not be stable over development. Second, Sutherland believed that most learning occurred through interactions with intimate others (predominantly peers). However, the learning process to Sutherland was an intricate and complex entity. One means of gaining knowledge could be an actor learning criminal behavior from criminally-inclined peers or, inversely, an actor learning conforming behavior from conforming peers. Another possibility could be an actor learning criminal behavior from conforming peers, or, alternatively, conforming behavior from deviant friends (see Cressey, 1960, especially p. 49; also Akers, 1998 [2009]).

Thus, the learning process to Sutherland encapsulated a large array of potential mechanisms.

Considering Sutherland's first through sixth points together, simply having the knowledge of how to commit a crime does not mean that an actor will do so. Instead, the definitions that one holds favorable or unfavorable to crime will determine behavioral outcomes. Definitions become more favorable to crime when an actor values numerous peers who commit criminal behavior. The opposite is also true; actors will hold more conventional definitions when those who they value behave conventionally as well.

Sutherland's principle of differential association (point six) emphasizes the general importance of social processes, and specifically contact with peers (see point three). But, the differential association process is not so simplistic. An actor's peer associations vary across the "modalities of association" (point seven), which Sutherland identified as frequency, duration, priority, and intensity. Since associations with peers vary across the modalities and the principal part of learning criminal behavior occurs in peer groups, the modalities of association must affect the learning of criminal behavior, albeit indirectly. While the extant research on the modalities has focused on the extent to which they mediate or reduce the relationship between friend deviance and crime (see Chapter 2 for a discussion of this research), I take the approach that the modalities may moderate this relationship. This perspective is quite compatible with Sutherland's theory. Drawing from the general perspective of Sutherland, I argue that the deviant behavior of a peer will be more influential for an actor's behavior when the actor frequently interacts with him/her, has interacted with him/her for a long period of time, interacted with him/her earlier than other peers, and feels close to him/her. The same is

true for non-deviant friends. Thus, the influence that the deviant or conforming behavior of peers exerts on an actor will be amplified when the actor shares high levels of frequency, duration, priority, and intensity with the friend. Sutherland's eighth and ninth points are more matters of clarification than substance. The learning of crime is no different than the learning of any other action (point eight), and crime is an expression of internalized norms and needs, at least to an extent (point nine).

In summary, Sutherland's theory emphasizes the importance of the learning process in the etiology of criminal behavior. Both criminal and conforming behaviors are learned primarily through peer groups. These groups contain criminal and anti-criminal patterns, or, stated differently, those who support the commission of crime and those who do not. The exposure to these peers produces definitions. An excess of definitions to either crime or deviance should sway an actor's behavior in that direction. These definitions, however, vary in respect to the modalities of association since actors differentially value their peers. The behavior of friends with whom the actor interacts more frequently (frequency), has interacted with for a longer period of time (duration), interacted with first (priority), and most closely values (intensity) will be more influential for the behavior of the actor.

### **The Reception of Differential Association Theory**

Sutherland's differential association theory has been well received by scholars and has served several important roles in criminology (Akers, 1998 [2009]). First, the theory helped criminology emerge as a distinct field of science (Cohen et al., 1956; Cullen, 2011). Second, it also played the crucial role of placing theory at the center of the explanation of crime (Cullen, 2011, p. 297). Third, it showed the field what a crime theory would look like, and later theories adopted this model as well (e.g., Hirschi,

1969). Thus, Sutherland's theory "has had a massive impact" on the field of criminology (Vold and Bernard, 1986, p. 225).

The construct of differential association, which was Sutherland's sixth point, is generally operationalized through the amount of deviant peers one has. This variable has become one of the most – if not the most – empirically tested and supported theoretically derived variables in criminology (see Chapter 2). Elements of Sutherland's theory have also been explicitly incorporated into other major theories of crime, such as Akers's social learning theory (e.g., 1998 [2009]) and Agnew's (2006) general strain theory. Integrated theoretical approaches, such as Elliott and colleagues' (1979) bonding-strain model, Thornberry's (1987; Thornberry et al., 1994) interactional theory, and Colvin et al.'s (2002) coercion theory have incorporated Sutherland's statements into theoretical hypotheses, as well (also see Hoffman, 2003, p. 757-758; 776-777). As such, statements from differential association theory are widely applied.

Despite the warm reception, there have been criticisms of differential association theory. Many of the initial critiques were caused by misreadings, or false interpretations, of the theory. These have since been proven invalid (see Cressey, 1960). Some criticisms, however, have been valid. For instance, the theory does not precisely define what definitions favorable and unfavorable to crime mean (Cressey, 1952). Regardless, this issue has been remedied through the work of Akers (e.g., 1985). Another critique is that the theory does not properly specify ontological or epistemological assumptions. Through the work of DeFleur and Quinney (1966) and Cressey (1966), this has since been resolved and is no longer a relevant critique.

Setting aside the disproven, moot, or minor critiques, authors have concluded that the logic underlying differential association is sound and its propositions are testable (DeFleur and Quinney, 1966). Nevertheless, two substantive criticisms of Sutherland's work have been identified in the literature, both of which were first identified by Cressey (1960). The first criticism is that Sutherland failed to define or specify the learning process (also see Burgess and Akers, 1966; Jeffery, 1965). That is, he failed to identify how learning occurs. Since the learning process takes such a central role in his theory, this is a notable shortcoming. Second, Sutherland has been criticized for not offering definitions for the modalities of association despite their seeming importance (e.g., see Halbasch, 1979). Because the modalities affect associations which then affect crime, this is also a founded and substantive critique.

Several researchers have critiqued Sutherland for failing to explicate on the learning process (Burgess and Akers, 1966; Cressey, 1960; De Fleur and Quinney, 1966; Jeffery, 1965; see an early discussion by Cressey, 1952). Despite several authors identifying the problem, few (Adams, 1973; Burgess and Akers, 1966) have been able to suggest a resolution to the issue. The best solution that exists to date in the literature is the differential association-differential reinforcement theory of criminal behavior offered by Burgess and Akers (1966). This article served as the foundations of social learning theory, which is discussed in the Chapter 2.

The second critique – that the modalities of association were undefined – has been identified by several researchers (Glaser, 1956; Gongaware and Dotter, 2005, p. 394; Halbasch, 1979; see the same criticism in reformulations of differential association by Bruinsma [1992]) and has led to a large amount of speculation as to exactly what

frequency, duration, priority, and intensity are actually referring. Authors have since stepped in to aid in the definitions of the modalities of association, and especially Short (1957; 1958). Additionally, Matsueda (1988, p. 296) makes a convincing argument that the four modalities identified by Sutherland (frequency, duration, priority, and intensity) are only some of the potential modalities that may exist. While other modalities of association may potentially exist, no one – including Akers (see 1998 [2009], p. 26-27) – has identified others.

Despite the criticisms, Sutherland's main point is clear: Not all friends are created equal. After all, his is a theory of differential association. Friends will exert different influences on deviant behavior; some will be quite influential and some will be inconsequential. This influence should vary across the modalities. In the current project, Sutherland's omission of a discussion on the learning process is not a major concern. Instead, the primary critique this project aims to contribute to is the lack of clear definitions of the modalities. A substantial portion of Chapter 2 and Chapter 3 is directed at eliminating this problem by the incorporation of the concept of multiplexity from social network literature.

### **The Current Status of Peer Influence in Criminological Theory**

Speaking to a larger issue of the importance of theory in criminology, Vold and colleagues (1998, p. 3) state that “criminology has been blessed (or cursed, depending on one's point of view) with a very large number of scientific theories.” The truth to this statement is echoed in Weisburd and Piquero's (2008) recent work, as they identified dozens of criminological theories that have been proposed and/or tested in extant literature. Because of the rich history and importance underlying the deviant peers construct, a good number of these theories make statements on how friends or peers

should influence criminal or deviant behavior. However, the vast majority of these theories simply echo statements that were made by Sutherland's (1947) differential association theory. For instance, Agnew's reconceptualized general strain theory (2006), Stafford and Warr's (1993) deterrence theory, and Colvin and colleagues' (2002) social support element of coercion theory all incorporate Sutherland-esque statements on why peer deviance will relate to criminal behavior.

Instead of focusing on the number of theories that explicitly include a differential association-influenced deviant peer relationship or implicitly are compatible with the construct, it is more pragmatic to mention theories that expressly deny a peer influence on crime. Three fit this criterion: social control theory (Hirschi, 1969), self-control theory (Gottfredson and Hirschi, 1990), and Hirschi's (2004) combined social/self-control theory. Aside from sharing an author in common, these theories all infer that the peer influence on crime is spurious due to third-party factors and particularly selection effects. While evidence loosely supports the notion that people select into friendships with similar others (see Cairns et al., 1988; although see Young, 2011), the peer delinquency construct has not been proven spurious (see Pratt et al., 2010). As such, the time has come (and passed) for the three control theories to back off their stance that peers are irrelevant for crime causation.

The theories that incorporate themes of differential association in hypotheses serve to bolster the evidence that friends matter but do not advance theory in the direction as to why friends matter. To provide a comprehensive answer to the latter question, Sutherland's modalities of association must be examined as potential moderators of the differential association/crime relationship.

Due to gaps in Sutherland's work, this task would be aided by a theory that adopts peer influence as a central component, much the same way that Sutherland's differential association does. Only one theory currently exists that satisfies this condition – Burgess and Akers's (1966) theory of social learning.

Though Burgess and Akers (1966, p. 131) originally intended their concept of social learning to serve as a "restatement of [differential association] theory," the academic community viewed it as a related, but distinct, theory. Their work focused on specifying and applying a mechanism of learning to Sutherland's work. Drawing on contemporary work from social psychology, they stated that "Criminal behavior is learned according to the principles of operant conditioning" (p. 137).

Learning was theorized to primarily occur in "peer group[s]" (p. 139), which Burgess and Akers saw as a central element in Sutherland's work. In these peer groups, actors were theorized to learn through "differential reinforcement" (p. 134). Differential reinforcement describes the process where a person's actions are either positively or negatively reinforced. This reinforcement can be rewarding or stigmatizing to the actor, thus increasing or decreasing the likelihood of the behavior reoccurring, respectively. The concept has been well received by scholars (e.g., Agnew, 1991) and is empirically supported as a correlate of crime (Akers and Jensen, 2006).

Burgess and Akers's article served as the foundation for a theory of social learning (e.g., see Akers et al., 1979), which has become one of the most tested and supported theories of crime (Akers and Jensen, 2006; Pratt et al., 2010). Despite the distinction between differential association and social learning theories, the two approaches share inherent similarities and, as a consequence, the research examining

one necessarily is relevant to the other. Explicitly, the primary focus of this project is on conceptually extending the concept of differential association to accommodate concepts of social networks in a developmental light. Due to omissions in Sutherland's theory, social learning theory's hypotheses, discussions, and statements will frequently be used throughout this project. This will become particularly evident when discussing development across the life-course. While Sutherland's differential association cannot account for development and change in deviance or crime, Akers's social learning construct offers clear and testable hypotheses for how development, differential association, and crime should be related.

### **The Future of Friends in Criminological Theory**

In the aptly named Sutherland Address presented at the annual meeting of the American Society of Criminology in November of 2010, Frank Cullen 'called out' criminologists for being too focused on crime during adolescence. Cullen declared that the field was stuck in what he termed "adolescence-limited criminology" (ALC; 2011, p. 287), a label that plays off of Moffitt's (1993) taxonomy of life-course offending. To remedy this issue, Cullen argued that criminological scholars must embrace the fact that people do not live cross-sectionally. He instead argued for a renewed focus on the developmental and life-course (DLC) paradigm, calling the ALC paradigm "intellectually bankrupt" (Cullen, 2011, p. 306).

While Cullen's call for a redirected focus to the DLC perspective served as a 'wake-up call' for an emerging generation of criminologists, it was hardly a revolutionary idea. Sutherland's most developed version of differential association included a discussion of how a valid "explanation of criminal behavior is made in terms of the life experience of a person" (1947, p. 5). Although Sutherland had no chance to elaborate

on what this statement meant for his theory of differential association, he was conscious of the usefulness and pragmatic value of a developmental approach to crime causation. As an unusually keen and scrupulous scholar, it is possible (and probably likely) that Sutherland would have incorporated a developmental statement or hypothesis into his theory had he not died suddenly in October of 1950 (see the discussion of Cohen et al., 1956).

Unfortunately, posterity is left with a construct of differential association that is either incapable of explaining the development of friendships or delinquency or has not been used in such a manner. Since there are no statements as to how friends should influence crime at different points in the life-course, what should be done with Sutherland's construct? In arguing that the ALC paradigm is exhausted, Cullen (2011) notes that theories "matter" (p. 310). Instead of "throwing the baby out with the bathwater" (p. 301), Cullen recommends theories that offer valid explanations for crime "should be age graded, with the effects of their factors specified contemporaneously by age grade" (p. 310).

In one light, this project can be viewed as a response to Cullen's statement on what criminologists should do with theories that were primarily designed to explain crime at one time period (presumably adolescence). In at least one case, however, Cullen does not pay extant theory its fair due. Over a decade ago, Akers (1998 [2009]) made developmental hypotheses as to how social learning variables, and differential association specifically, should explain crime over the life-course. Generally, Akers hypothesizes that differential associations will change as an actor ages and, overall,

friends become more conforming. However, differential associations will still retain a strong, significant effect on crime for those who offend at all points of the life-course.

### **Summary**

Since Cullen and Akers are both supporters of the developmental paradigm, Cullen's recent speech and Akers's extensions of differential association theory via social learning theory are symbiotic with one another. The two scholars' perspectives form a cohesive approach through which to think about how and why differential association may exert different effects on criminal behavior at various points in the life-course. Being that differential association is one of the most historically important and empirically supported constructs to the field of criminology, fostering an understanding of whether it can explain criminal behavior in a life-course perspective is critically important. Such is the reasoning for undertaking the current project.

It is the purpose of this dissertation to move towards a more thorough understanding of the applicability of differential association as a developmental explanation of crime. Three of Sutherland's four modalities of association – frequency, duration, and intensity – will be joined with concepts from social network research to form an operationalization of the modalities of association. Using structural equation modeling and longitudinal coefficient comparison tests, the explanatory ability of the modalities and the crime of friends (a measure of differential association) on the crime of the actor will be evaluated across three developmental periods – middle adolescence, late adolescence, and emerging adulthood. Drawing upon hypotheses derived from the life-course paradigm and social learning theory, the extent to which differential association is suitable as a developmental explanation for crime is addressed.

To offer an in-depth and structured look into the intricacies of the peer effect on crime, Chapter 2 offers a review of the literature and discusses the conceptual overlap between the modalities of association, social network concepts, and the developmental perspective. Chapter 3 discusses why a developmentally-focused integration of social network concepts and differential association/social learning theory makes conceptual sense and reviews what such a merger would look like. Chapter 4 will discuss the Rochester Youth Development Study data and measures that will be used in analyses. Chapter 5 will review the plan of analysis to test the proposed hypotheses. Results from these analyses will be presented in Chapter 6. A detailed discussion of the theoretical, empirical, and applicative value of the results, as well as the limitations and conclusions of the study, will be offered in Chapter 7.

## CHAPTER 2 FRIENDS, DEVELOPMENT, AND CRIME: A REVIEW OF THE RESEARCH

While differential association and social learning theories have been subjected to numerous empirical tests in literature, surprisingly few studies have attempted to operationalize the modalities of association (frequency, duration, priority, and intensity). Warr (1993, p. 19) elaborates by saying that “part of the reason” that “[t]ests of Sutherland have ignored [the modalities of association]” is because “Sutherland did not clearly define all of these dimensions and offered no help as to how they were to be measured or operationalized”. Other authors who have commented on the lack of research on the modalities share the same opinion (e.g., see Glaser, 1956; Halbasch, 1979).

Despite there being only a few studies which have put the modalities to empirical test, the four elements have routinely been the subject of conceptual discussions. This review first covers these conceptual arguments alongside empirical research on the modalities. A chronological format is followed, allowing the reader to see how conceptualization and operationalization worked concurrently to reach a consensus on what the modalities signify. Second, social learning theory – which also incorporates the modalities of association – is reviewed. After a discussion of the meaning of the modalities in social learning theory, the similarity between tests of the modalities in the two theoretical traditions is then reviewed. Third, a general overview of the social network approach will be provided. This section concludes with a summary of the empirical status of concepts most frequently tested in social network research. The fourth and final section of Chapter 2 discusses the developmental approach to studying the influence of friends. Following a synopsis of social psychology research focused on

explaining how friends influence actors differently over the life-course, emphasis will be placed specifically on how friends influence criminal behavior differently across development.

A theme throughout this discussion that will repeatedly arise is the similarity of the goals of the various approaches reviewed in Chapter 2. The differential association, social learning, social network, and life-course approaches to crime explanation all share the same goal; each tries to explain why some friends may be more influential for the causation of crime than others.

### **An Overview of Research on Sutherland's Modalities of Association**

The first study to place emphasis on the modalities of association following Sutherland's final theoretical conceptualization was written by Donald Cressey in 1952. Using a qualitative analysis in a sample of offenders, Cressey found support for the general principles of differential association. However, it was apparent that he did not know exactly how his qualitative work applied to the modalities of association (p. 52). The reason for this was because he did not see the applicability of qualitative research to the modalities – after all, Sutherland (1947, p. 7) had said explicitly that the modalities should be represented in quantitative form. Thus, Cressey (p. 44) called for future research to move towards a more complete operationalization of the theory by including a quantitative representation of the modalities.

Cressey's subsequent research (1955; 1960; 1966), however, was unable to quantify the modalities. For instance, his 1955 study, which was directed towards a need for applicative uses of differential association theory in institutionalized offender populations, did not even mention the modalities. Nor did his 1966 research, which was directed towards reviewing other conceptual research on differential association.

Regardless, Cressey understood the importance of the modalities to Sutherland's construct and the need to quantify them. In a conceptual examination of differential association, Cressey (1960) called for research to incorporate the modalities. The implications of not including them, as he understood, meant a misspecification of the theory of differential association. Drawing on Clinard's (1946) study of the conceptual overlap between wartime atrocities and theory, Cressey (p. 50-51) explained: "If these 'modalities,' as Sutherland called them, are ignored, then the theory would equate the impact of a behavior pattern presented in a [wartime] radio show with the impact of a pattern presented numerous times to a child . . . [The theory] does not so equate the patterns." Cressey's example could not be more clear. The behavior patterns of soldiers during wartime are nothing like the behavior patterns of child-rearing. He understood that the modalities of association were necessary to distinguish behavioral patterns and definitions from one another.

Glaser's work in 1956, which reviewed how theories of crime could provide realistic images of criminals and crime causation, was heavily critical of Sutherland. He called differential association theory a "failure" (p. 438) since Sutherland had not offered a precise definition of the modalities of association (among other poorly defined elements of the theory). Without clear definitions, Glaser felt that differential association would achieve only "limited acceptance" (p. 438) among academics.

Glaser's willingness to write off differential association because of poorly defined modalities serves as a clear indication of how important he thought they were to the theory. But, all things considered, Glaser's work ended up bringing little to the table for the modalities or future research. He had effectively criticized the modalities' lack of

definitions but had suggested no resolution to this problem (Sutherland could not help solve this issue because of his death in 1950). The concept that he attempted to develop in his work – differential identification, which was essentially an integration of Mead’s (1934 [1967]) generalized other and differential association theory – included no mention of frequency, duration, priority, or intensity (see a similar study by Gongaware and Dotter, 2005).

While Glaser’s contemporaries understood the definitional problems facing the modalities, not all felt it sufficient to offer idle complaints with no resolution. James Short was instrumental in the move to define, operationalize, and test the modalities of association.

In 1957, Short provided the first empirical test of Sutherland’s theory with original data on adolescents in vocational schools in a western US state. Short believed that the modalities were central to Sutherland’s theory, and developed one item measures of each. He operationalized frequency by asking the respondents “Think of the friends you have associated with most often. Were (or are) any of them juvenile delinquents?” (p. 235). The other three modalities were operationalized in a similar fashion. Duration was measured with an item asking participants if any of the friends they had known the longest were juvenile delinquents. To tap priority, respondents were asked if any of the first friends that they could remember were juvenile delinquents. And finally, intensity was measured with one item that asked if any of the actor’s best friends were juvenile delinquents.

Short’s research was revolutionary. Though the modality measures were only binary, they provided the first quantitative measurement strategy for Sutherland’s

explicitly quantitative theoretical elements. Short also found that they were empirically supported. Using bivariate statistics, all four modalities were significantly and positively related to delinquent behavior. The most supported modalities were frequency and intensity, which shared a correlation of .58 with crime. Duration was also relatively strongly related to crime ( $r = .47$ ). The least supported modality was priority, which still nonetheless was significantly related to crime ( $r = .29$ ) in the hypothesized direction.

A year later, Short published another empirical test of differential association, this time focusing solely on the influence of delinquent friends on crime. Using similar operationalizations for the modalities as he did in his 1957 piece, Short found that the modality of intensity was the most strongly related to crime. The next strongest was frequency, and then duration, which was significant in all but one test. The priority modality, however, failed to reach significance in half of the models, making it the least supported modality of association.

Drawing on his empirical research from the 1950s, Short published a conceptual study on differential association in 1960. Despite the numerous critiques of differential association that had appeared in contemporary literature (such as Glaser's [1956]), Short defended the theory by arguing that his prior empirical studies (1957; 1958) had yielded support for the differential association construct generally and the modalities of association specifically. Further, and importantly, his research showed that the modalities of association were testable in a quantitative format.

Although his research (1957; 1958) had demonstrated support for the modalities, Short was aware that the conceptual definitions of the modalities he developed were hardly set in stone. His research had provided an interpretation of the modalities, which

he saw only as precedent on what the modalities could mean and how they could be operationalized. He did not want his conceptual definitions to become the unquestioned, sole meanings for the modalities in literature – a point which he explicitly stated (1960, p. 16-18).

Despite Short's recommendation to explore different interpretations of the modalities of association, others began to mimic his measurement strategy. In 1964, Voss published a replication study of Short's (1957; 1958) empirical research. Using the same measurement strategy for the modalities as Short, Voss found empirical support for all four modalities. Duration was the most strongly related to crime, followed by intensity and frequency. Though it was significant, priority held a weak relationship with crime. Voss then took the four modality measures and scaled them together to fit a construct of differential association, also finding that this scale was related to crime.

In 1966, Melvin De Fleur and Richard Quinney wrote a conceptual paper directed towards adding ontological and epistemological assumptions to Sutherland's theory. However, De Fleur and Quinney argued that the modalities of association were "not central to [Sutherland's] explanation of the genesis of delinquent conduct" (p. 8). They felt that the modalities instead offered "qualifications" (p. 8) about the operation of differential association. De Fleur and Quinney were correct that the modalities qualify the nature of the relationship between the crime of friends and the crime of the actor. However, it is conceptually incorrect to say that the qualifications they provide are not central to differential association theory. Sutherland's modalities represented a theoretical attempt to determine which friends influence the commission of (and abstention from) crime (see Cressey, 1960). Simply, not all friends exert the same

influence on conforming and/or deviant behavior; without the modalities, there would be no specified mechanism for why this is the case, and all friends would be assumed to exert the same influence on criminal behavior.

De Fleur and Quinney's article was reviewed by Cressey, who wrote a response to their study (1966). Though making no mention of the modalities of association specifically, Cressey applauded De Fleur and Quinney for making differential association theory manageable. The assumptions they added, in Cressey's opinion, greatly aided in the quantifiability of Sutherland's theory, thereby making it more easily testable.

Also in 1966, Burgess and Akers published an extension of differential association theory. They stated that the modalities of association were "straightforward enough" (p. 144) and were directly testable. They felt that the modalities were important because they tapped the extent to which behavior (whether it be criminal or not) was reinforced. Accordingly, they argued that the modality of frequency should measure how often a behavior is reinforced, duration should measure the length of time it is reinforced, priority should measure the first reinforcements, and intensity should measure the strength of the reinforcement. This paper, which served as the foundation for the development of social learning theory, will be further elaborated on in the next section of Chapter 2.

The work of Burgess and Akers (1966), De Fleur and Quinney (1966) and others (e.g., Cressey, 1966; Jeffery, 1965; Short, 1957; 1958) was criticized in 1979 by Keith Halbasch. Halbasch believed that prior research had failed to demonstrate that

Sutherland's theory generally, and the modalities of association specifically, were quantifiable.

Halbasch provided three reasons for his critiques. First, he discussed how no one really knew what to do with the modalities since they were so poorly defined by Sutherland (p. 223). All work on them was speculative, and definitions of them were subjective. Second, there was no consensus on the mathematical formulas that Sutherland had stated through which the modalities should be measured. Without these formulas, Halbasch believed that "no application of the principle of differential association would be possible" (Halbasch, 1979, p. 224). Third, and finally, he felt that the modalities had been applied incorrectly in contemporary research (p. 222-224). Based on his reading of Sutherland's theory (1947), he believed that the modalities should be used as a weight on definitions. But, then again, no one knew a systematic meaning for the modalities, and, as such, the theory of differential association was deemed "untestable" (p. 223).

Halbasch's criticism seemed to make little impact since scholars continued to test and operationalize the modalities of association. In 1985, Marv Krohn and colleagues created a differential association scale with the modalities of intensity, duration, and frequency (like Voss, 1964). One item each tapped the length of time of interactions with delinquent friends (frequency), the duration of the associations (duration), and the closeness of those associations (intensity). They also included a measure of differential association that tapped the proportion of one's friends who were deviant. Interestingly, the measure of the proportion of delinquent peers item was found to be collinear with a scale of the modality items. Thus, Krohn et al. dropped the proportional measure of

delinquent friends since they believed the modalities to be a more valid interpretation of Sutherland's theory. Using a path modeling approach, Krohn and colleagues concluded that the modalities scale had a significant indirect effect on smoking behavior. A year later, Massey and Krohn (1986) utilized the same analytical approach in a test of Sutherland's (1947) differential association theory and Hirschi's (1969) social control theory. The same results were found.

Tittle and colleagues (1986) discussed how Short's method of operationalizing the modalities of association was presumptive because it was unclear whether Sutherland's definitions were intended to be general (i.e., an actor perceives the same definitions for all crimes) or crime-specific (i.e., an actor perceives different definitions for different offenses). Because of this possibility, Tittle and colleagues did not include a measure of the modalities in their empirical examination. Instead, they measured differential association through a measure that asked about the proportion of the actor's friends who committed crime.

In 1987, Matsueda and Heimer used differential association to explain variation in offending based on race. Using the Richmond Youth Study data, Matsueda and Heimer operationalized the modalities as weights on definitions favorable to crime. Actors were asked to report definitions that were presented more frequently (frequency), for a longer period of time (duration), earlier in life (priority), and from a more prestigious source (intensity). They concluded that the effects of both parents and peers on crime operated through the modality-weighted definitions, interpreting this to be supportive of Sutherland's theory.

Matsueda and Heimer's (1987) research served as the backbone for a theoretical extension of differential association written a year later (Matsueda, 1988).<sup>1</sup> In this study, Matsueda defended his interpretation of the operationalization of the modalities (definitions weighted by modalities). However, he stressed that the notion of differential social organization (a level-two construct) was important to differential association theory (a one-level theory; this same argument was provided by Heimer and Matsueda [1994]). In Matsueda's model, the modalities were hypothesized to affect definitions at level-one in much the same way they did in Matsueda and Heimer's (1987) research.

This area of Matsueda's research, however, has been criticized by Akers (1998 [2009]). While Akers believes there is value in incorporating the constructs, he saw Matsueda's research as being subsumable under his social learning-social structure construct.<sup>2</sup>

Bruinsma (1992) took a Halbasch-like stand and criticized the theory of differential association. He argued that "During a period of 40 years the theory has never been empirically tested completely" (p. 32). As such, "the theory of Sutherland . . . remains vague, too abstract, confusing, and in essence untestable" (p. 32). To provide a means of improvement, Bruinsma drew on the work of the German sociologist Karl-

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<sup>1</sup> See an extension of differential association theory by Braithwaite (1989), who attempted to develop a construct of differential shaming. Braithwaite, however, made no mention of the modalities of association, suggesting that they are not central to his theoretical reconceptualization.

<sup>2</sup> Gottfredson and Hirschi (1990) have taken a different stance on this issue. They argue that differential association theory (what they call a 'cultural deviance theory') is incapable of explaining individual-level criminal behavior because it does not explain all forms of behavior. Akers (1996) has shown that this position is incorrect since Gottfredson and Hirschi seem to only focus on individual, extreme cases of behavior. Specifically, the modalities of association (like all elements of differential association) are conceptually valid explanations of micro-level criminal behavior.

Dieter Opp (1974).<sup>3</sup> His interpretation tapped two modalities – frequency and priority. Bruinsma operationalized the modality of frequency by the amount of unstructured time the actor spent with his/her friends, and priority was measured with one item that captured the length of time the actor had known his/her friends. The latter should probably be considered a measure of duration. While frequency was not correlated with crime, his priority/duration measure was significantly, positively correlated with crime. However, his path models loaded these two modalities directly onto a measure of behavioral norms, and not deviance. As such, little can be drawn from Bruinsma's findings.

Mark Warr's (1993) study evaluated the explanatory ability of differential association theory with the National Youth Survey, a nationally-representative panel dataset. Warr stressed the importance of the modalities of association and criticized the lack of empirical tests of them (p. 19).

Seeking to help resolve this problem, Warr (1993) operationalized all four modalities. Frequency was measured with one item asking about the amount of time the actor spent with friends. Duration measured the total number of years the respondent reported having delinquent friends, and priority was measured with the actor's age at the onset of having delinquent friends. Finally, intensity was operationalized with two items measuring 1) the importance of the friends to respondents and 2) the actor's commitment to friends.

Warr concluded that the amount of time spent with friends increased throughout adolescence and significantly related to alcohol use, marijuana use, theft, burglary, and

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<sup>3</sup> On April 14 – 16, 2012, Professor Opp and I communicated through email. He confirmed that his book is unavailable in English. As such, I do not include a description of his original work in the current study.

cheating on school tests. Further, the time that delinquent friends had been involved in the actor's life was also positively related to delinquency. While intensity was generally unrelated to crime, priority was significant, but in the wrong direction. This suggested that acquiring delinquent peers recently may be more influential for crime than acquiring delinquent friends earlier in life.

This finding was inconsistent with the propositions of Sutherland's theory as well as past research on the modality of priority (e.g., Short, 1957; 1958). Further seeking to understand this relationship, Warr performed some extra analyses investigating the nature of the relationship between duration and priority. These tests led Warr (1993, p. 34) to the conclusion that "The cumulative number of years in which an adolescent has had delinquent friends has a positive effect on his or her current behavior. But among adolescents with the same duration of delinquent friendships, those who acquired delinquent friends most recently are those who are most prone to delinquency."

In the process of this analysis, Warr discussed how the duration and priority modalities were "logically distinct" but found that they were not "empirically distinct" (p. 34). The two modalities were correlated as high as .82 among the outcomes explored. The reason for the high similarity between the duration and priority modalities was explained by Warr using a concept he developed from empirical results called "sticky friends" – once delinquent friends are acquired, they are not lost quickly. During this often long-term period of having delinquent friends, the addition of new friends who are predisposed towards offending (recency) increases delinquent behavior. Thus, prior research on the modalities of association may have suppressed this finding since the relationship between the modalities of priority and duration had never been explored in

such detail. Warr recommended that future research further explore the priority/recency issue in retrospect to the sticky friends hypothesis (see the follow-up research of Beaver et al., 2009). If this finding was replicated, however, he stated that the modality of priority be replaced with the modality of recency.

McCarthy (1996) used differential association to evaluate crime among homeless youth. He used two measures to tap the modalities of frequency and intensity. Frequency was measured with the proportion of the actor's friends who were arrested while the actor was living at home. Intensity was measured with the proportion of friends who were arrested when the actor moved out to the streets. Despite attempting to explain how these measures tapped two different modalities, these items actually do not tap any modalities. Instead, they are simply different ways of measuring the differential association (peer delinquency) construct.

Following Akers's (1996) defense of the modalities against the critiques of Gottfredson and Hirschi (1990; see footnote two), the next research to have a central focus on the modalities of association was Chamberlain and colleagues' work (2002). Their primary goal was to conceptually discuss how the modalities of association have implications for children in multidimensional treatment foster care. The children in this type of housing are generally delinquent and/or antisocial. They argued that understanding how the modalities affect the troubled children's differential associations could potentially help in the behavioral intervention strategies.

Dick and colleagues (2004) also drew upon the modalities of association for applicative purposes. They spoke to the need for 'peer courts,' which are a specific application of peer-based programming. By formulating these courts based on the

modalities of association, Dick et al. argued that deviant behavior could potentially be more successfully diverted. However, more recent research has discussed the severity of deleterious, unintended consequences of peer-based programming (e.g., Dishion and Tipsord, 2011), meaning the implementation of such specialized courts would need to be done very carefully.

Gang Lee and coworkers (2004) used data from the Boys Town Study for Youth Development to test if the modalities of association were significantly related to crime in the context of Akers' (1998 [2009]) social learning-social structure model. Three modalities were measured with items that asked about the most frequently encountered friends (frequency), the longest-term friends (duration), and best friends (intensity). These items were extremely highly correlated (all over .80). Since they were measuring something very similar, Lee and colleagues chose to scale them together. The modalities scale was then used in the construction of a social learning latent construct, which significantly predicted substance use.

The most recent (and one of the more unique) empirical application of the modalities was written by Pamela Hunt (2010), who used differential association theory to look at integration within the jam band subculture. Hunt argued that the modalities are valid and can be operationalized. She measured frequency with the amount of interactions with others in the jam band culture, duration was measured with an item tapping the number of years respondents had been embedded in the culture, priority was measured with an item measuring the age which the actor first became involved in the culture, and intensity measured the emotional and relational attachments to others in the culture. Although Hunt failed to find support for the priority and duration

modalities, frequency and intensity directly and positively predicted embedment in the jam band culture.

In a recent review of the literature on differential association, Bradshaw (2011, p. 4) discusses how the modalities – despite being undefined by Sutherland – have had very steady, “unadventurously” consistent, conceptual and operational definitions in extant research. When Short’s (1957) conceptual definitions are compared to Krohn and colleagues’ (1985) and Hunt’s (2010), Bradshaw is correct; the modalities have truly been operationalized and discussed in an extremely similar manner over the past 60 years.

Given that this discussion has now established the current state of research on the modalities, allow me to take a moment to digress back to the critiques of differential association theory and/or the modalities, and in particular the work of Halbasch (1979). Recall that Halbasch 1) criticizes Sutherland’s theory for failing to provide conceptual definitions and 2) criticizes past research for not doing more with the modalities. However, Halbasch fails to see the necessity of jointly evaluating theory and empirical research in unison and, as a consequence, misses what is potentially a shortcoming of prior research testing Sutherland’s theory and the modalities of association: In extant research, the modalities of association have been applied in only one consistent manner with Sutherland’s (1947) original writings.

Sutherland defined the construct of differential association as a person’s exposure to “both criminal and anti-criminal associations” (1947, p. 6). This construct is synonymous with ‘peer delinquency’ or ‘peer deviance’ and is normally operationalized by asking an actor how delinquent his/her friends are. This operationalization is valid

and true to the theory (Akers, 1991), meaning that the differential association construct is distinct from the modalities. Additionally, Sutherland (p. 7) stated that “Differential associations may vary in frequency, duration, priority, and intensity”. With these two statements considered together, I take the standpoint that the modalities should independently moderate the relationship between differential association (peer delinquency) and crime. This argument is, in my opinion, consistent with Sutherland’s theory. Orcutt (1987) may have realized this, but was unable to actually test these moderation effects of the modalities on crime. As a result, to date, moderation effects have not been explored in the modalities literature.<sup>4</sup> Instead, studies have generally evaluated how the modalities directly influence crime and other theoretical variables (e.g., differential reinforcement).

When implementing these tests, researchers have generally followed the conceptual and operational precedent set by Short (1957; 1958), or some variant derived thereof. Due to the undefined origins of the modalities, the consistency in research testing them is surprising. There was so much room for interpretation when Sutherland did not offer clear definitions in the final version of his theory – to use a colloquialism, the ‘sky was the limit.’ What is promising, though, is that there remains tremendous potential for further development of the conceptual and operational definitions of the modalities. Two bodies of research neatly coincide with the logic behind Sutherland’s arguments – social network and developmental research. These

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<sup>4</sup> See the work of Vitaro and colleagues (2000), who explored the potential that parental monitoring, disruptive tendencies, and delinquent attitudes may moderate the peer delinquency/crime relationship. However, these variables were not derived from differential association or social learning theories.

are reviewed in the remainder of Chapter 2 following a conceptual discussion of Akers's social learning theory.

### **Social Learning Theory and the Modalities of Association**

In 1966, Robert Burgess and Ron Akers published a study in the journal *Social Problems* that has since become one of the seminal manuscripts in criminology. Burgess and Akers's goal was to provide a conceptual discussion and extension of Sutherland's differential association construct.

The primary critique Burgess and Akers had of differential association was that Sutherland had not offered an explanation of how criminal behavior was learned. This was not a unique criticism. In 1965, C. Ray Jeffery had previously recognized this shortcoming (also Cressey, 1960). But, while Jeffery had discussed the potential for conceptual overlap between differential association and learning theories, he stopped short of applying the principles of learning to Sutherland's theory (as did Cressey, 1960). As such, Jeffery's effort was only "partially successful" (Burgess and Akers, 1966, p. 130) since it stopped short of explicitly showing how learning principles could be applied to differential association.

To more explicitly apply a learning mechanism to Sutherland's construct, Burgess and Akers offered that "Criminal behavior is learned according to the principles of operant conditioning" (p. 131, emphasis in original). Drawing heavily on social psychology research, this learning was theorized to primarily occur in a "peer group" (p. 139). The individuals in the peer group were hypothesized to differentially reinforce – that is, either support or reject – the actor's conforming or deviant behavior.

While Burgess and Akers's career paths diverged after their work in 1966, Akers stayed with the revised theory. As a result of several theoretical expansions and

refinements during the next decades (e.g., Akers, 1973; 1977; 1985; 1998 [2009]), the academic community began to see Akers's revision of differential association as a distinct theoretical approach.

In the early 1970s, Akers joined with Marv Krohn, Lonn Lanza-Kaduce, and Marcia Radosevich to conduct one of the first large-scale data collection efforts in criminology. This project, called the Boys Town Study for Youth Development, allowed Akers and colleagues to define, operationalize, empirically examine, and refine the elements of social learning theory (see Akers et al., 1979; Krohn et al., 1984; Lanza-Kaduce et al., 1984). As such, the Boys Town study played a central role in helping social learning theory develop its own, unique place in the spectra of criminological theory.

Social learning theory contains four major elements. The first is Sutherland's construct of differential association, which describes the process through which an actor is exposed to definitions favorable and unfavorable to crime. According to Akers and Jensen (2006), differential association is the most frequently empirically tested concept of social learning theory. It is also the most empirically supported (Pratt et al., 2010).

The second element of social learning is definitions favorable or unfavorable to crime. Definitions are described as the attitudes and meanings that an actor attaches to a given behavior. Definitions favorable to crime are the second most commonly measured (Akers and Jensen, 2006) and empirically supported (Pratt et al., 2010) element of the theory.

Differential reinforcement, the third element of social learning, was a key addition to Sutherland's differential association theory. It refers to the balance of anticipated or

actual rewards and punishments associated with any particular behavior. It is the third most frequently tested element of social learning (Akers and Jensen, 2006) and has received modest support in empirical research (Pratt et al., 2010).

The fourth and final element of social learning theory is imitation, which describes how an actor may engage in a behavior after he/she observes others engaging in such behavior. Due to difficulties in operationalizing the construct (see Warr and Stafford, 1991), imitation is the least tested of the four elements of social learning theory (Akers and Jensen, 2006). When it is tested, however, it receives modest support (Pratt et al., 2010; see Akers et al., 1979).

Since Akers draws upon differential association theory, the modalities of association are important to his theory and have been since his initial work with Burgess. Akers states that “Priority, frequency, duration, and intensity of association with criminal persons and groups are important to the extent that they insure that deviant behavior will receive greater amounts of reinforcement” (Burgess and Akers, 1966, p. 144). Akers’s later research (e.g., 1985; 1998 [2009]; Akers et al., 1979; Lee et al., 2004; see the summary of Rogers, 2001) echoes this opinion. As such, Akers – like Sutherland – expects that the modalities of association will influence the relationship between differential association with delinquent friends and delinquent outcomes.

Because of the inherent overlap between differential association and social learning theories, the modalities have the same conceptual and operational definitions. Thus, the same research that tests the modalities in differential association theory is also testing social learning theory’s statements on the modalities of association (e.g., Krohn et al., 1985). As such, this research has already been reviewed.

## **The Network Approach: An Empirical Review**

Sutherland's (1947) use of the modalities was intended to help determine how friends may influence the behavior of actors in different ways. Another means of looking at this same issue is through social network research. Explicitly, the differential association and social network approaches share in common the goal of discovering which friends are the most influential for behavior. As such, principles from the two traditions coincide philosophically, leaving considerable room for conceptual and theoretical integration.

The social network approach is a product of anthropological, mathematic, psychiatric, and psychological research (Krohn, 1986; Scott, 2000). It was originally conceived as a technique to understand how the personal characteristics (e.g., attitudes, mental health states) of friends may influence the personal characteristics of actors. Criminological applications of the network approach can be traced back to the research of Denise Kandel, who used concepts of networks to explore similarities and differences among offending behaviors of adolescents (Kandel, 1978a; 1978b) and later adults (Kandel and Davies, 1991).

There are two types of network designs. The first is called a personal network design. A personal network, which is also referred to as an 'ego-network' by Young (2011), is "one that is centered on the individual and represents his or her links to other people" (Krohn, 1986, p. 82). Figure 2-1 provides a visual depiction of a personal network. In a personal network design, all traits, behaviors, and characteristics of individual friends are perceptually reported by the actor him/herself, making them individual-level variables. This places the conceptual and operational focus on "ego-centric" opinions of the friendship; in other words, the focus is "how an actor feels about

the friendship” rather than “how an actor’s feelings about a friendship compare to the peer’s feelings about the friendship.” Actor reports can also be used to assess objective properties of a network. For instance, an actor can identify the location of where he/she interacts with friends (e.g., at work, at the gym), demographic and personal characteristics of friends, and whether his/her friends know each other. Thus, the most appropriate units of analysis in a personal network design are individual actors and/or the actors’ social networks.

The primary difference between a personal network design and a social network design is the latter captures the characteristics of friends by self-reports directly from the actor’s friends (see Figure 2-1). By actually seeking out and gathering measures from the actor’s friends specifically, the social network approach – like the personal network approach – allows for the construction of friendship webs and allows for the reciprocity of links between friendship ties. The units of analysis in a social network design can be individual actors, dyads, or entire networks.

The two types of network approaches are extremely similar. Regardless of whether a personal or social network approach is used, the goal of criminological network research is to determine how friends influence behavior. As such, there are several constructs that are frequently discussed in the network literature: homophily, centrality, density, and multiplexity.

Originally proposed by Lazarsfeld and Merton (1954), homophily refers to the tendency of individuals to be similar to their friends. This concept was originally used in criminological research by Kandel (1978a; 1978b) to explore the offending similarities between friends. She found that homophily was high for substance use, a behavioral

dimension in which adolescent actors and friends were highly similar (cf. Krohn and Thornberry, 1993). Other than the use of substances, she found few similarities in offending behaviors across friends.

Since Kandel's (1978b) research, homophily is generally used to describe non-behavioral rather than behavioral similarities between friends. However, homophily across non-behavioral elements is still relevant to criminal behavior since homophily is high for variables that are frequently linked to criminal activity, such as educational attainment (Kandel and Davies, 1991; see Kandel, 1978b) and employment status (Kandel and Davies, 1991).

The next major concept from social network research is centrality. Centrality refers to the actor's position within a social network. An actor who has high centrality is one who holds friendship ties to almost all or all others in the network (see Haynie, 2001).

Centrality is generally used as a predictor of information transmission (e.g., gossip) between individuals in networks (see, for example Haynie, 2001; McGloin and Shermer, 2009; Young et al., 2011). However, research has demonstrated that centrality may have a relationship with both differential association and deviant behavior (Haynie, 2001). Some evidence also exists that suggests an actor's centrality in a social network may moderate the relationship between differential association and deviant behavior (Haynie, 2001; McGloin and Shermer, 2009). However, some studies find that centrality is unrelated to most deviant behavior (e.g., McGloin and Shermer [2009] conclude that centrality influences deviance in girls, but not boys). Other research fails to find an effect for centrality whatsoever (e.g., Young et al., 2011; also

see similar findings with aggression by Cairns et al., 1988). Therefore, the evidence regarding whether centrality shares a relationship with crime is inconsistent.

The social network concept of density distinguishes how tightly integrated an actor is into his/her social network. It is measured by the number of observed ties an actor has to other network members divided by the total number of possible ties the actor potentially could have in the network (see Haynie, 2001). Networks with higher density are theorized to have less deviant members because the number of ties an actor has constrains the actor's deviant behavior (Krohn, 1986).

Density is somewhat supported as being a correlate of deviance in literature. While McGloin and Shermer (2009) and Haynie (2001; 2002) find that density is directly related to crime, Haynie (2001) also finds that it conditions the effect of peer deviance on crime. Alternatively, McGloin and Piquero (2010) conclude that density only increases specialization in crime. And Krohn and Thornberry (1993) find that density does not significantly relate to deviant involvement.

The final network element that is often investigated in research – multiplexity – is a concept that refers to role overlap in a social network (Fischer et al., 1977). If an actor shares many different roles (e.g., teammate, student, coworker) in a network, his/her role in the network is said to be multiplex.

Actors frequently take on a wide variety of roles in the networks in which they are active. Taking on more than one role generally means the actor will take on many different roles, thereby making his or her network quite multiplex (Verbrugge, 1979). Further, networks can contain friends and family members alike (Verbrugge, 1979).

Drawing on the social psychological research of Claude Fischer (e.g., 1982; Fischer et al., 1977) and the demographic work of Lois Verbrugge (1979), Krohn adapted the construct of multiplexity for use in criminological applications. Higher multiplexity is used as a theorized constraint on an actor's deviance (Krohn, 1986). Actors with many different roles have much to lose by committing crime because offending in one role can jeopardize the actor's participation in the other role(s) which he/she holds in a network (Krohn, 1986).

To provide an example of how multiplexity could constrain a behavior, an actor might potentially serve as an uncle, a mentor, a coworker, and a friend in a network. By offending in the 'friend' context, the actor would be jeopardizing established social roles as an uncle, a mentor, and a coworker. The actor would understand this when deciding whether to commit the crime and would ultimately consider the risks to be too high. Thus, the offense would be restrained because of the actor's overlapping roles in the network.

In addition to multiple roles, multiplexity can also refer to the number of arenas (school, neighborhood, etc.) that an actor shares with a friend (Krohn, 1986). An actor can have multiplex friendships if he/she plays only one role in a network, but plays that role in multiple physical locations. For example, if an actor only plays the role of a 'friend' in a network, he can be said to have multiplex friendships if he is a friend to others in many different physical settings.

Empirical research on the concept of multiplexity generally shows that it is related to crime. Using a wide array of items tapping the concept of multiplexity, Krohn and colleagues (1988) explored if tobacco use was restrained by high multiplexity. Using

data from personal networks, they created a count measure of the number of contexts an actor shared with his/her three best friends. Krohn et al. found that higher multiplexity was significantly related to less smoking among adolescents after several control variables, including attachment to friends (analogous to Sutherland's modality of intensity). Krohn and colleagues' conclusions were consistent with the findings of Hawkins and Fraser (1985; also Fraser and Hawkins, 1984a; 1984b), who found that multiplexity restrained repeated heroin use in a sample of heroin users.

Once again using personal network data, Krohn and Thornberry (1993) explored whether multiplexity was related to drug use among adolescents. They argued that there were two forms of multiplexity that may be related to crime during adolescence – shared contexts with and without an adult presence. Shared contexts with adults present should be negatively related to drug use, and shared contexts without adults present should be positively related to drug use. The essential argument for this was based on opportunity; more crime opportunity for adolescents exists when adults are not around, and vice versa. Krohn and Thornberry concluded that having adults frequently present in an actor's contexts had no influence on the amount of drugs an actor used. However, actors whose networks frequently lacked adults used drugs more often than those in networks which only occasionally lacked adults.

If Krohn and Thornberry (1993) had combined the two measures of multiplexity into one, larger measure, they would have run the risk of suppressing the finding that adult absence (but not presence) was a cause of drug use. Their findings speak to the potential need to investigate whether certain types of multiplexity (e.g., multiplexity in formal settings versus informal settings) relate to crime in different ways.

Despite a rather small amount of multiplexity literature in criminology, it does appear that the construct is consistently, significantly related to deviant behavior. Because of the apparent empirical importance of the concept, there have been calls for more research on this network concept (McPherson et al., 2001).

Network literature's extensive focus on the nature of peer influence has yielded a number of valuable findings, several of which were just reviewed. An additional contribution from network research is that people are influenced by their friends in different ways at different ages (Hartup, 1999). That is, the amount to which peers influence deviant behavior (e.g., Warr, 2002; see needed future directions by Berndt, 2004) is not constant across the life-course. Because of this, criminologists and developmental psychologists have embraced an integrated, developmental approach to studying the influence of peers on behavior.

### **Friends and Crime: The Developmental / Life-Course Approach**

One way crime researchers have tried to better understand the influence of friends on criminal behavior is by looking at how friends may exert different influences on friends at various points in the life-course. The approach held by the modalities and the network approach is identical in the developmental paradigm; all try to explain how friends might exert different influences on an actor's criminal behavior.

When evaluating the status of developmental research on friends and crime, concepts from social psychology – a branch of developmental psychology – and criminology are equally relevant. Since the life-course approach was originally created by psychologists, empirical research from social psychology forms the foundation of the developmental work done by criminologists. As such, generalizations on the nature of

friend influence over the life-course from social psychology will first be discussed. This review will be followed by a discussion of the developmental approach as it applies to the relationship between friends and criminal behavior specifically.

### **The Variant Influence of Friends**

The developmental approach in the psychological sciences emerged from the work of Harry Stack Sullivan in the 1940s (see Sullivan, 1953), a psychiatrist who attempted to explain personality outcomes using experiences with friends. Sullivan's emphasis on friendships formed a precedent in psychological research, as many psychological theories (e.g., Bronfenbrenner, 1979; Bowlby, 1982) make hypotheses regarding how friendships change over time and how this influences malleable personality traits.

Because of the theoretical importance of friends across development, a tremendous amount of research in psychology has examined the influence of friends across the life-course (e.g., see the review of Lipsey, 2006; Sijtsema et al., 2009). Consistently, this research finds that friends do not exert the same influence on actors at all developmental periods (e.g., Bronfenbrenner, 1979; Dishion and Tipsord, 2011).

During the first stages of the life-course, from birth to early childhood, the primary influence for the actor's personal characteristics (Bowlby, 1982) and behavior (Tremblay, 2003; Tremblay et al., 2004) is the child's primary caregiver(s), which is usually his/her mother (or parents). During these developmental stages, friends exert small, but increasingly important, influences on actors.

As actors transition from early childhood into middle and late childhood, the primary source of influence shifts from parents to friends (see Hartup, 1996, p. 8). The

key change that is taking place during this developmental transition is voluntary relationships are becoming more important to the actor than involuntary, or imposed, relationships. By the time an actor reaches early adolescence, friends are the most important interpersonal influences on an actor's behavior and characteristics (Warr, 1993, p. 25). Friendships will remain the most influential interpersonal ties until actors reach middle adulthood, when family relationships begin to slowly reappear as being more influential (see Farrington and West, 1995).

The age-graded influence that friends exert on actors is "widely accepted" (Steinberg and Monahan, 2007, p. 1532) and can be described as an "inverted U-shaped curve, increasing during early adolescence, peaking around age 14, and declining thereafter" (p. 1531; see also Brown, 2004). The apex of the curve at age 14 is an indication that friends exert the strongest influence on individuals in middle adolescence (at least at the aggregate level). This observation is of immediate importance when considering the general shape of the age/crime curve.

### **The Life-Course Perspective in Criminology: Development, Friends, and Crime**

A major reason why Cullen (2011) believes that criminologists must move towards a more complete understanding of how crime works over development is because crime is not stable at all points in the life-course. The age/crime curve describes the pattern of how crime generally increases until middle adolescence, peaks at about the age of 16, and then decreases throughout the remainder of the life-course (see Figure 2-2). Interestingly, like the peer influence curve, the age/crime curve is also an inverted U-shaped curve, and it too peaks in middle adolescence. An explanatory

mechanism for the similarity between the two aggregate curves is the focus of the current section. In order to fully appreciate the similarities between the curves, however, it will first be useful to review the general historical context of the life-course perspective in criminology.

The underpinnings of the developmental perspective in criminology can be traced as far back as the Chicago School of criminology, and particularly Clifford Shaw and Howard Becker's groundbreaking work called *The Jack Roller* (1930 [1966]; see Snodgrass, 1982). Shaw and Becker followed the life-course and developmental changes of 'Stanley,' a young man who grew up and became involved in crime and deviance. Shaw and Becker's work was well received by their contemporaries and posterity (see Burgess's discussion [1930]; also Gelsthorpe, 2007; Maruna and Matravers, 2007).

Several years later, in the mid 1930s, Sheldon and Eleanor Glueck began their efforts to gather data in order to trace the life histories of 500 offenders. Their goal was to develop an instrument for the prediction of who would become criminals and who would not. Though such an instrument has never been validated, the work of the Gluecks was a groundbreaking step for developmental criminology because it alerted scholars to the possibility that a longitudinal, life-course oriented approach to criminology was indeed obtainable.<sup>5</sup>

In 1975, the sociologist Glen Elder moved beyond the work of the Gluecks and provided four suggestions he thought would be useful for the creation of a specific life-course research orientation in the social sciences. The first principle stressed the

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<sup>5</sup> This is especially true considering the follow up research of Sampson and Laub (e.g., 2005) using the Gluecks' data.

importance of considering criminal behavior in context of the historical time period; contexts change over time, and our view of crime should change with it. Research looking into crime trajectories – or latent behavioral pathways hidden underneath the aggregate age/crime curve – has revealed that crime fluctuates across person and time (e.g., see Nagin and Tremblay, 2005a; 2005b; 2005c). Although the methods vary, this knowledge has allowed researchers to explore how crime changes based on contemporary and historical contexts (e.g., Steffensmeier and Harer, 1991). Second, he emphasized how important life transitions were. Transitions can be normative (e.g., pregnancy after settling into marriage) or off-time (e.g., pregnancy in early adolescence; see Krohn et al., 2009). The third of Elder’s main points was human agency. Humans make choices, and these choices can strongly impact instantaneous and future outcomes. Elder’s fourth tenet was what he called the principle of “interdependent life paths” (p. 173). This referred to the fact that humans are social creatures and are constantly influencing decision-making processes of others. Thus, actors mutually influence their contemporaries, and vice versa.

Elder’s (1975) work served as the foundation for a rapid increase in the emphasis placed on the explanation of crime over the life-course. In the mid 1980s, the Panel of Research on Criminal Careers, chaired by Alfred Blumstein (Blumstein et al., 1986), was established in an attempt to better understand how criminal behavior begins, continues, and terminates. Adopting Elder’s (1975) approach, they called for researchers to create long-term, panel datasets that put emphasis on variations in crime over the life-course. Shortly thereafter, several large-scale panel data collections (e.g.,

the Rochester Youth Development Study, the Pittsburgh Youth Study) began collecting data.

Not all researchers thought that Blumstein and colleagues' recommendation for an expansion of panel data in criminology was warranted. In 1987, Michael Gottfredson and Travis Hirschi, who had previously discussed how there was no way that the age/crime curve could be explained (Hirschi and Gottfredson, 1983; also Gottfredson and Hirschi, 1990) dismissed the need for longitudinal data. They felt that expensive, complex, multi-wave data collections were unnecessary because no contemporary longitudinal research had answered seemingly basic questions about criminal behavior. Their main critique was that researchers had not been able to resolve how or why individuals first begin engaging in criminal behavior.

Gottfredson and Hirschi seemingly felt that factors causing crime initiation should be obvious to researchers who had longitudinal data. This opinion was quite unreasonable, as criminologists have since demonstrated the complexity of crime initiation; in short, people may begin committing crime for a diverse number of reasons (see, for instance, Krohn et al., 2009). There is no 'catch-all' cause of crime initiation as Gottfredson and Hirschi believed there would be (also see Gottfredson and Hirschi, 1990). Research has since demonstrated serious errors in most of their statements from the 1980s (see Akers, 1991; 1996; 1998 [2009]; Warr, 1998).

While Hirschi and Gottfredson's thoughts on the need for longitudinal data and the influence of friends on crime were clearly incorrect, their controversial tone was at least partially responsible for spawning what would become a fairly large body of research on the developmental influence of friends and crime. The first response came

in 1993, when Mark Warr wrote a strong, empirically driven reply to Gottfredson and Hirschi. Drawing on the perspective of social learning theory, Warr concluded that the influence which friends exert on crime is not constant over the life-course. Instead, the influence is age-graded, and friends are most influential for crime “in the middle-to-late teens” (1993, p. 25).

This finding, which has been consistently replicated since Warr’s study (Dishion and Tipsord, 2011; Lipsey, 2006; Sijtsema et al., 2009; Warr, 2002; see LaGrange and White, 1985), suggests a reason for why there are such similarities between the age/crime curve and the peer influence curve. The reason why crime spikes so much in adolescence is directly attributable to the fact that actors are most strongly influenced by their friends in adolescence. That is, as peer influence increases, crime increases. The opposite also holds true; as peer influence decreases, crime decreases. This suggests that friends are an instrumental cause of deviant behavior – a finding that is strongly supported in research (e.g., Agnew, 1991; Akers, 1998 [2009]; Pratt et al., 2010; Warr, 1993; 2002).

Though this discussion is the first to explicitly compare the general shape of the peer influence and age/crime curves, for decades have crime researchers demonstrated an understanding that there is a direct relationship between the two curves. Some of the most influential studies in the developmental crime literature emphasize the age-graded nature of the influence of friends on crime. For instance, Moffitt’s (1993) dual taxonomy model – which proposes that there are two types of offenders, those who offend only in adolescence and those who offend throughout the life-course – acknowledges that one reason for the existence of adolescent-limited

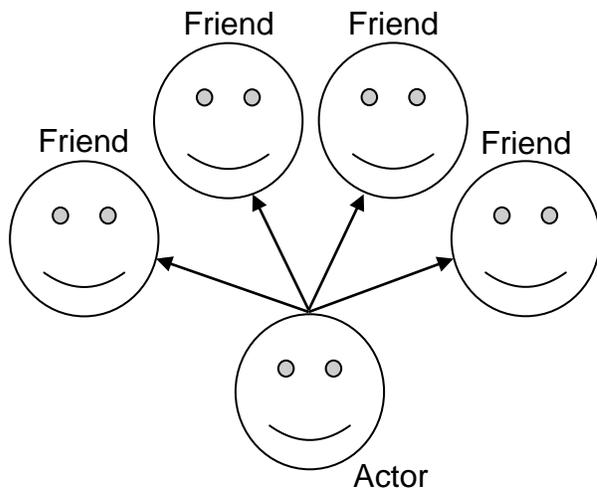
offenders is the influence of friends (p. 686-687). Additionally, Anderson's (1999) study of gangs in Philadelphia showed that friends were instrumental in teens' decisions to join a gang and gang-related activity. And Reiss and Farrington (1991) find that co-offending between friends was less frequent as actors aged out of adolescence and into early adulthood (also see McGloin et al. [2008]; and Warr's concept of 'peer careers' [1998]). As such, it is well understood that friends do influence crime, but this influence is strongest in mid-adolescence.

### **Conclusions**

A theme throughout this dialogue has been the similarity of the general perspectives held by the reviewed research. Sutherland's modalities of association, the incorporation of the modalities into Akers's social learning theory, the network method, and the developmental paradigm all seek to explain why some friends may be more influential for crime than others.

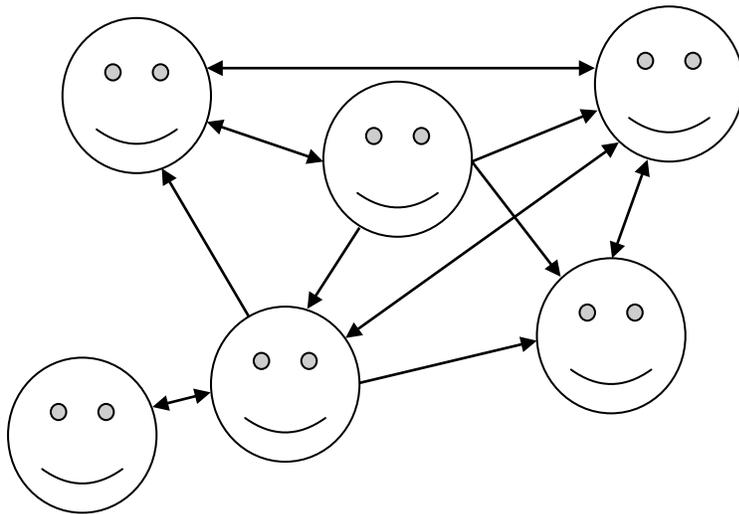
The approaches to answering this question differ. Sutherland and Akers try to answer this question by focusing on the time spent with friends (frequency), the length of the friendships (duration), which friendships were formed the earliest (priority), and the closeness of the friendships (intensity). The network approach focuses on the nature of the actor's relationships with his/her friends within his/her network. And the developmental approach emphasizes how friends may differentially influence the actor's behavior based on the developmental stage of the actor.

Because the same perspective is held by the Sutherland and Akers theoretical perspectives and the network and developmental approaches, there is considerable potential for the integration of them into one cohesive, theoretically derived test. Such is the purpose of Chapter 3.



*A Personal Network Design*

Arrows represent an actor's friendship nomination and the actor's perception of the friend's characteristics, opinions, or attitudes (the number of friends may vary from actor to actor).



*A Social Network Design*

Unidirectional arrows represent unreciprocated friendship ties and bidirectional arrows represent reciprocated friendship ties (the number of individuals may vary from network to network).

Figure 2-1. Conceptual diagram of personal network and social network designs.



Figure 2-2. The age/crime curve. (Adapted from Moffitt, 1993, p. 675).

## CHAPTER 3 THEORETICAL DEVELOPMENT AND HYPOTHESES

### **The Identity of Differential Associates**

Differential association theory (Sutherland, 1947) and social learning theory (Akers, 1998 [2009]) stress that the identity of differential associates can vary widely. Essentially, anyone can be a differential associate – family members, teachers, pastors, friends, and mentors, to name a few. However, in empirical research, the most common differential associates are ‘peers,’ a term that has traditionally been loosely interchangeable with ‘friends’ (Kreager, 2004). This project follows in the footsteps of prior research by focusing specifically on the differential association of friends.

A distinction must be drawn between ‘peers’ and ‘friends,’ however. The word ‘peer’ is predominantly a legal term that describes those with whom an actor is similarly situated (e.g., a jury of one’s peers). Being similarly situated is a legal concept that describes a person being like another person or group of persons in terms of age, abilities, demographic background, or socioeconomic status. Thus, a *peer* is defined as an individual with whom an actor shares the same legal status; they can be colleagues, coworkers, schoolmates, or the like. On the other hand, the term *friend* is defined as an individual with whom an actor shares affectionate interpersonal ties. While friends are usually peers, peers are rarely friends (Kreager, 2004). In United States culture, for instance, all native or naturalized citizens share in common the same legal status. Of course, an actor will not consider all citizens friends; the term friend is reserved for those to whom an actor feels especially close.

Actors and their friends are nested within ‘friendships.’ A *friendship* is defined as a relationship shared between two people who share reciprocal affectionate ties with

one another (Ainsworth, 1989; Hartup, 1993). That is, Person A perceives he/she is friends with Person B, and B perceives he/she is friends with A. It is operationalized with a dyadic-level variable that denotes whether reciprocal ties exist between the two friends.

While the friendship is a dyadic-level (level-two) entity, it exists because of lower-order (level-one) 'friendship ties.' *Friendship ties* are defined as perceived bonds of affection held by an actor that describe the situation where the actor believes he/she is in a friendship with an individual peer (see Ainsworth, 1989). They are individual-level friendship markers. If an actor characterizes a peer as a friend, the friendship is real to the actor regardless of whether the peer reciprocates the friendship; friendship ties are the information that the actor relies upon when judging whether or not he/she is in a friendship. As a result, friendship ties are friendships in the mind of any particular individual because they represent one's belief of the existence of a relationship, though they are not actually a level-two measure of that relationship (see Ainsworth, 1989). The preceding definitions are summarized in Table 3-1.

Friendship ties are the focus of the current project and will henceforth be referred to as 'friendships' for semantic simplicity. When higher-level friendships are discussed from time to time, they will be referred to as 'higher-level friendships.'

### **Differential Association and the Modalities: Definitions and Hypotheses**

#### **Differential Association**

The heart of Sutherland's theory – the construct of differential association with deviant and non-deviant friends – is central to the current project. As defined by Sutherland, differential association describes the situation where an actor has "both criminal and anti-criminal associations" (1947, p. 6). Translated to the current project,

differential association is defined as the actor's exposure to conforming and deviant patterns provided by friends. This meaning follows prior research testing the construct of differential association (see Pratt et al., 2010).

In research to date, differential association is most frequently operationalized through an actor's perceptions of the amount of deviant behavior committed by his/her friends or the proportion of his/her friends who are deviant. Because of this operationalization, differential association is colloquially referred to as 'peer delinquency' or 'peer deviance.' Because the focus of the current project is specifically on the deviance of 'friends' rather than the larger group of 'peers,' this construct will be referred to as friend deviance instead of its more well known 'peer deviance' label. The conceptual and operational definitions are summarized in Table 3-2.

Sutherland (1947) and Akers (e.g., Akers et al., 1979) both hypothesize that the deviance of friends will positively impact an actor's deviant behavior. Well over 100 studies have supported this hypothesis (Pratt et al., 2010). This hypothesis is described in visual format in a path diagram provided in Figure 3-1. Drawing on Sutherland and Akers's statements and past research, the following hypothesis is offered:

- H1: The friend deviance construct will positively relate to the actor's criminal involvement.

## **Frequency**

The previously discussed definitional problems of Sutherland's modalities necessitate that the current project provide conceptual and operational definitions of the modalities of association. In discussing the overlap between social learning and differential association theories, Akers (1998 [2009, p. 62]) defines the modality of frequency as "how often one interacts with a group or individual". Note that Akers's

definition is analogous with Short's (1957; 1958). Further, it only encapsulates contact between friends; implicitly, this contact can take any form (e.g., face-to-face interaction, social media, texting, etc.).

The current project progresses by defining frequency as the incidence or amount of time an actor spends with a friend over any particular period of time. In concept, this length of time could be anything from minutes to many years.<sup>1</sup> This measure does not capture the full range of potential forms of contact to which Akers implies, but rather the specific form of face-to-face contact with a friend. Operationally, frequency should be measured through a self-reported frequency or amount of time which an actor has spent with a friend over any particular period of time.

To provide a more comprehensive viewpoint of the nature of time that actors spend with friends, the basic definition of frequency is conceptually extended using a developmental take on the network concept of multiplexity. Following the work of Fischer and colleagues (1977), Verbrugge (1979), Krohn (1986), and McPherson and colleagues (2001), multiplexity is defined here as the frequency with which an actor shares contexts or roles with a friend over any particular time period. Two things are explicitly captured in the multiplexity construct. First, Sutherland's modality of frequency, per Short's (1957; 1958) and Akers's (1998 [2009]) definitions, is contained in the definition of multiplexity since both Short and Akers define frequency as how often an actor interacts with a friend. Thus, in accordance with Akers's and Short's work, the term 'frequency' in the definition of multiplexity is designed to reflect the amount of time

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<sup>1</sup> Since the phrase "any particular period of time" can carry a wide array of meanings, it may benefit the reader to know that this project operationalizes time periods across the past six months or one year (see the next chapter).

an actor has spent with a friend. Second, the nature of the environment in which that time is spent is also contained in the multiplexity concept. It is treated as an individual-level construct operationalized with a count measure of the frequency to which an actor shares contexts with a friend over any particular time period (see Krohn, 1986; Krohn et al., 1988).

The context or situation in which individual friends are encountered changes across the various developmental stages of the life-course (Ainsworth, 1989; Reiss and Farrington, 1991; Simons et al., 1994; compare the developmental research of Grosbras et al. [2007] and Tremblay et al. [2004]). As Osgood and colleagues (Osgood et al., 1996; Osgood and Anderson, 2004; also Warr, 2002) discuss, some contexts are conducive to criminal activities and some are not. One of the simplest and most effective ways to determine the crime potential of a context is to distinguish between formal and informal contexts (Krohn and Thornberry, 1993; Osgood and Anderson, 2004; Warr, 2002). Formal contexts are any activities or locations that are supervised by an authority figure; they carry low situational opportunity for crime (see Krohn et al., 1988). The type of supervision and the identity of the authority figure will differ across the life-course (Sampson and Laub, 1994; Simons et al., 1994; Warr, 1998) and across historical context (Elder, 1998). Various examples of formal contexts include classes, sports practice, time spent with one's family and/or parents, religious services, and work. Informal contexts are defined as unstructured and unsupervised activities in which an actor is not directly accountable to an authority figure (see Krohn et al., 1988; Osgood et al., 1996; Osgood and Anderson, 2004). They carry a high situational crime opportunity. Examples of informal activities are free periods in school, an adolescent

hanging out with friends without parental supervision, an adult spending time with friends without a spouse, and drinking in a bar. Contexts within which an actor is nested should be captured by self-reported measures.

Once contextual crime opportunity is accounted for, there are actually two multiplexity mechanisms at work at any one time; formal multiplexity and informal multiplexity. Formal multiplexity is the frequency with which an actor shares formal, supervised contexts or roles with a friend over any particular time period. Informal multiplexity is the frequency with which an actor shares informal, unsupervised contexts or roles with a friend over any particular time period. Both types of multiplexity are operationalized through a self-reported frequency of the amount of time spent with any particular friend in formal or informal contexts over any particular time period, respectively. Table 3-3 summarizes the definitions of frequency, multiplexity, formal and informal contexts, and formal and informal multiplexity.

Because there are multiple mechanisms at work in the time spent with friends construct, the modality of frequency will be empirically represented by measures of formal and informal multiplexity. This operationalization measures time spent with friends (the frequency modality) within certain environments. Since both multiplexity constructs inherently entail actors and friends spending time together, the time-environment measures should exert an influence on both friend deviance and actor deviance. Formal multiplexity should share a negative relationship with both friend and actor deviance since there is direct supervision over the context, meaning there is little to no crime opportunity. Informal multiplexity should share a positive relationship with

friend and actor deviance since there is a lack of supervision and, thus, plenty of crime opportunity. As such, the following hypotheses can be proposed:

- H2: Formal multiplexity (an element of frequency) will negatively relate to friend deviance.
- H3: Formal multiplexity (an element of frequency) will negatively relate to the actor's criminal involvement.
- H4: Informal multiplexity (an element of frequency) will positively relate to friend deviance.
- H5: Informal multiplexity (an element of frequency) will positively relate to the actor's criminal involvement.

Since formal and informal multiplexity directly impact friend deviance and crime, the two multiplexity measures should be influential for criminal behavior because they operate indirectly through the construct of friend deviance. Accordingly, a portion of the total effect of formal and informal multiplexity on crime should be transmitted through the friend deviance construct. The following two hypotheses can additionally be provided (hypotheses are summarized in Figure 3-2):

- H6: A portion of the total effect of formal multiplexity (an element of frequency) on crime will be indirect through the friend deviance construct.
- H7: A portion of the total effect of informal multiplexity (an element of frequency) on crime will be indirect through the friend deviance construct.

This discussion of the conceptual overlap between the frequency modality and the network concept of multiplexity advances the friendship and crime literature in three ways. First, this is the most comprehensive (and arguably the only) reconceptualization of the frequency modality since Short's work in the 1950s (compare the similarity between Short, 1957 and Hunt, 2010). Second, despite the overlap in the approaches to the modalities and social networks (see Haynie, 2001), this is the first marriage of a network concept with one of Sutherland's modalities of association. Third, although the preceding discussion demonstrates how research (particularly Krohn et al., 1988; Krohn

and Thornberry, 1993; also Osgood et al., 1996) points to the conclusion that two multiplexity mechanisms exist, this is the first work other than Krohn and Thornberry's (1993) that attempts to distinguish between the constructs of formal and informal multiplexity and empirically capture them.

Similar to the modality of frequency, Akers (1998 [2009]) has contributed to the development of the meaning of duration. Akers (p. 62) argues that there are “two dimensions” of duration. The first refers to “the sense of length of time – the more long standing the relationship, the more it will influence the person’s behavior.” This is identical to Short’s (1957; 1958) definition and is synonymous with friendship stability. The second “involves absolute and relative amounts of time spent in differential associations.” This is a measure of the amount of time spent with friends over any particular time period. As such, per the specifications of social learning theory, the lower-order factors of friendship stability and time spent with one’s friend should load onto a unidimensional, higher-order factor of duration.

As Akers (1998 [2009]) defines the modalities of frequency and duration, one of the elements of duration – time spent with friends – is in fact encapsulated in the modality of frequency. This is true because time spent with friends is itself a form of contact between friends, regardless of however short (seconds) or long (hours or days) the period of contact is.

This leaves one remaining dimension of duration; the amount of time an actor has perceived he/she has maintained a friendship, or friendship stability. *Duration* is defined as friendship stability. *Friendship stability* is the length of time an actor

perceives a peer is a friend (see Ladd et al., 1996). This definition follows the essence of Short's (1957) definition of duration.

To operationalize duration, Short asked about friends who an actor had known "for the longest time" (Short, 1957, p. 234). This is a very subjective operationalization since the 'longest time' can vary substantially from actor to actor – for some, their longest friendship will be a few months; for others, it will be many years. While this project's conceptual definition generally follows Short's work, the operational definition is expanded to provide a more objective measure of duration. Duration (friendship stability) should be operationalized with a self-reported, observed variable that measures the length of time an actor perceives that a peer has been a friend. It is best measured with relatively specific time units because there is a considerable amount of friendship turnover (instability) in childhood and adolescence (e.g., Kandel, 1978b; although see McGloin, 2009). Accordingly, friendship stability is best measured in weeks or months rather than years. The conceptual and operational definitions of duration and friendship quality are summarized in Table 3-4.

Unfortunately, the measures of friendship stability used in this project do not closely tap the conceptual definition of stability. Though stability can be measured in months, two of three measures of the construct cannot capture the potential for long-term stability of a friendship. Instead, they capture short-term stability over the past six months only. The measures are essentially binary – they can capture whether a friendship has been stable for six months or whether it has not been stable for six months (that is, it was recently formed).

Sutherland made no mention specifically of how the short-term stability of friendships should influence behavior. However, drawing on the general orientation of his work, I have argued that duration should positively affect the amount to which differential association impacts an actor's behavior through a statistical moderation. Specifically, the longer an actor has considered a peer a friend, the more the friend's behavior should influence the actor's behavior. As the duration of a friendship increases, the more the friend's behavior will influence the actor's behavior. Inversely, as the duration of a friendship decreases, the less the friend's behavior will influence the actor's behavior. Even though this project can only measure short-term duration, the same general perspective applies to the current measurement strategy. The behavior of a friend should matter more for an actor's behavior when he/she has been a friend for six months compared to not having been a friend for six months. That is, the behavior of a friend who has been at least somewhat stable should exert more influence on an actor than a friend who was recently acquired as a friend.

This can be written as a hypothesis that expects a moderation effect between friendship stability and criminal behavior:

H8: Longer duration will amplify the relationship between friend deviance and the actor's criminal involvement through a statistical interaction between duration and friend deviance.

Since two of the three measures of duration only tap short-term stability, a portion of the forthcoming empirical examination is a partial and interpretative test of Sutherland's statements on how duration should affect behavior. However, the partial test that will be provided is valuable because it will allow criminologists to gain an alternative understanding of 1) how to potentially test Sutherland's duration modality and 2) the empirical support that the duration modality may receive. As

previously discussed, I am unaware of any research which has explored the possibility that duration moderates the friend deviance-actor deviance relationship. Drawing on my reasoning, this suggests that no research has tested differential association theory's duration modality in one way that is consistent with Sutherland's statements.

### **Priority**

Switching focus to the modality of priority, Short (1957; 1958) and Akers (1998 [2009, p. 62-63]) argue that Sutherland was referring to the formation of associations. That is, friendships formed earlier than others will be more important for the behavior of actors than those formed more recently.

In his response article to Gottfredson and Hirschi's (1983) controversial manuscript on the age/crime curve, Warr (1993, p. 34) argues that the priority modality is "logically distinct" from the duration modality. However, once operationalized, he finds that duration and priority are not "empirically distinct." The reason for Warr's discovery of a high empirical similarity between duration and priority is because the two modalities are *not* "logically distinct" as Warr states. Because it is tapping the formative stages of a friendship, I argue that there is no conceptual difference between the concept of priority and duration (with an important qualification discussed in a moment). By examining the length of time an actor has been friends with another, one necessarily knows the approximate date of the formation of the friendship. Priority is a cross-sectional property of the longitudinal modality of duration.

In concept, priority is defined as the rank order of the formation date of friendships. It is operationalized through the starting point of a stable friendship, which is captured in the duration (friendship stability) modality. If priority provides no new

information in addition to duration, it does not need to be separately measured in multivariate models that contain duration measures (see a conceptually similar argument made by Krohn and Massey [1980] involving Hirschi's [1969] commitment and involvement elements of the social bond). The conceptual and operational definitions of priority are provided in Table 3-5.

The preceding discussion is based solely on concept and must be qualified. If an actor's friendship stability cannot be validly operationalized in a way that allows for the researcher to assuredly know the point of friendship formation, then priority and duration will hold different meanings. Such is the case here. The current project's friendship stability measures do not allow for priority to be operationalized (this will be further discussed in Chapter 4). This means that by examining the short-term stability of a friendship, the formation date of the friendship cannot be determined. Additionally, there are no independent priority measures in the data used for this project. As such, the present research progresses by not measuring the modality of priority. This indicates that all four of Sutherland's modalities of association cannot be tapped, which is a limitation of the current project.

### **Intensity**

The final modality – intensity – was the most difficult for Sutherland to define (Akers, 1998 [2009, p. 64]). For this reason, it holds “many” potential meanings (Short, 1960, p. 18). First, intensity could refer to the salience, or importance, of the friendship tie held by an actor (Akers, 1998 [2009, p. 64-65]). If intensity refers to salience, then the behavior of friends who are more important to the actor would be more important for the actor's behavior.

Although not discussed extensively in literature, a second argument that could be made is drawn from Sutherland's (1947, p. 7) use of the word "prestige." This word may be an indication that he was referring to the actor's desire for an association with a prestigious – or popular – friend. If this is the case, differential association theory would postulate that the conforming or deviant behavior of friends who are more popular will be of more importance to the conforming or deviant behavior of the actor, respectively. Although they do not mention popularity specifically, a similar argument to this made by Dick and colleagues (2004, p. 1453), who define intensity as "the prestige and emotional power of the association."

A third possibility is that intensity is synonymous with friendship closeness. Short (1957; 1958) makes a similar argument, as does Akers (1998 [2009], p. 64), who refers to closeness as "attachment." Drawing on the prior two potential meanings of intensity, actors will presumably perceive closer friends to be more important to them (salience). It is also possible that actors may perceive higher friendship closeness with popular friends than less popular friends. As such, defining intensity as friendship closeness may be beneficial since the concept may then capture elements of both the salience and popularity interpretations.

Given the range of potential meanings of the intensity modality, it makes the most sense to use the most versatile definition possible. The current project defines the modality of intensity as the extent to which an actor feels close to a friend. It is conceptually similar to Hirschi's (1969) element of attachment in the social bond. Intensity should be operationalized with a scale of items that inquire how close the actor

feels to the friend. The possible meanings of the intensity modality are provided in Table 3-6.

While each of these interpretations of intensity is feasible, my discussion of only three potential definitions is not meant to be the final word on what the modality represents. Other definitions of intensity may exist, although I, like Short (1960), cannot speculate as to what they may be outside of what I have reviewed.

Drawing on Sutherland's general approach, I argue that intensity should affect the amount to which differential association influences an actor's behavior through a statistical moderation. Close friendships with deviant friends should cause crime, and, inversely, close friendships with non-deviant friends should inhibit crime. As the actor's perception of closeness towards a friend increases, the more that friend's conforming or deviant behavior will impact the actor's conforming or deviant behavior, respectively.

This moderation effect can be stated in the following hypothesis:

- H9: Higher intensity will amplify the relationship between friend deviance and the actor's criminal involvement through a statistical interaction between intensity and friend deviance.

The pragmatic value of using friendship closeness as a measure of intensity is further demonstrated by research in social psychology. Social psychologists frequently propose that the hypothesized relationships between a friend's characteristics (independent variables) and an actor's characteristics (dependent variables) are "magnified" when the actor is very closely tied to the friend (see Berndt, 2004). Since Sutherland makes the same argument (the ninth hypothesis), results regarding the intensity modality may serve to inform research and theory within both the criminological and social psychological context.

A summary of the names, conceptual definitions, and operational definitions of the modalities and differential association measures captured in the current project is provided in Table 3-7.

### **Incorporating Social Learning Theory: Moderation and Mediation Hypotheses**

#### **Social Learning and Social Structure**

The current project explores both the potential for moderation and mediation effects of differential association measures. This portion of the dissertation formulates hypotheses consistent with Akers's social learning theory that are drawn from his "social learning-social structure" model (1998 [2009]).

Social learning-social structure is an extension of social learning theory which hypothesizes that macro-level social structure variables (e.g., population density, social disorganization) should cause crime indirectly through social learning principles. Though a major focus of the model is on level-two variables, Akers also places considerable emphasis on the level-one variables of age, SES, race, and gender. His statements, which are elaborated on in this section, form the basis of several final hypotheses.

#### **The Age-Grading of Social Learning Theory**

Overall, crime increases until it peaks in middle adolescence, decreases strongly in late adolescence and emerging adulthood, and continues to steadily decrease throughout the remainder of the life-course (e.g., Moffitt, 1993). Given this observation, Cullen (2011) has called for theories to be revised so that age-graded hypotheses can be proposed.

To this end, Akers has recognized the importance of the developmental paradigm in criminology and has proposed a series of testable hypotheses that draw on

the life-course perspective and, implicitly, Cullen's suggestions. Akers (1998 [2009]; Akers and Jensen, 2006; Akers and Lee, 1999) suggests that the four modalities and friend deviance measures should predict crime equally well across the life-course despite the varying crime rates at different developmental periods. Akers makes the argument that age is only "one indicator of location in the social structure that exerts an influence on conforming and deviant behavior through its effects on the social learning variables" (Akers and Lee, 1999, p. 2). Drawing upon the joint standpoint of social learning theory and social learning-social structure, Akers and Lee (1999, p. 3) elaborate:

The differences in the social learning variables at each age, supposedly reflecting age-related changes in social, economic, and other life circumstances, are hypothesized to account for variations in criminal and deviant behavior at each age. The theory would predict that persistence or desistance or increase or decrease in deviant behavior as persons grow older accompanies persistence or change in the social learning variables, operating in the sequential and reciprocal manner proposed by social learning theorists.

Akers stresses that social learning is a general theory and can explain crime equally well at all points of the life-course. Social learning theory's position on the age-crime relationship is that meaningful differential associations transform over time as an actor ages, and these changes will result in conforming or deviant behavior at all ages. Actors who offend past adolescence should have meaningful differential associations with deviant friends that cause such behavior despite the fact that crime rates are decreasing as actors age. Thus, the effects of the modalities and differential association on crime should exist regardless of the age of an actor. Ultimately, social learning theory would lead us to believe that age will not moderate the relationship

between the modalities of association and friend deviance. This is stated in the following hypotheses:

- H10: The magnitude of the effect strength of the modalities of association on crime will not vary across age.
- H11: The magnitude of the effect strength of friend deviance on crime will not vary across age.

A summary of the age-grading hypotheses is provided in Table 3-8.

Despite the theoretical backing of Akers's propositions, they could be viewed as null hypotheses since they propose no variation in coefficient size for the modalities or differential association variables across age. A (surprisingly) small amount of literature that has tested for potential age-grading effects in differential association theory suggests that other hypotheses may also be appropriate. Using data from the National Youth Survey, Warr (1993) concluded that time spent with peers dramatically increased between the developmental periods of early and middle adolescence. This indicates that the frequency of interactions with friends – one of Sutherland's modalities – may not be stable over the life-course. Similarly, Simons and colleagues' results (1994) suggest that the deviance of friends is much more strongly related to offending in middle and late adolescence than early adolescence. Collectively, these observations reinforce the observation that the "zenith" of friend influence is middle adolescence (Warr, 1993, p. 25).

As discussed in the concluding remarks of Chapter 3, it may be no coincidence that the aggregate peaks of both crime and peer influence are in middle adolescence. Drawing on the approach in Elder's (1975; also 1998) writings, these changes may suggest that different variables predict crime across various periods of the life-course. Alternatively, the same variables could predict crime at different magnitudes over

development. Building on the developmental paradigm generally and the empirical findings of Warr (1993) and Simons and colleagues (1994) specifically, I propose hypotheses that can be viewed as alternative hypotheses to the prior two hypotheses derived from Akers's research:

H12: The magnitude of the effect strength of the modalities of association on crime will vary across age.

H13: The magnitude of the effect strength of friend deviance on crime will vary across age.

More specific hypotheses consistent with the approaches of the life-course paradigm and Warr's (1993) and Simons and colleagues' (1994) research can be offered given the current state of the research on age-graded friend influence. Since friends are less influential in late adolescence and emerging adulthood than middle adolescence (e.g., Steinberg and Monahan, 2007), one may hypothesize that the modalities and friend deviance should more strongly relate to criminal behavior during middle adolescence than late adolescence and emerging adulthood. And since friends are less influential in emerging adulthood than late adolescence (e.g., Steinberg and Monahan, 2007), the modalities and friend deviance might have significantly less predictive ability in emerging adulthood than late adolescence. Joining these observations along with the general approach of the developmental perspective, the following hypotheses can be proposed:

H14: The magnitude of the effect strength of the modalities of association on crime will be stronger during middle adolescence than late adolescence and emerging adulthood.

H15: The magnitude of the effect strength of friend deviance on crime will be stronger during middle adolescence than late adolescence and emerging adulthood.

H16: The magnitude of the effect strength of the modalities of association on crime will be stronger during late adolescence than emerging adulthood.

H17: The magnitude of the effect strength of friend deviance on crime will be stronger during late adolescence than emerging adulthood.

### **Statistical Control Variables and Mediation**

Control variables are frequently used in multivariate modeling to protect against spuriousness. Because of their consistent relationships with criminal behavior, age, gender, race, and socio-economic status (SES) are frequently used as controls. To protect against the potential of spurious relationships, gender, race, and SES will be used as control variables in the current project. Age is not used as a control measure because of its considerable substantive importance to the project.

Setting age aside, Cullen (2011) does not postulate or infer as to how control variables may exert age-graded influences on crime. However, Akers does. As a general theory of crime, social learning theory postulates that any effect of gender, race, and SES will be captured by the social learning variables regardless of the developmental period under investigation. That is, the modalities of association and friend deviance variables will mediate a large portion of the effect that the controls may have on crime.

Research on Akers's mediation hypotheses receives mixed support (see Lee et al., 2004; Pratt et al., 2010, p. 784-787). Differential association and other social learning variables have been somewhat successful in covering the effect of SES and race on crime (Akers and Lee, 1999; Lee et al., 2004). In these cases, the social learning variables do not entirely eliminate the control variables' significant relationships. Instead, the research supports the notion that social learning measures will substantially mediate the relationship between race and SES and crime.

Evidence routinely suggests that males commit crime at much higher rates than females (e.g., Blackwell, 2000). This relationship is one of the most, if not the most, replicated and studied empirical associations in the crime sciences (Heimer, 1996; see the discussion of Moffitt et al., 2001). Perhaps because of the strength of this relationship, criminological theories are generally unsuccessful at explaining away the effect of gender on crime. While Akers's theory is more successful in this endeavor than other theories (Akers and Jensen, 2006; Smith, 1979; although see Burton et al., 1998), learning variables are still not all that effective at eliminating the gender effect. Most of the time, the strength of the gender-crime relationship is only partially reduced by learning variables (see Akers, 1998 [2009]; although see Akers et al., 1979).

Due to the empirical successes and shortfalls of social learning theory's proposed mediation of control variables, Akers (1998 [2009, p. 340, *emphasis in original*]) specifies that there are different levels of support that can be provided for his mediation hypotheses:

The strongest expectation is that the variations and stabilities in the behavioral and cognitive variables in the social learning process account for *all* variations and stabilities in criminal behavior and thereby mediate *all* of the significant relationships between the structural variables and crime. The more realistic statement is that variations and stabilities in the behavioral and cognitive variables specified in the social learning process account for a *substantial portion* of individual variations and stabilities in crime and deviance and mediate a *substantial portion* of the relationship between *most* of the structural variables in the model and crime. A weak statement of the theory is that the social learning process accounts for *some* portion of the variation and stability in criminal behavior and mediates *some* portion of the relationship between the correlates and crime.

While Akers does acknowledge that there may be a range of support provided for his mediation hypotheses, social learning is a general theory and its variables should substantially cover the effects of controls, per Akers's 'realistic' expectation. Thus, the

effects of social learning indicators would ideally substantially reduce the relationship that control variables exert on crime and deviance (see also Akers, 1998; Akers and Lee, 1999; Lee et al., 2004). As such, the following hypotheses are proposed:

- H18: The differential association variables will substantially mediate the relationship between socioeconomic status and crime.
- H19: The differential association variables will substantially mediate the relationship between race and crime.
- H20: The differential association variables will substantially mediate the relationship between gender and crime.

If the results from the mediation hypotheses do not meet standards for “substantial” mediation, results may still yield weak support to the theory if the control variables are somewhat mediated. Alternatively, strong support for the theory would be demonstrated by significant effects between the control variables and crime that are reduced to non-significance once theoretical variables are inserted into the model. As such, a varying amount of support will be given to the theory depending on how much the social learning variables mediate the effects of the controls on crime.

A visual depiction of the control variable mediation hypotheses is presented in Figure 3-5. To evaluate these hypotheses, a two-step model building process is necessary. The first step would load the exogenous control variables onto the crime outcome (the bottom half of the model). The second model would add in the theoretical variables that were previously discussed (the top half of the model). To yield support to the 18<sup>th</sup> through 20<sup>th</sup> hypotheses, any significant effects of the control variables on crime should be substantially reduced when the theoretical variables are staged into the model (hence the “X” in the middle of the control variable pathways). A summary of all hypotheses is presented in Table 3-9.

Table 3-1. Summary of conceptual definitions for peers, friends, friendships, and friendship ties.

Concept	Definition
Peer	An individual with whom an actor shares the same legal status
Friend	An individual with whom an actor shares affectionate interpersonal ties
Friendship	A relationship shared between two people who share reciprocal affectionate ties with one another
Friendship ties	Perceived bonds of affection held by an actor that describe the situation where the actor believes he/she is in a friendship with an individual peer

Table 3-2. Summary of the conceptual and operational definitions for differential association.

Concept Name	Conceptual Definition	Operational Definition
Differential association	The actor's exposure to conforming and deviant patterns provided by friends	An actor's perception of the amount of deviant behavior committed by his/her friends or the proportion of his/her friends who are deviant

Table 3-3. Summary of the conceptual and operational definitions for frequency, multiplexity, formal and informal contexts, and formal and informal multiplexity.

Concept Name	Conceptual Definition	Operational Definition
Frequency	The incidence or amount of time an actor spends with a friend over any particular period of time	A perceptual, individual-level, self-reported amount of time which an actor has spent with a friend over any particular period of time
Multiplexity	The frequency with to an actor shares contexts or roles with a friend over any particular time period	A perceptual, individual-level, self-reported frequency of the amount of shared contexts with a friend
Formal contexts	Activities or locations which are supervised by an authority figure	--
Informal contexts	Unstructured and unsupervised activities in which an actor is not directly accountable to an authority figure	--
Formal multiplexity	The frequency with which an actor shares formal contexts or roles with a friend over any particular time period	An individual-level, self-reported frequency of the amount of time spent with a friend in formal contexts
Informal multiplexity	The frequency with which an actor shares informal contexts or roles with a friend over any particular time period	An individual-level, self-reported frequency of the amount of time spent with a friend in informal contexts

Table 3-4. Summary of the conceptual and operational definitions for duration and friendship stability.

Concept Name	Conceptual Definition	Operational Definition
Duration	Synonymous with friendship stability	<i>See below</i>
Friendship stability	The length of time an actor perceives a peer is a friend	A self-reported, individual-level, count measure of the length of time an actor perceives a peer has been a friend, measured in weeks or months

Table 3-5. Summary of the conceptual and operational definitions for priority.

Concept Name	Conceptual Definition	Operational Definition
Priority*	The rank order of the formation date of a friendship	A cross-sectional property of duration; captured through the starting point of a stable friendship

\* Not measured in the current project

Table 3-6. Summary of the conceptual and operational definitions for intensity and friendship closeness.

Concept Name	Conceptual Definition	Operational Definition
Intensity (meaning #1)	The salience, or importance, of the friendship ties held by an actor	Not operationalized
Intensity (meaning #2)	An actor's desire for an association with a prestigious, or popular, friend	Not operationalized
Intensity (meaning #3)	Synonymous with friendship closeness	<i>See below</i>
Friendship closeness	The extent to which an actor feels close to a friend	A perceptual, individual-level, self-reported scale of items that inquire how close the actor feels to the friend

Table 3-7. Summary of the names, conceptual, and operational definitions of the constructs operationalized in the current project.

Concept Name	Alternative Concept Name	Conceptual Definition	Operational Definition
Differential association	Friend deviance	The actor's exposure to conforming and deviant patterns provided by friends	An actor's perception of the amount of deviant behavior committed by his/her friends or the proportion of his/her friends who are deviant
Frequency	Formal multiplexity	The frequency to which an actor shares formal contexts with a friend over any particular time period	An individual-level, self-reported frequency of the amount of time spent with a friend in formal contexts
Frequency	Informal multiplexity	The frequency to which an actor shares informal contexts with a friend over any particular time period	An individual-level, self-reported frequency of the amount of time spent with a friend in informal contexts
Duration	Friendship stability	The length of time an actor perceives a peer is a friend	A self-reported, individual-level, count measure of the length of time an actor perceives a peer has been a friend, measured in weeks or months
Intensity	Friendship closeness	The extent to which an actor feels close to a friend	A perceptual, individual-level, self-reported scale of items that inquire how close the actor feels to the friend

Table 3-8. Summary of the age-graded hypotheses.

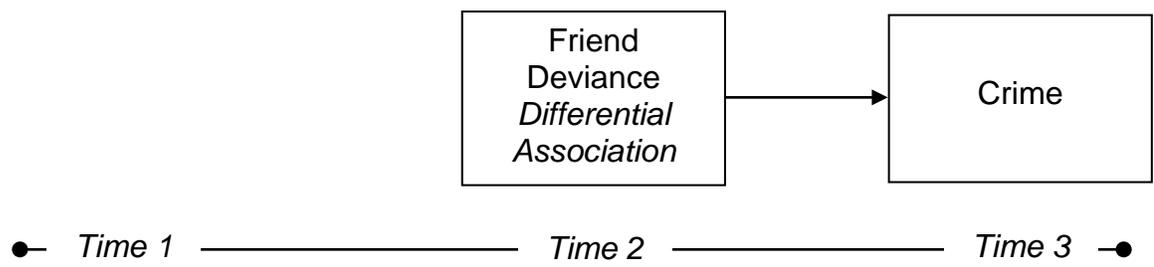
H #	Derived from:	Hypothesis
H10	Akers	The magnitude of the effect strength of the modalities of association on crime will not vary across age.
H11	Akers	The magnitude of the effect strength of friend deviance on crime will not vary across age.
H12	Life-course approach and Cullen	The magnitude of the effect strength of the modalities of association on crime will vary across age.
H13	Life-course approach & Cullen	The magnitude of the effect strength of friend deviance on crime will vary across age.
H14	Life-course approach & Cullen	The magnitude of the effect strength of the modalities of association on crime will be stronger during middle adolescence than late adolescence and emerging adulthood.
H15	Life-course approach & Cullen	The magnitude of the effect strength of friend deviance on crime will be stronger during middle adolescence than late adolescence and emerging adulthood.
H16	Life-course approach & Cullen	The magnitude of the effect strength of the modalities of association on crime will be stronger during late adolescence than emerging adulthood.
H17	Life-course approach & Cullen	The magnitude of the effect strength of friend deviance on crime will be stronger during late adolescence than emerging adulthood.

Table 3-9. Summary of hypotheses.

#	Subject Matter	Hypothesis
1	Differential association	The friend deviance construct will positively relate to the actor's criminal involvement.
2	Frequency	Formal multiplexity (an element of frequency) will negatively relate to friend deviance.
3	Frequency	Formal multiplexity (an element of frequency) will negatively relate to the actor's criminal involvement.
4	Frequency	Informal multiplexity (an element of frequency) will positively relate to friend deviance.
5	Frequency	Informal multiplexity (an element of frequency) will positively relate to the actor's criminal involvement.
6	Frequency	A portion of the total effect of formal multiplexity (an element of frequency) on crime will be indirect through the friend deviance construct.
7	Frequency	A portion of the total effect of informal multiplexity (an element of frequency) on crime will be indirect through the friend deviance construct.
8	Duration	Longer duration will amplify the relationship between friend deviance and the actor's criminal involvement through a statistical interaction between intensity and friend deviance.
9	Intensity	Higher intensity will amplify the relationship between friend deviance and the actor's criminal involvement through a statistical interaction between intensity and friend deviance.
10	Age-grading	The magnitude of the effect strength of the modalities of association on crime will not vary across age.
11	Age-grading	The magnitude of the effect strength of friend deviance on crime will not vary across age.
12	Age-grading	The magnitude of the effect strength of the modalities of association on crime will vary across age.
13	Age-grading	The magnitude of the effect strength of friend deviance on crime will vary across age.

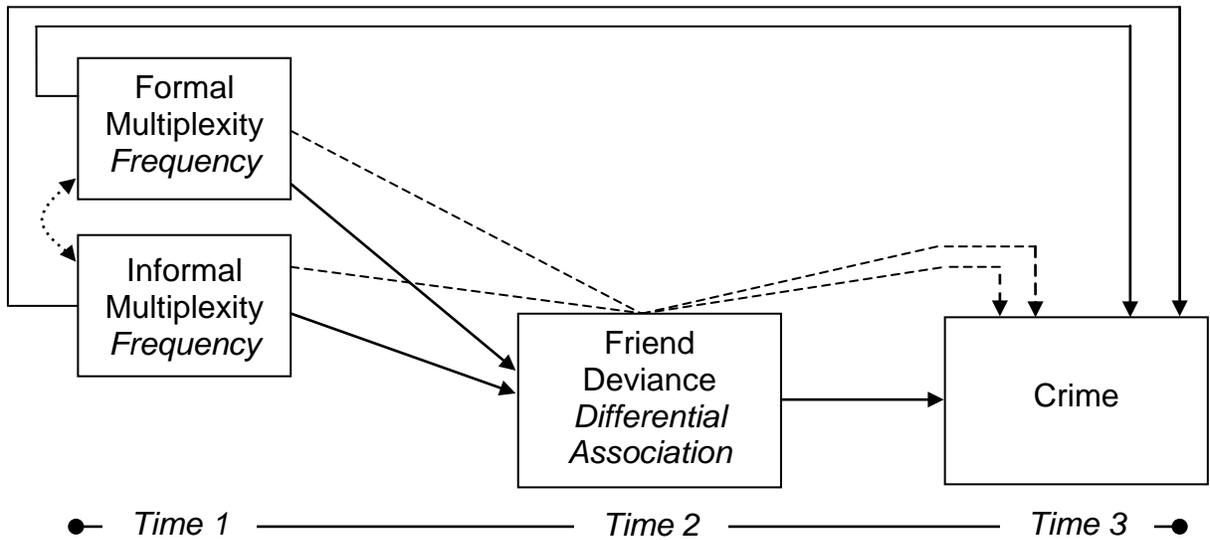
Table 3-9. Continued

#	Subject Matter	Hypothesis
14	Age-grading	The magnitude of the effect strength of the modalities of association on crime will be stronger during middle adolescence than late adolescence and emerging adulthood.
15	Age-grading	The magnitude of the effect strength of friend deviance on crime will be stronger during middle adolescence than late adolescence and emerging adulthood.
16	Age-grading	The magnitude of the effect strength of the modalities of association on crime will be stronger during late adolescence than emerging adulthood.
17	Age-grading	The magnitude of the effect strength of friend deviance on crime will be stronger during late adolescence than emerging adulthood.
18	Control variable mediation	The differential association variables will substantially mediate the relationship between socioeconomic status and crime.
19	Control variable mediation	The differential association variables will substantially mediate the relationship between race and crime.
20	Control variable mediation	The differential association variables will substantially mediate the relationship between gender and crime.



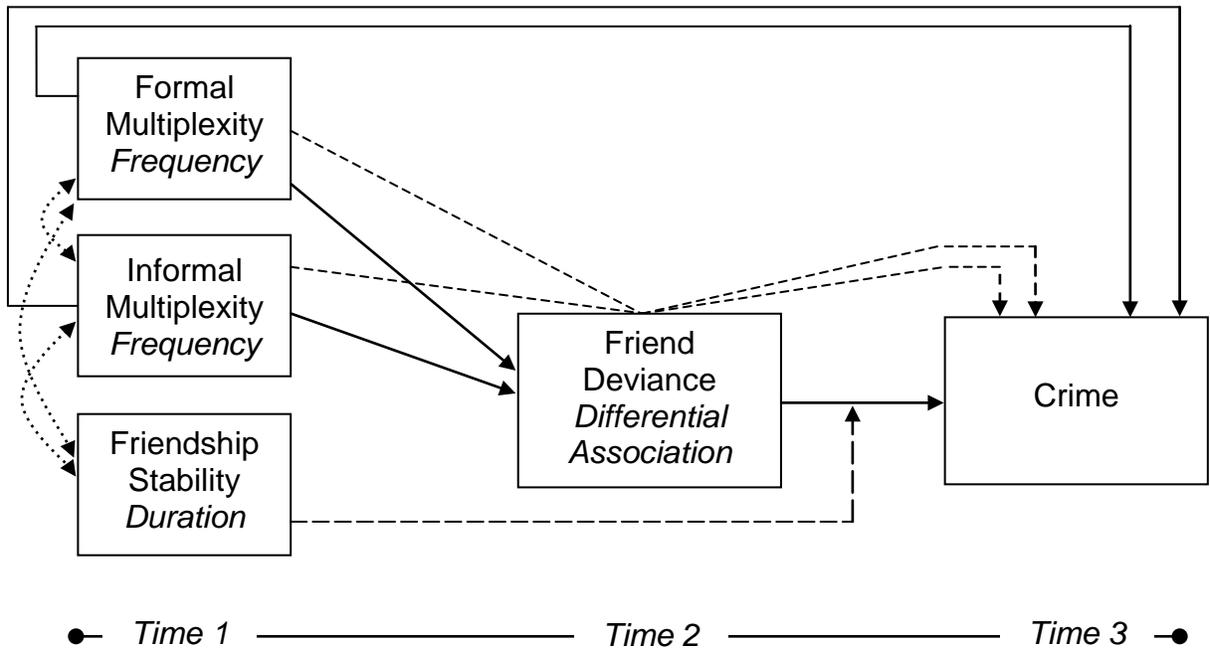
*H1:* The friend deviance construct will positively relate to the actor's criminal involvement.

Figure 3-1. The differential association hypothesis. Notes: Direct effects represented by solid lines



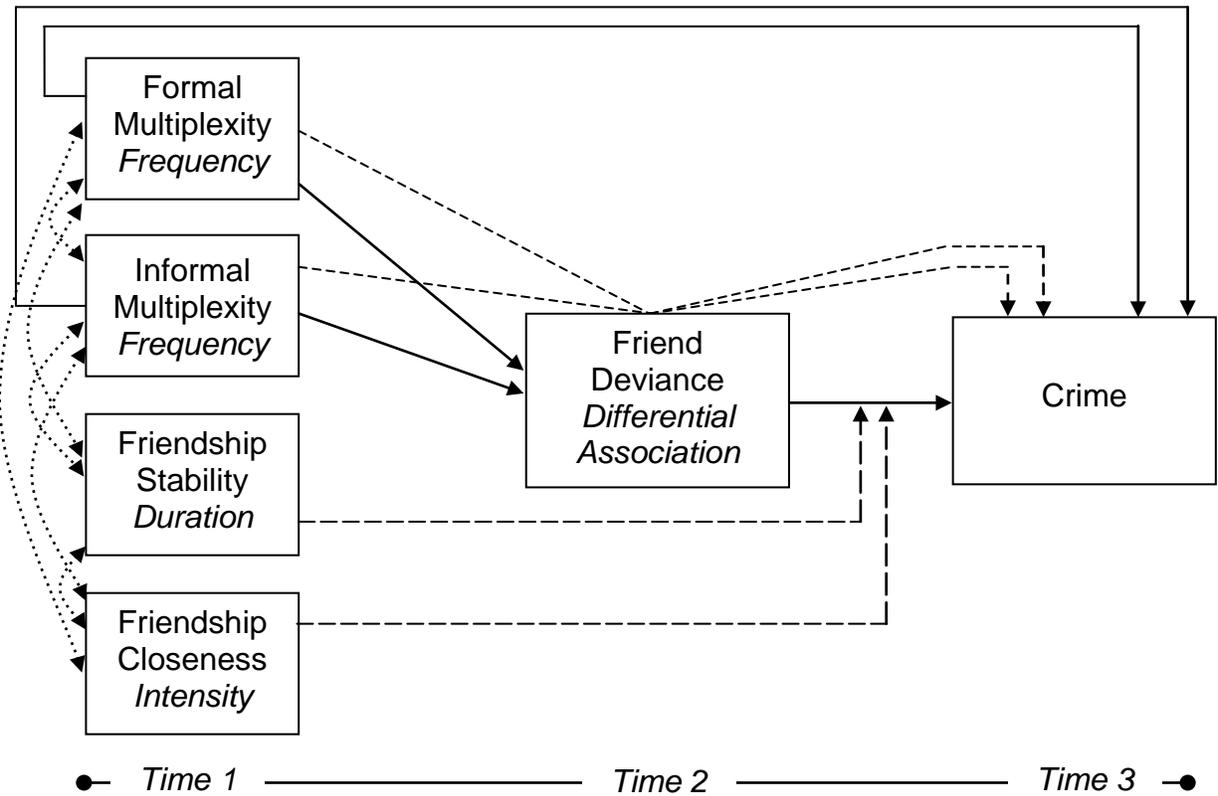
- H2:* Formal multiplexity (an element of frequency) will negatively relate to friend deviance.
- H3:* Formal multiplexity (an element of frequency) will negatively relate to the actor's criminal involvement.
- H4:* Informal multiplexity (an element of frequency) will positively relate to friend deviance.
- H5:* Informal multiplexity (an element of frequency) will positively relate to the actor's criminal involvement.
- H6:* A portion of the total effect of formal multiplexity (an element of frequency) on crime will be indirect through the friend deviance construct.
- H7:* A portion of the total effect of informal multiplexity (an element of frequency) on crime will be indirect through the friend deviance construct.

Figure 3-2. The formal and informal multiplexity (frequency) hypotheses. Notes: Direct effects represented by solid lines. Indirect effects represented by short-dashed lines. Total effects = Sum of direct and indirect effects (not pictured)



*H8:* Longer duration will amplify the relationship between friend deviance and the actor's criminal involvement through a statistical interaction between duration and friend deviance.

Figure 3-3. The friendship stability (duration) hypotheses. Notes: Direct effects represented by solid lines. Indirect effects represented by short-dashed lines. Moderation effects represented by long-dashed lines. Total effects = Sum of direct and indirect effects (not pictured)



*H9:* Higher intensity will amplify the relationship between friend deviance and the actor's criminal involvement through a statistical interaction between intensity and friend deviance.

Figure 3-4. The friendship closeness (intensity) hypotheses. Notes: Direct effects represented by solid lines. Indirect effects represented by short-dashed lines. Moderation effects represented by long-dashed lines. Total effects = Sum of direct and indirect effects (not pictured)

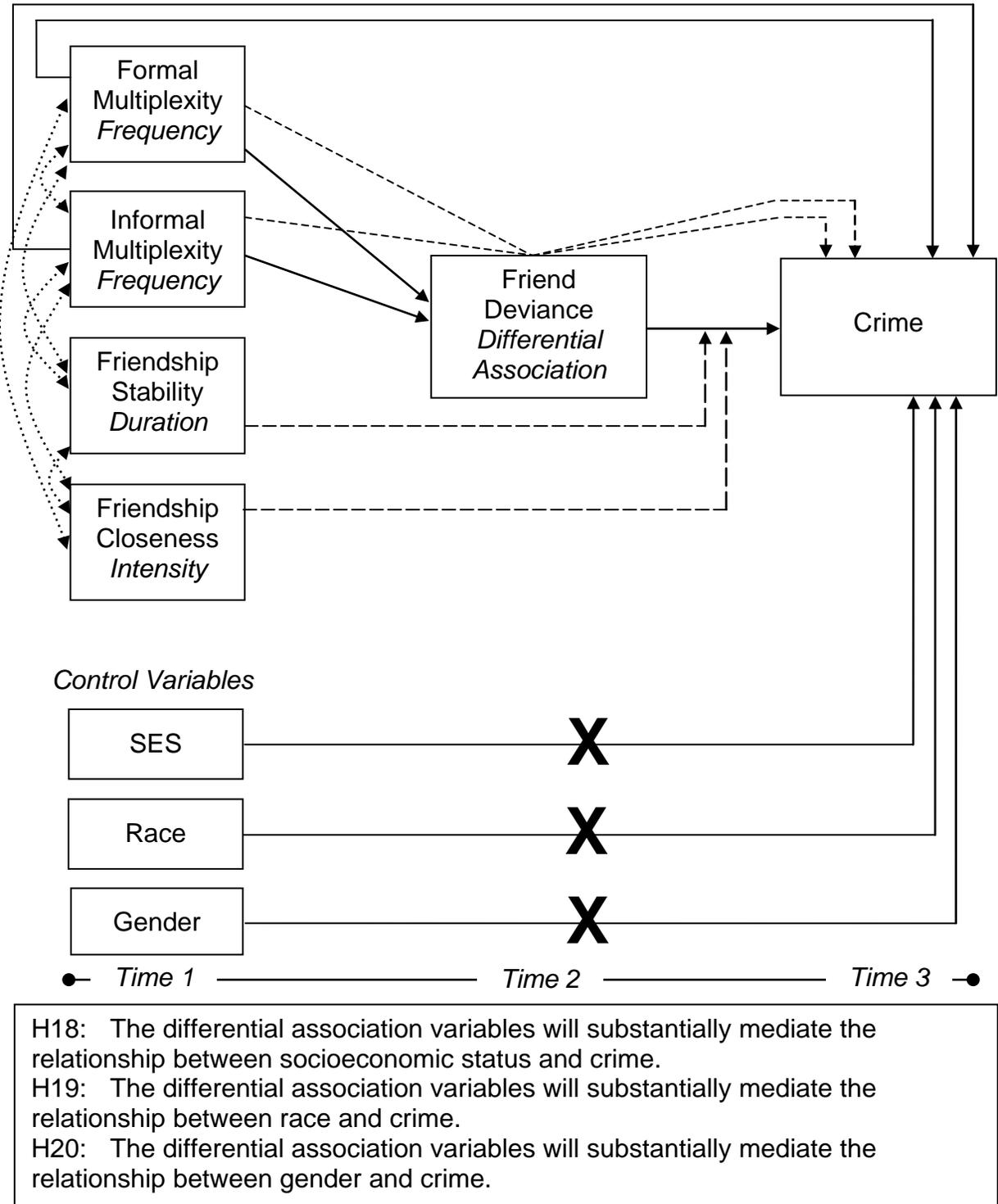


Figure 3-5. Akers's control variable mediation hypotheses. *Notes:* Direct effects represented by solid lines. Indirect effects represented by short-dashed lines. Moderation effects represented by long-dashed lines. Total effects = Sum of direct and indirect effects (not pictured)

## CHAPTER 4 METHODS AND MEASURES

### **Data and Sample**

**Rochester Youth Development Study.** Data analyzed in this dissertation come from the Rochester Youth Development Study (RYDS), a prospective longitudinal panel study that began in the spring of 1988 in Rochester, New York (see Thornberry et al., 1993). Today, the RYDS is still an ongoing data collection effort, and the data have illustrated much insight into the etiology of criminal behavior (Krohn et al., 2013) including serious delinquent behavior in conjunction with adolescent development (e.g., Krohn et al., 2009), drug use (e.g., Krohn et al., 1996), gang membership (e.g., Krohn et al., 2011), and characteristics of social networks (e.g., Krohn and Thornberry, 1993; see the review of Thornberry et al., 2003). Being that these were the primary goals of the RYDS project, the study has been overwhelmingly successful.

A two stage stratified sampling procedure was used to select adolescents deemed to be at 'high risk' for delinquency. First, males were oversampled at a rate of 3:1 (75% men; 25% women) since they are much more likely to be involved in serious criminal behavior than women (e.g., Blackwell, 2000). Second, arrest data from each census tract in the city was obtained from the Rochester Police Department's 1986 crime statistics, and from these a geographical oversampling procedure was implemented so that adolescents from high-crime areas were included more frequently. This strategy relied on the assumption that respondents in high-crime areas are more likely to commit crime than those in low-crime areas. The final sampling frames were weighted before selection on the gender and geographic strata, and 1,000 respondents were randomly chosen to be included in the sample.

The original panel at wave one consisted of 1,000 adolescents living in Rochester, New York, United States. At the current time, data has been collected from these individuals a total of 14 times over three phases: Phase one refers to waves one through nine data collections, phase two refers to the wave ten, eleven, and twelve data collections, and phase three refers to waves 13 and 14. Table 4-1 summarizes the sampling procedures and the timeline of the project.

Phase one data collection began in the spring of 1988. Respondents were sampled using structured, face-to-face interviews every six months during this phase. Both quantitative and qualitative data were collected during phase one. Data collection for wave nine ended in the spring of 1992 when the respondents were 17.9 years old, on average. The retention rate between waves one and nine was extremely high, as 881 of the original 1,000 individuals remained in the sample at the end of the phase one.

After a 24-month delay in data collection, phase two began in 1994 with wave ten. Individuals were assessed using structured, face-to-face interviews during phase two, and both quantitative and qualitative data were obtained. Respondents were interviewed every twelve months during the second phase. At the conclusion of the wave twelve data collection, the retention rate of the original 1,000 individuals was high, as 846 of the original 1,000 individuals remained in the data.

During phases one and two, the primary caregivers (most of the time these were biological mothers) of the respondents were also interviewed. Their interviews took place separately from respondents to avoid cross-contamination. As such, there are two generations of individuals in the data. Generation one (abbreviated "G1") refers to

the primary caregivers (most frequently biological mothers) of the teenage respondents, who are referred to as generation two (“G2”).<sup>1</sup>

Phase three data are not analyzed in this dissertation because the necessary measures are not available during waves 13 and 14. Instead, the focus here is strictly on the behavior and development of the G2 respondents during phases one and two. Aside from one control variable (socioeconomic status) which is reported by the G1 parents, the variables used in this analysis are reported by the G2 respondents themselves.

### **Defining and Operationalizing Three Developmental Periods**

As discussed in Chapter 2, the influence of friends changes across the life-course (e.g., Warr, 1993). Friends are more influential during middle adolescence than late adolescence and emerging adulthood (e.g., Steinberg and Monahan, 2007). And friends are more influential during late adolescence than during emerging adulthood (e.g., Steinberg and Monahan, 2007). The hypotheses tied to these observations (hypotheses 10-17, and especially 14-17) require that these three developmental periods be defined in the RYDS data.

The first of three investigated developmental periods – middle adolescence – is generally defined as the time when actors are between 13 and 15 years of age (Kastenbaum, 1993). For the purposes of this project, it is defined as the time period when respondents are 14.5 to 15.5 years of age, on average (mean age at wave two = 14.403, SD = 0.761, minimum = 11.9, maximum = 16.1, 95% confidence interval =

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<sup>1</sup> Though not the focus of the current study, many of the G2 respondents have children who are now included in a project called the Rochester Intergenerational Study. Thus, the RYDS project is one of the more unique developmental studies in that it can look at three generations of respondents.

14.343 – 14.458). These ages capture the time period where the age/crime curve is increasing rapidly just before it peaks. This developmental period corresponds with waves two through four of the RYDS data.

The second of three developmental periods that will be tested in the current project is the time period of late adolescence. This developmental stage corresponds with a sharp decrease in criminal involvement immediately after the peak of the age/crime curve. Developmental scholars define late adolescence as the time period when an actor is between 16 and 18 years of age (Kastenbaum, 1993). For the current study, late adolescence is defined as the time when respondents are 16.5 to 17.5 years of age, on average (mean at wave six = 16.379, SD = 0.775, minimum = 13.9, maximum = 18.1, 95% confidence interval = 16.320 – 16.438). Analytically, this age range corresponds with waves six through eight of the RYDS data.

The final developmental period that will be investigated in this project is emerging adulthood. Emerging adulthood is loosely defined as the time period when an actor is 18 to 25 years of age (Arnett, 2000). The emerging adulthood period is defined in this project as the time when respondents are between 20.5 and 22.5 years of age, on average (mean at wave ten = 20.579 years, SD = 0.790, minimum = 18.0, maximum = 22.4, 95% confidence interval = 20.519 – 20.639). This age range corresponds with waves ten through twelve of the RYDS data.

### **Attrition and Sample Size**

Because separate models are estimated at three different developmental periods, the sample size has the potential to decrease over time as participants drop out. However, the changing sample size may pose an interpretational problem for this project. If different respondents were included in each model, any observed differences

in model comparisons across developmental stages could either be the result of 1) actual differences in the magnitude of coefficients over time or 2) differences between people included or not included in the sample at different developmental stages. Instead, having the same respondents in each developmental period's model would allow for clear comparisons over time because any observed differences in the magnitude of coefficients would assuredly not be attributable to different individuals in the data at different developmental periods.

Several procedures were used to guarantee that analyses included the same individuals across all three developmental periods. First, if a respondent failed to respond to all exogenous variables, he/she was removed from the analysis. Without access to auxiliary variables to aid in imputations (which were not available in the secure data file I requested due to the need for statistical software that is not available over the RYDS's Unix server), the assignment of missing values to exogenous predictors is not ideal (Allison, 2010).<sup>2</sup> This is especially true considering most of the exogenous variables are also tied to theoretical hypotheses. Thus, instead of implementing an imputation strategy that would not have contemporaneous measures to aid in the imputation, these individuals were removed from the sample.

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<sup>2</sup> Because of the length of the longitudinal data collection, it is feasible that the identity of the respondents could be discovered if the data were to fall into the wrong hands. As such, the RYDS investigators have implemented some of the most stringent security protocols in the field in order to protect the identity of the respondents and the integrity of the data collection.

There are two levels of security clearance. The basic security clearance allows analysts to estimate basic models through SAS 7.0 via a secured UNIX server. More advanced modeling – such as the models estimated here – requires the advanced security clearance. Analysts (such as me) with the advanced security clearance are allowed to hold parts of the RYDS data in their personal offices. The approved data download allowed for 276 variables to be privately held, which is the exact number of measures needed to conduct this analysis. This approval was among the largest data requests ever approved by the RYDS data security office since the project began in 1988. Because all the measures downloaded were of substantive theoretical importance, there was no room for other items (such as auxiliary variables for data imputation) to be included in the request.

Second, participants who did not respond to any items in the self-reported crime outcomes during the third developmental time period were removed. Imputing missing data on a dependent variable can be very problematic and can inflate standard errors in models (Allison, 2002). There were no other measures available at waves four, eight, or twelve in the secure data held for use in specialized software, meaning the necessary auxiliary variables are unavailable to aid in the imputation of the complete missing data.

Following the removal of respondents with 100% missingness on the exogenous or outcome measures, 907 individuals remained in the middle adolescence sample, 872 in the late adolescence sample, and 833 in the emerging adulthood sample. To provide the same sample size over time, the user identification number was recorded for all participants who met the criteria for removal during any developmental period. After removing all of these individuals, 786 respondents remained who had available data at all developmental periods.

The final removal step entailed determining which of the 786 non-deleted respondents were socially isolated. Individuals without friends by default have no multiplexity, friendship stability, friendship closeness, or friend deviance. Research has concluded that very few individuals are socially isolated (about 5% or less, per Kreager, 2004; cf. to Berndt et al., 1999, who find no individuals who are friendless). An implication of this is that very large samples (around 14,000 per Kreager, 2004, p. 362) are necessary to investigate the differences between individuals who do and do not have friends.

In the RYDS, the number of individuals who do not have friends varies across developmental period. Of the 786 non-deleted respondents, only five (0.6%) individuals

in middle adolescence fail to report they have friends. In late adolescence and emerging adulthood, however, that number increases to 37 (4.7%) and 87 (11.1%), respectively.<sup>3</sup> Supplemental analyses were unable to detect a behavioral difference between those who did and did not have friends (see Appendix). As such, individuals who failed to report having friends at any developmental period were removed from the sample.<sup>4</sup>

Following the removal of the dropouts and the individuals without friends, there were 670 individuals remaining. This represents 74% of the 907 non-dropouts in the middle adolescence models, 77% of the 872 non-dropouts at late adolescence, and 80% of the individuals who had not dropped out by the emerging adulthood models. Using the full RYDS sample of 1,000 individuals, a series of supplemental analyses were unable to detect behavioral or demographic differences between those who were and were not removed, with the exception that blacks were more likely to be retained

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<sup>3</sup> This finding was confirmed based on a series of variables I created based on missing data patterns with friendship measures as well as secure measures provided by the RYDS data staff denoting the number of friends nominated at each wave. The findings between these methods were identical. Of the full sample size of 1,000, seven individuals indicated they had zero friends during middle adolescence (wave two), 48 had zero friends during late adolescence (wave six), and 93 had zero friends during emerging adulthood (wave ten). It is unclear as to why there is such an increase in the number of friendless respondents over time. Two possibilities seem most likely. First, it could be a method effect. Perhaps individuals learned over time that they could get through the interviews quicker if they indicated they had no friends since they would not have to answer supplemental questions about each friend. This is a testable hypothesis in the RYDS data, as the interviewers recorded the length of each interview. The second possibility is that this trend could reflect real, substantive changes in the respondents over time. Perhaps off-time life-course transitions (see Krohn et al., 2009) could be causes of an actor losing friends across development. I would like to thank the RYDS staff for their assistance in this matter, and especially Marv Krohn, Adrienne Freeman-Gallant, and Amanda Emmert.

<sup>4</sup> The research on social isolation suggests that the implications of not having friends may be more psychological than behavioral (Berndt et al., 1999; Kreager, 2004). While investigating the reason for the increase in being friendless over time in the RYDS data is beyond the scope of the current effort, this is a logical future direction, especially considering the calls for more research to address the behavioral consequences of not having friends (Hartup, 1996).

while Hispanics and males were more likely to be lost (see Appendix).<sup>5</sup> The descriptive statistics and the estimated statistical models throughout the remainder of this dissertation use an analysis sample of 670.

## Measures

### Dependent Variables

**Self-reported crime.** Self-reported crime was measured at each wave of the RYDS project. The self-reported crime outcomes are from wave four (for middle adolescence), wave eight (for late adolescence), and wave twelve (for emerging adulthood). At each wave, the respondent was asked to identify if he/she had engaged in 19 criminal behaviors (1 = engaged in; 0 = did not engage in). The measures inquired about the respondent's participation in assault, vandalism, theft, and fraud. The same set of 19 items was included in the construction of the outcome measure at each developmental period, meaning that the dependent variables are conceptually identical at all developmental periods. This allows for precise comparisons between models.<sup>6</sup> Crime items are listed in Table 4-2, and descriptive statistics of the items are provided in Table 4-3. A summary of the wave of measurement of all constructs and reliability statistics are provided in Table 4-4.

Instead of using a variety index of the respondent's criminal involvement in the path models, the current analysis implements an item-response theory (IRT) approach to investigating criminal behavior. This approach is more advantageous than using

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<sup>5</sup> This follows past work in the RYDS data that show that Hispanics are more likely to be lost due to attrition (see Krohn and Thornberry, 1999). Also, Krohn and Thornberry (1999) find that males were slightly more likely to be lost in the RYDS data.

<sup>6</sup> The type of crime committed by an actor may change as he/she ages without changing the underlying latent construct that crime forms (heterotypic continuity). The use of the same 19 items is not meant to detract from this possibility, but rather provide the most precise method to compare coefficients over time.

variety indices since IRT models account for measurement error, which a standard variety index would not.

Item-response theory provides a different conceptual approach than classical test theory. A main difference between classical test theory and IRT frameworks is the latter approach allows for individual survey items to function differently across persons (de Ayala, 2009). This is important because personal characteristics, which can influence the way a person responds to survey items, differ considerably between individuals. In order to allow for this, IRT models calculate standard errors for each person in the sample based on properties of the individual survey items.

Item response models are latent variable models that have the goal of using the observed responses to survey items to estimate a latent construct called the 'ability estimate,' or the 'theta parameter.' Theta scores represent a normally distributed latent construct with a mean of zero that is calculated for each person within the model itself (de Ayala, 2009). The calculation of theta also controls for unobserved constructs, thus holding constant other factors at the time of measurement that may exert an influence on crime (de Ayala, 2009). Since it will be calculated from the self-reported crime items, it measures a respondent's 'proclivity towards crime' or 'crime proclivity.' The crime proclivity measures will serve as the dependent variables at time three in the models. Crime proclivity and self-reported crime share a positive relationship. Higher proclivities for crime reflect the fact that the respondent has committed more crime, and lower proclivities indicate that less criminal behavior has been committed.

Given that dichotomous items are used to measure crime in the current study, a logistic IRT model must be used. Three logistic IRT models were considered: the

constrained Rasch model (also known as a one parameter logistic model), the unconstrained Rasch model, and a two parameter logistic model (“2PL”). These models are similar in the fact that they all define the probability of committing a crime as a function of the difficulty and discrimination parameters. The difficulty parameter is the point on the latent crime proclivity trait where there is a 50% probability of committing the crime. Depending on the proportion of crime occurrence, these models account for the fact that some crimes can be more or less difficult to commit. To provide an example, less people commit aggravated battery than common theft. Because of this, an item measuring common theft would have a lower difficulty value than an item measuring aggravated battery.

In classical test theory, all items in a scale are assumed to have equal weight. In the IRT framework, the discrimination parameter allows for survey items to vary. Stated differently, this parameter allows some items to be more influential than others, and can thus be thought of as a weighting procedure.

Both the Rasch and 2PL models treat item parameters as sample independent and crime proclivity estimates as item independent. They calculate the difficulty and discrimination parameters for each item as a function of each person’s crime proclivity (the theta parameter). If a person has a higher crime proclivity, he/she is more likely to commit crime, meaning that crime is less difficult for him/her to commit.

The unconstrained and constrained Rasch models are similar. They both assume that all crime items discriminate equally, meaning all items are equally weighted in the construction of the crime proclivity outcomes. The constrained Rasch model restricts the discrimination parameter to be equal to one for all items. Thus, the model

is 'constrained' because it is not allowed to pick its own discrimination value. On the other hand, the unconstrained Rasch allows the discrimination parameter to be decided by the model itself. Because the discrimination parameter is not restricted to be equal to one, the model is 'unconstrained' (see de Ayala, 2009).

The constrained and unconstrained Rasch models differ in a key way from the 2PL. In the 2PL, it is assumed that the items do *not* discriminate equally (de Ayala, 2009). This means that certain crimes can be more influential than others in the calculation of the crime proclivity outcomes. As such, a separate discrimination parameter is estimated for each item in addition to the difficulty parameter.

To generate the crime proclivity (or theta parameter) estimates that are the dependent variables, the constrained Rasch model, the unconstrained Rasch model, and the 2PL were estimated using the 19 crime items at each wave.<sup>7</sup> To determine which of these models' crime proclivity estimates were most appropriate to use, the fit of the three types of models at each wave was compared using an analysis of variance test in the R statistical package (v. 2.1.0). These tests consistently demonstrated that the 2PL offered a significant improvement in closeness of fit to the data over the

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<sup>7</sup> IRT models are sensitive to the dimensionality of the measures under investigation. Crime at all waves satisfied conditions of unidimensionality and local independence. All models fit the data closely with either traditional fit standards (confirmatory fit index [CFI]  $\geq .90$ ; Tucker-Lewis Index [TLI]  $\geq .90$ ; root mean squared error of approximation [RMSEA]  $\leq .10$ ) or modern fit standards (CFI  $\geq .95$ ; TLI  $\geq .95$ ; RMSEA  $\leq .06$ ). Thus, the data support the conceptual grouping of the crime items to form a "general crime" construct.

A second set of CFAs was performed to determine if the crime items loaded onto separate factors of violent and non-violent crime. Indeed, the models fit the data closely (traditional or modern fit criteria were satisfied) and revealed two subfactors within the general deviance measure – a violence and non-violence construct. However, the constructs were extremely highly related. The correlations between the violence and non-violence constructs at waves four, eight, and twelve (where crime is an outcome) were .936, .854, and .948, respectively. At waves two, six, and ten (where crime is a control variable), the correlations between violence and non-violence constructs were .919, .765, and .769, respectively. Thus, the measures of violence and non-violence are so highly correlated that estimating separate models based on violence and non-violence would yield the same results. As such, a general crime measure is the only dependent variable.

constrained and unconstrained Rasch models (all tests significant at  $p < .001$  level of significance). Thus, allowing each item to discriminate differently was preferred. As a result, all crime proclivity estimates used in this project come from 2PL models. These models were estimated in Mplus version 5. The difficulty and discrimination parameters for each crime item are provided in Table 4-5, and the descriptive statistics of the crime proclivity estimates are summarized in Table 4-6.

### **Friendship Nomination Procedure**

The friendship nomination process is relevant to the construction of the frequency (multiplexity), duration (stability), and intensity (closeness) measures. Part of the RYDS sampling procedure was to ask the participants to verbally identify the first name of up to three of their closest friends in their personal network. If the respondent's personal network did not consist of three friends, he/she was allowed to identify only as many friends as he/she had (ranging from 0-2).<sup>8</sup>

Despite a strong design, implementation problems occurred with these measures. First, a maximum of seven letters of the first names of friends were recorded by researchers. In conjunction with no last name identification, it becomes very difficult to validly determine if a friend is the same person over multiple waves. This problem is further exacerbated by the names that were given to the interviewers. The names provided by respondents in the structured, face-to-face interviews were often unusual and/or difficult for the interviewer to spell. To provide a real example, a friend identified as "Shawnic" at one wave could be the same as "Chonika" at a later wave. Because of

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<sup>8</sup> This design has been successfully used in other panel data collections, including the National Youth Survey (Elliott et al., 1985). However, individuals frequently have more than three friends, meaning that the friendship nominations are probably not capturing the actor's entire personal network in many cases. This will be discussed in the concluding chapter.

the different spellings and the fact that both responses were limited to seven digits, it is impossible to say that the friend is the same person or a different person.

This has two notable implications for purposes of the analysis. First, the friendship nomination variables cannot be used to construct the friendship stability measures, limiting the measures of friendship stability. Second, measures at any particular wave can be linked to specific friends, but it is impossible to track the specific friends over time. As such, it is not possible to estimate models that track the development of a respondent's individual friendships alongside his/her own delinquent and criminal behavior. Instead of tracking individual friendships, the current project proceeds by tracking a respondent's friendships in general over the three developmental periods. The average number of nominated friends (for the 670 respondents who did nominate friends) at time one of each developmental period is reported in Table 4-7.

## **Independent Variables**

### **Formal multiplexity (frequency)**

Drawing on the work of Krohn and colleagues (1988; Krohn and Thornberry, 1993) and Osgood and colleagues (Osgood et al., 1996; Osgood and Anderson, 2004), formal multiplexity was measured with seven total items that asked how often a respondent had taken part in a series of structured, supervised activities with each specific friend since the last interview. The items, which are summarized in Table 4-8, measure the frequency which a respondent shared religious activities, school activities, club sports, school sports, physical exercise, organized musical groups, and club memberships with each nominated friend. All items were measured on a four point,

Likert-type scale where higher scores indicated more formal multiplexity (1 = never; 2 = seldom; 3 = sometimes; 4 = often).

During middle and late adolescence, six items were included in the instruments that measured the frequency of spending time in formal contexts with each friend. In the event that a respondent nominated multiple friends, item scores were weighted by the number of friends. This was done by summing the item scores for friend one, friend two (if nominated), and friend three (if nominated) and dividing by the number of nominated friends separately at waves two, six, and ten. The weighting procedure performed on each item can be described through Equation 4-1, which shows that the formula for the friend-weighting procedure is

$$Wi_{1...k} = ([i_{1...k} | F_1] + [i_{1...k} | F_2] + [i_{1...k} | F_3]) / m$$

where  $Wi_{1...k}$  is the item score weighted across the number of friends for items one through  $k$ ;  $i_{1...k}$  is the raw item score for items one through  $k$ ;  $k$  is the total number of items;  $F_{1...3}$  is friend one, two, and three; and  $m$  is the total number of friends. The formula can be read as the weighted item score for item  $k$  is equal to the sum of the item scores reported by the respondent for friends one, two, and three, conditional on the respondent indicating that he/she had friends one, two, and three, divided by the number of friends nominated. For instance, if the respondent nominated three friends and reported formal multiplexity scores of 2, 4, and 4 for item one, his/her item one score would be  $(2 + 4 + 4) / 3 = 3.33$ . If the respondent only nominated two friends and his item one scores were 4 and 3, the formula would read  $(4 + 3) / 2 = 3.50$ . Or, if a respondent nominated one friend and reported a score of 2, then his item one score would be  $(2) / 1 = 2$ . This method loosely follows the research of Krohn and Thornberry

(1993; also see Krohn et al., 1988, p. 349), who used two separate measures to tap multiplexity. Additionally, this formula places a great deal of emphasis on the frequency of interaction, which is a critical element of Sutherland's theory, while accounting for the number of friends. This same basic weighting procedure is used throughout Chapter 4 in the construction of other measures.<sup>9</sup>

During emerging adulthood, only two items measured formal multiplexity with each nominated friend due to changes in the instruments. The same weighting procedure was applied to these items. Descriptive statistics for the weighted formal multiplexity items at each wave are provided in Table 4-9.<sup>10</sup>

Formal multiplexity could either be a latent or observed variable. In order to acknowledge that both methods may be feasible, the current project progresses by implementing a method that allows for the use of observed variables that have latent underpinnings – factor scores.

The friend-weighted formal multiplexity measures are scaled using refined factor scores. To generate these factor scores, principal component analyses (PCAs) were estimated for the formal multiplexity items at each developmental period. Following the estimation of the PCAs, factor scores (also referred to as component scores in the

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<sup>9</sup> While research regularly utilizes an actor's reports of his/her perceptions of his/her relationships with friends (e.g., time spent with a group of friends [Osgood et al., 1996], bonds to friends [Hirschi, 1969], etc.), I am unaware of research explicitly using this procedure to tap the characteristics of an actor's social networks. Despite this, the approach to the current equation is similar to prior studies since general characteristics of the actor's networks are the result of this formula.

<sup>10</sup> The change in the number of items over time raises attention to an important, and potentially complex, measurement issue: Do items tapping formal multiplexity (or any other construct) change over development in a fashion where the same construct is captured? Since adults are not supervised by their teachers or parents, the supervisory figure could change during this time (for instance, a spouse). As such, it must be acknowledged that the changes in items for the formal multiplexity construct in particular could potentially indicate that different constructs are being measured during adolescence versus emerging adulthood. The final chapter further discusses this issue in the context of future research.

context of PCA; see DiStefano et al., 2009) were generated for each of the individual items (components) using Thurstone's (1935) regression method.<sup>11,12</sup> These factor scores, which have a mean of zero, provide the person's location on a continuum of a latent factor of formal multiplexity. A score of zero for a factor score indicates that the person's item score is equal to the mean of the latent factor (DiStefano et al., 2009). A value of 1 indicates that the person's score on the item is one standard deviation higher than the mean of the formal multiplexity latent construct, and, inversely, a score of -1 would suggest that the person's score is one standard deviation below the mean. Scores of |2| and |3| indicate that the person's relative spacing on the item score is increasingly further away from the mean of the latent formal multiplexity construct.

To construct a scale of formal multiplexity at time one of each model, factor scores were summed. These scales, which have a mean of zero, represent the respondent's total relative distance from the mean of the latent factor of formal multiplexity. Values further from zero indicate the actor's individual scores were increasingly farther away from the mean. For example, a score of five would indicate the actor's individual factor scores summed to five standard deviations above the mean of the latent construct of formal multiplexity. Likewise, a score of -10 would indicate that

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<sup>11</sup> Although there is a distinction between factor scores and factor score estimates, factor score estimates are referred to simply as 'factor scores' for semantic simplicity.

<sup>12</sup> Factor scores calculated with an orthogonal rotation are assumed to be uncorrelated with another (Gorsuch, 1983). To check if this assumption was violated, factor scores were first estimated using an orthogonal (varimax) rotation and were then also calculated via an oblique (promax) rotation. Unlike orthogonal rotation assumptions, the oblique method allows for non-zero correlations among factor scores to exist, if the data supports their existence (Gorsuch, 1983). The orthogonal assumption was violated for all measures that are scaled using factor scores; factor scores of all constructs showed consistent non-zero correlations with one another, making the use of varimax rotation untenable. As such, all factor scores are calculated using the oblique, promax rotation technique.

the actor's factor scores summed to being ten standard deviations below the mean of the formal multiplexity latent construct.

Factor score scales are used as exogenous variables. A description of the summary statistics for the formal multiplexity factor scores and the factor score scales is provided in Table 4-10.

### **Informal multiplexity (frequency)**

Informal multiplexity was measured with five total items that measure the frequency which a respondent spends time in unsupervised contexts with each identified friend. The items are listed in Table 4-11. The items asked how many times a week the respondent and the friend hung out where someone was using or selling alcohol or drugs (item 1 [waves two, six, and ten]), got together without adult supervision (item 2 [waves two and six]), drove around with no special place to go (item 3 [waves two and six]), hung out on a street corner (item 4 [wave ten]), and hung out somewhere else other than a street corner (item 5 [wave ten]). All items are coded on a metric of 1 to 5 where higher values indicate higher amounts of time spent in informal contexts (1 = never; 2 = one time a week; 3 = two times a week; 4 = three or four times a week; 5 = every day).

The items that measure informal multiplexity are similar to the Likert-type items that were used to measure unstructured time spent with peers by Osgood and colleagues (1996). In later research, Osgood and Anderson (2004, p. 530) use a count measure of the number of hours spent with "current friends". The operational distinction between the measurement strategies of unstructured time with peers and informal multiplexity is the former captures time spent with anyone nested within the respondent's complete friendship network while the latter measures time spent with up

to three close friends. Due to the lack of measures tailored towards Osgood's construct, I cannot speak to the empirical similarity between unstructured time with peers and informal multiplexity. Conceptually, though, they are very similar, suggesting that there may be a high correlation between the two measures. This issue is revisited in Chapter 7.

Of the five total informal multiplexity items, three are included in the modeling during each developmental period due to changes in the items included in the instrumentation over time (middle and late adolescence: items 1, 2, and 3; emerging adulthood: items 1, 4 and 5). To construct the measures across multiple friends at any wave, the individual items were weighted by the number of nominated friends using the formula presented in Equation 4-1. Descriptive statistics for these weighted items measuring informal multiplexity are provided in Table 4-12.

Like the formal multiplexity construct, informal multiplexity could be either an observed or latent construct. For this reason, factor scores for the friend-weighted informal multiplexity items were generated from PCAs using Thurstone's (1935) regression method. Factor scores were summed to create factor score scales of informal multiplexity (see Table 4-13). These scales are used as exogenous variables in the forthcoming modeling.<sup>13</sup>

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<sup>13</sup> The use of factor scores does not account for error variance. While this is not a great concern in the formal multiplexity items since their reliabilities are high, the reliability of the informal multiplexity items is relatively low (see Table 4-4). Confirmatory factor analyses with only three items necessarily fit the data perfectly. As such, they could not determine how closely a latent construct of informal multiplexity may fit the data, suggesting that treating informal multiplexity as a pure latent construct may not be ideal. Future work should reinvestigate the measurement of informal multiplexity and explore the possibility that it may form a latent construct.

### **Friendship stability (duration)**

Friendship stability is measured for each nominated friend during all developmental periods under investigation. During middle adolescence, the actor responded to an item that asked “Think back to the last time we interviewed you. Was (friend name) a good friend of yours then?” This item was placed immediately after the friendship nominations. Unfortunately, this measure was not included in the wave two (time one) instruments. The middle adolescence models instead use friendship stability measured at wave three as a predictor of crime proclivity at wave four. The measure is binary where values of ‘0’ denote that the friend was not a friend at wave two (zero months of stability) and values of ‘6’ denote that the friend was a friend at wave two (six months of stability).

The late adolescence models use the same measurement strategy for friendship stability. The difference is, however, that friendship stability is measured at wave six (time one). The friendship stability measure is once again binary (0 = zero months of stability; 6 = six months of stability).

At wave ten, during the developmental period of emerging adulthood, the measurement strategy changed. Respondents were asked “How long has (friend name) been a good friend of yours?” The responses to this question were reported in years and months but are converted to count measures of months for the current purpose. As such, the feasible values of the stability measures during wave ten range from zero to the age of the respondent in months.

The best way to measure friendship stability, as discussed in Chapter 3, is the technique used at wave ten. The method used during waves three and six is not ideal. The measurement strategy in the friendship stability measures at phase one does, to an

extent, pose a limitation; many people have friendships that last longer than six months, and the phase one measures cannot capture the stability of these friendships.<sup>14</sup> This also complicates the interpretation of comparisons made during the developmental periods because the phase one measures may not be fully capturing the length of the respondent's stable friendships. Regardless, the inclusion of this measure in analyses will serve to provide a preliminary understanding for how the modality of stability may moderate the relationship between friend deviance and crime proclivity. Further discussion of the limitations surrounding this measure will be provided in Chapter 7.

The measures of friendship stability are weighted by the number of friends at each developmental period to provide the average stability of the respondent's friendships. This procedure followed the formula presented in Equation 4-1.

Descriptive statistics of these measures are provided in Table 4-14.

### **Friendship closeness (intensity)**

Six items measured at waves two, six, and ten measured closeness to each of the respondent's nominated friends. The items asked how often the respondent talked to the friend about personal things and private problems, asked for advice, borrowed money, and the extent to which the respondent trusted the friend. The strategy used to measure friendship closeness in the RYDS is similar to that used by developmental psychologists (e.g., Berry et al., 2000). During middle and late adolescence, the response categories were ordered 1 to 4 (1 = never; 2 = seldom; 3 = sometimes; 4 = often). During emerging adulthood, the four point metric remained, but the respondent

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<sup>14</sup> While this is a limitation, it is perhaps somewhat tempered by the fact that the developmental period of adolescence is a period of the life-course when actors have relatively few stable friendships (Kandel, 1978b; Kandel and Davies, 1991; although see McGloin, 2009).

was instead asked how likely he/she would be to confide in the friend (1 = very unlikely; 2 = unlikely; 3 = likely; 4 = very likely). Higher scores measure higher friendship closeness. Items are displayed in Table 4-15.

The individual friendship closeness items at the time one waves (two, six, and ten) were weighted by the number of friends using Equation 4-1 in the same manner used for other measures. The descriptive characteristics of these items are reflected in Table 4-16.

Friendship closeness could potentially be a latent variable or an observed variable. Because of this, the friend-weighted friendship closeness items were inserted into a PCA and factor scores were generated in a conceptually identical process as the multiplexity items. The friendship closeness item factor scores were summed together to create a scale. The descriptive statistics of the factor score items and scale at time one of each model is provided in Table 4-17.

### **Friend Deviance**

The friend deviance items in the RYDS do not measure the deviance of individual friends, but rather a respondent's group of friends. Before the items were asked, respondents were instructed to "think of the whole group [of friends] you hung out with" since the time of the last interview. Thus, this group contains the nominated friends from the respondent's personal network, but can contain other friends as well (this is consistent with traditional measures of differential association; see, for instance, the measure used by Akers et al., 1979). The friend-weighting procedure used in prior independent variables is unnecessary.

Friend deviance is measured at each wave of the RYDS data. The measures used here come from the wave three, wave seven, and wave eleven data. A total of

eight items, which are commonly found in the literature as measures of differential association (see Agnew, 1991; Elliott et al., 1985), measure friend deviance at these waves. The items asked, “Since we interviewed you last time, how many of [your] friends (act).” The acts measure robbery, aggravated battery, assault, theft of relatively inexpensive items, theft of expensive items, vandalism, vehicle theft, and gang membership (see Table 4-18). All items are measured on a scale where scores of ‘1’ represent “none of them,” scores of ‘2’ represents “a few of them,” scores of ‘3’ represent “some of them,” and scores of ‘4’ indicate “most of them.” Due to changes in the items in the instruments over time, only seven friend deviance items are used in each developmental period’s model (refer to Table 4-18). The descriptive statistics of the friend deviance items are displayed in Table 4-19.

Friend deviance items were transformed into factor score estimates in a conceptually identical manner as the multiplexity and friendship closeness items. The factor scores were summed to create a scale. This scale is used as an endogenous variable at time two of each model. Descriptive statistics of the friend deviance factor scores and the friend deviance factor score scales is provided in Table 4-20.

## **Control Variables**

### **Socioeconomic status**

During middle (wave two) and late adolescence (wave six), the parents (G1) of the respondents (G2) were asked a yes or no question regarding whether their household or anyone in it had received cash assistance or other forms of financial aid from social services. This measure was coded so that the higher scores measure higher SES, or not receiving welfare aid (0 = welfare receipt; 1 = no welfare receipt). During emerging adulthood (wave ten), the G2 actors responded to a similar question

that asked if they had personally received welfare or cash assistance of any kind from social services (0 = yes; 1 = no). At each of the developmental periods, approximately two thirds to three quarters of the individuals indicated they had not received government aid, placing them in the higher SES category. All control variables are exogenous. Descriptive statistics are provided in Table 4-21.

### **Race**

Respondents reported their race (1 = white; 2 = black; 3 = Hispanic). Past research (Giordano et al., 1986), including research using the RYDS data (Krohn and Thornberry, 1993; Krohn et al., 2011), has found significant behavioral differences based on race. Two dummy variables were created. The first dummy variable distinguishes between respondents who were black (coded '1') or non-black (coded '0'). The second distinguishes respondents who were Hispanic (coded '1') or non-Hispanic (coded '0'). Most Hispanics in these data are Puerto Rican (Thornberry and Krohn, 2003). Whites are the comparison group. This dummy variable scheme is consistent with prior research using the RYDS data (e.g., see Krohn et al., 1996).

### **Gender**

The gender of the respondent is coded so that scores of '0' represent females and scores of '1' represent males.

### **Self-reported crime**

To minimize bias and protect against spuriousness, crime at time one (waves two, six, and ten) is included as a control measure. To be consistent with the dependent variables, these measures are also transformed into crime proclivity estimates using 2PL IRT models. Models controlling crime will predict change in crime proclivity rather than overall crime proclivity.

Table 4-1. Description of Rochester Youth Development Study (RYDS) data.

	Phase 1 Interviews biannually		Phase 2 Interviews annually		Phase 3 Interviews every 2 years	
	Wave 1	Wave 9	Wave 10	Wave 12	Wave 13	Wave 14
Time	Spr. 1988	Spr. 1992	1994 – 95	1996 – 97	2003 – 04	2005 – 06
N	n = 1000	n = 881	n = 855	n = 846	n = 785	n = 75s9
Retention	--	88%	86%	85%	79%	76%
Mean age	14.0	17.9	20.7	22.7	29.1	31.2

Table 4-2. Self-reported crime items in the RYDS data.

Item #	Wording
1	Used a weapon or force to make someone give you money or things?
2	Attacked someone with a weapon or with the idea of seriously hurting or killing them?
3	Been involved in gang or posse fights?
4	Hit someone with the idea of hurting them (other than what you just told me about)?
5	Carried a hidden weapon?
6	Thrown objects such as rocks or bottles at people?
7	Been loud or rowdy in a public place where somebody complained or you got in trouble?
8	Damaged, destroyed, marked up, or tagged somebody else's property on purpose? (This includes graffiti)
9	Gone into or broken into a building to steal or damage something?
10	Tried to steal or actually stolen money or things worth \$5 or less?
11	Tried to steal or actually stolen money or things worth between \$5 and \$50?
12	Tried to steal or actually stolen money or things worth between \$50 and \$100?
13	Tried to steal or actually stolen money or things worth more than \$100?
14	Shoplifted or taken something from a store on purpose (including anything you already told me about)?
15	Stolen someone's purse or wallet or picked someone's pocket?
16	Stolen something from a car?
17	Tried to buy or sell things that were stolen?
18	Stolen or tried to steal a car or other motor vehicle?
19	Used a credit card or debit card without permission?

Table 4-3. Descriptive statistics of self-reported crime items, per wave (means and standard deviations reported [n = 670; range of all items is 0 – 1]).

Item #	Wave 2 (control)	Wave 4 (outcome)	Wave 6 (control)	Wave 8 (outcome)	Wave 10 (control)	Wave 12 (outcome)
1	.003 (.055)	.003 (.055)	.004 (.067)	.004 (.067)	.001 (.039)	.001 (.039)
2	.046 (.210)	.040 (.197)	.039 (.194)	.031 (.174)	.058 (.234)	.013 (.115)
3	.139 (.346)	.110 (.314)	.064 (.245)	.045 (.207)	.022 (.148)	.004 (.067)
4	.239 (.427)	.201 (.401)	.170 (.376)	.169 (.375)	.151 (.358)	.082 (.275)
5	.196 (.397)	.137 (.344)	.133 (.340)	.185 (.389)	.170 (.376)	.106 (.308)
6	.133 (.340)	.072 (.258)	.039 (.193)	.028 (.166)	.019 (.138)	.007 (.086)
7	.133 (.340)	.090 (.286)	.048 (.213)	.045 (.207)	.043 (.204)	.025 (.157)
8	.075 (.263)	.054 (.226)	.051 (.220)	.048 (.213)	.013 (.115)	.009 (.094)
9	.010 (.102)	.013 (.115)	.003 (.055)	.004 (.067)	.004 (.067)	.001 (.039)
10	.055 (.229)	.037 (.190)	.028 (.166)	.027 (.162)	.033 (.178)	.007 (.086)
11	.027 (.162)	.034 (.182)	.018 (.133)	.015 (.121)	.019 (.138)	.003 (.055)
12	.009 (.094)	.004 (.067)	.004 (.067)	.009 (.094)	.012 (.109)	.003 (.055)
13	.007 (.086)	.004 (.067)	.015 (.121)	.007 (.086)	.013 (.115)	.004 (.067)
14	.079 (.270)	.049 (.217)	.033 (.178)	.025 (.157)	.033 (.178)	.010 (.102)
15	.006 (.077)	.001 (.039)	.003 (.055)	.009 (.094)	.003 (.055)	.001 (.039)
16	.021 (.143)	.009 (.094)	.019 (.138)	.009 (.094)	.004 (.067)	.003 (.055)
17	.030 (.170)	.027 (.162)	.030 (.170)	.024 (.153)	.055 (.229)	.030 (.170)
18	.010 (.102)	.012 (.109)	.016 (.127)	.021 (.143)	.004 (.067)	.001 (.039)
19	.012 (.109)	.006 (.077)	.004 (.067)	.004 (.067)	.004 (.067)	.001 (.039)
Total	1.230 (1.923)	0.905 (1.694)	0.722 (1.525)	0.704 (1.392)	0.665 (1.257)	0.316 (0.739)

Table 4-4. Summary of time of measurement, number of items, and reliability statistics of construct: Form of number of items (alpha); (n = 670).

Construct	W2	W3	W4	W6	W7	W8	W10	W11	W12
Formal multiplexity	6 (.73)	--	--	6 (.78)	--	--	2 (-)	--	--
Informal multiplexity	3 (.43)	--	--	3 (.49)	--	--	3 (.60)	--	--
Friendship stability	--	1 (-)	--	1 (-)	--	--	1 (-)	--	--
Friendship closeness	6 (.81)	--	--	6 (.86)	--	--	6 (.88)	--	--
Friend deviance	--	7 (.89)	--	--	7 (.89)	--	--	7 (.86)	--
SES	1 (-)	--	--	1 (-)	--	--	1 (-)	--	--
Non-black	1 (-)	--	--	1 (-)	--	--	1 (-)	--	--
Male	1 (-)	--	--	1 (-)	--	--	1 (-)	--	--
Crime	19 (.75)	--	19 (.76)	19 (.76)	--	19 (.71)	19 (.65)	--	19 (.48)

Note: Reliabilities for non-binary items calculated with Cronbach's alpha. Reliabilities for binary crime items calculated with the Kuder-Richardson 20 test.

Table 4-5. Descriptive statistics of the difficulty (Diff.) and discrimination (Disc.) parameters of the crime items: two parameter logistic model results (n = 670).

Item #	Wave 2 (control)		Wave 4 (outcome)		Wave 6 (control)		Wave 8 (outcome)		Wave 10 (control)		Wave 12 (outcome)	
	Diff.	Disc.	Diff.	Disc.	Diff.	Disc.	Diff.	Disc.	Diff.	Disc.	Diff.	Disc.
1	3.010	2.206	2.863	2.524	3.140	1.615	3.142	1.720	3.433	1.705	--	--
2	2.303	1.144	2.110	1.646	2.316	1.284	2.562	1.149	2.344	0.959	2.588	1.868
3	1.444	1.207	1.639	1.238	2.260	0.970	2.399	1.073	2.552	1.380	3.395	1.358
4	1.205	0.729	1.352	0.813	1.604	0.754	1.922	0.573	2.019	0.601	2.850	0.580
5	1.125	1.249	1.578	1.026	1.515	1.169	1.320	0.934	1.656	0.713	2.030	0.816
6	1.526	1.120	1.843	1.470	2.485	1.092	2.586	1.189	2.904	1.101	4.351	0.778
7	2.219	0.585	2.098	0.881	3.024	0.702	3.015	0.724	2.720	0.866	3.887	0.637
8	1.832	1.372	2.004	1.507	2.281	1.114	2.742	0.812	2.830	1.355	2.991	1.446
9	2.667	1.849	2.688	1.559	3.415	1.493	2.653	7.312	2.623	3.013	--	--
10	2.564	0.840	2.498	1.106	2.136	2.191	2.327	1.639	2.244	1.578	2.437	6.595
11	2.239	1.840	2.169	1.713	2.279	2.443	2.303	3.193	2.247	2.523	2.589	16.793
12	2.867	1.583	2.596	3.740	2.744	2.640	2.843	1.693	2.413	2.549	3.223	1.743
13	2.938	1.599	2.516	6.875	2.303	2.736	3.174	1.357	2.761	1.440	3.692	1.149
14	2.253	0.838	2.057	1.501	2.069	2.205	2.183	2.262	2.205	1.679	2.654	1.968
15	3.992	0.927	-7.582	-0.542	2.797	3.198	6.078	0.616	2.844	2.437	3.556	1.642
16	2.555	1.428	3.137	1.263	2.413	1.791	3.294	1.170	2.417	10.118	3.606	1.337
17	2.259	1.635	2.588	1.219	2.616	1.128	2.981	0.971	2.360	0.979	2.852	0.964
18	2.871	1.473	2.743	1.557	2.578	1.597	3.344	0.843	5.736	0.608	--	--
19	3.276	1.054	2.955	1.686	2.965	1.914	3.974	1.018	2.661	2.769	7.110	0.579

Note: A '--' notes that the item was dropped because it was not aiding in the ability estimation process and was causing convergence errors.

Table 4-6. Descriptive statistics of crime proclivity ( $\theta$ ) measures (n = 670).

	Mean of $\theta$	SD of $\theta$	Min.	Max.
Wave 2 (control)	-0.007	0.790	-0.643	2.875
Wave 4 (outcome)	-0.003	0.759	-1.103	2.709
Wave 6 (control)	-0.008	0.716	-0.441	2.936
Wave 8 (outcome)	-0.010	0.687	-0.452	3.329
Wave 10 (control)	-0.007	0.675	-0.422	2.482
Wave 12 (outcome)	0.003	0.560	-0.252	2.706

Table 4-7. Descriptive statistics of friendship nominations (n = 670).

Wave	# of Friendship Nominations			
	Mean	SD	Min.	Max.
Wave 2	2.915	0.328	1	3
Wave 6	2.827	0.473	1	3
Wave 10	2.493	0.731	1	3

Table 4-8. Formal multiplexity items in the RYDS data.

Item #	Wording	Waves
1	(Friend) take place in church or religious activities with you?	2, 6, 10
2	(Friend) take part in school activities like clubs or special events, like a school play, with you?	2, 6
3	(Friend) take part in organized sports or teams outside of school with you?	2, 6
4	(Friend) take part in other organized groups like the "Y", Boys and Girls Club, or Scouts with you?	2, 6
5	(Friend) take part in school sports (intramurals or varsity sports, but not gym classes) with you?	2, 6
6	(Friend) take part in any organized musical or singing groups, including at school, with you?	2, 6
7	(Friend) take part in physical exercise like jogging, weightlifting, playing team sports like basketball or other sports like tennis or bowling with you?	10

Note: Root: Since (date of last interview), how often did ...

Table 4-9. Descriptive statistics of the average formal multiplexity shared with friends, per wave (means and standard deviations reported).

Item #	Wave 2	Wave 6	Wave 10	Range
1	1.751 (0.925)	1.626 (0.889)	1.875 (0.986)	1 – 4
2	1.663 (0.885)	1.414 (0.728)	--	1 – 4
3	2.166 (1.072)	1.612 (0.940)	--	1 – 4
4	1.642 (0.958)	1.429 (0.815)	--	1 – 4
5	1.708 (0.945)	1.519 (0.853)	--	1 – 4
6	1.488 (0.845)	1.336 (0.717)	--	1 – 4
7	--	--	2.502 (1.051)	1 – 4

Table 4-10. Descriptive statistics of the formal multiplexity factor score scales (n = 670).

	Mean	SD	Min.	Max.
Wave 2	0.000	3.922	-4.632	13.612
Wave 6	0.000	3.740	-3.094	16.110
Wave 10	0.000	1.540	-1.948	4.681

Table 4-11. Informal multiplexity items in the RYDS data.

Item #	Wording	Waves
1 <sup>R1</sup>	You and (Friend) get together where someone was using or selling drugs or alcohol?	2, 6, 10
2 <sup>R1</sup>	You and (Friend) get together where no adults were present?	2, 6
3 <sup>R1</sup>	You and (Friend) drive around with no special place to go?	2, 6
4 <sup>R2</sup>	How many times do you and (Friend) hang out on a street corner or in the streets?	10
5 <sup>R2</sup>	How many times do you and (Friend) just hang around someplace other than on a street corner or on the streets with no particular place to go?	10

Table 4-12. Descriptive statistics of the average informal multiplexity shared with friends, per wave (means and standard deviations reported; n = 670).

Item #	Wave 2	Wave 6	Wave 10	Range
1	1.139 (0.496)	1.304 (0.777)	1.629 (1.025)	1 – 5
2	3.237 (1.070)	3.226 (1.168)	--	1 – 5
3	1.621 (0.998)	1.719 (1.004)	--	1 – 5
4	--	--	1.527 (0.997)	1 – 5
5	--	--	2.436 (1.219)	1 – 5

Table 4-13. Descriptive statistics of the informal multiplexity factor score scales (n = 670).

	Mean	SD	Min.	Max.
Wave 2	0.000	2.057	-2.987	10.485
Wave 6	0.000	2.104	-3.011	8.544
Wave 10	0.000	2.245	-2.322	8.943

Table 4-14. Descriptive statistics for friendship stability measures, in months (n = 670).

	Mean	SD	Min.	Max.
Stability wave 3	5.228	1.418	0	6
Stability wave 6	4.693	1.813	0	6
Stability wave 10	82.572	57.013	0	252

Table 4-15. Friendship closeness items in the RYDS data.

Item #	Wording
1	Talk to (Friend) about personal or private things?
2	Ask (Friend) for advice when you need to make an important decision?
3	Borrow money from (Friend) if you need it?
4	Talk to (Friend) about problems you are having at home?
5	Talk to (Friend) about problems you are having with another friend?
6	How often do you feel you can trust (Friend) with just about anything you tell him/her?

Note: All items measured at W2, W6, and W10. Root: How often do you (W2 and W6) If you needed to, how likely would you be to (W10)

Table 4-16. Descriptive statistics of the average friendship closeness perceived towards friends, per wave (means and standard deviations reported; n = 670).

Item #	Wave 2	Wave 6	Wave 10	Range
1	2.893 (0.817)	3.124 (0.741)	3.425 (0.584)	1 – 4
2	2.817 (0.775)	3.011 (0.756)	3.314 (0.597)	1 – 4
3	2.192 (0.809)	2.427 (0.847)	2.966 (0.804)	1 – 4
4	2.322 (0.881)	2.723 (0.859)	3.157 (0.719)	1 – 4
5	2.835 (0.806)	2.965 (0.784)	3.322 (0.597)	1 – 4
6	3.384 (0.627)	3.440 (0.590)	3.421 (0.510)	1 – 4

Table 4-17. Descriptive statistics of the friendship closeness factor score scales (n = 670).

	Mean	SD	Min.	Max.
Wave 2	0.000	4.299	-13.736	9.445
Wave 6	0.000	4.627	-15.884	8.101
Wave 10	0.000	4.855	-16.473	6.850

Table 4-18. Friend deviance items in the RYDS data.

*Root: Since we last interviewed you, how many of your friends ...*

Item #	Wording	Waves
1	Used a weapon or force to get money or things from people?	3, 7, 11
2	Attacked someone with a weapon or with the idea of seriously hurting them?	3, 7, 11
3	Hit someone with the idea of hurting them?	3, 7, 11
4	Stole something worth more than \$5 but less than \$50?	3, 7, 11
5	Stole something worth more than \$100?	3, 7, 11
6	Damaged or destroyed someone else's property on purpose?	3, 7, 11
7	Took a car or motorcycle for a ride or drive without the owner's permission?	3, 7
8	Have been a member of a street gang or posse?	11

Table 4-19. Descriptive statistics of friend deviance items, per wave (means and standard deviations reported [n = 670]).

Item #	Wave 3	Wave 7	Wave 11	Range
1	1.208 (0.599)	1.174 (0.501)	1.167 (0.478)	1 – 4
2	1.320 (0.709)	1.287 (0.640)	1.264 (0.600)	1 – 4
3	1.720 (0.955)	1.558 (0.845)	1.605 (0.859)	1 – 4
4	1.312 (0.701)	1.226 (0.577)	1.297 (0.638)	1 – 4
5	1.167 (0.561)	1.167 (0.504)	1.213 (0.552)	1 – 4
6	1.357 (0.739)	1.300 (0.687)	1.210 (0.551)	1 – 4
7	1.238 (0.639)	1.261 (0.637)	--	1 – 4
8	--	--	1.215 (0.640)	1 – 4

Table 4-20. Descriptive statistics of the friend deviance factor score scales (n = 670).

	Mean	SD	Min.	Max.
Wave 3	0.000	5.500	-3.134	27.393
Wave 7	0.000	5.559	-2.996	31.596
Wave 11	0.000	5.321	-3.054	31.933

Table 4 -21. Descriptive statistics of statistical control variables (n = 670).

Measure	Wave 2	Wave 6	Wave 10	Range
High SES (=1)	0.706 (0.456)	0.632 (0.483)	0.775 (0.418)	0 – 1
Black (=1)	0.707 (0.455)	<i>Same as W2</i>	<i>Same as W2</i>	0 – 1
Hispanic (=1)	0.122 (0.328)	<i>Same as W2</i>	<i>Same as W2</i>	0 – 1
Male (=1)	0.704 (0.457)	<i>Same as W2</i>	<i>Same as W2</i>	0 – 1
Age	14.403 (0.761)	16.379 (0.775)	20.579 (0.790)	12 – 16 (W2) 14 – 18 (W6) 18 – 22 (W10)

## CHAPTER 5 ANALYTICAL STRATEGY

### **Structural Equation Modeling**

The first of two major parts of the statistical analysis in this project implements structural equation modeling (SEM). Structural equation models are primarily designed to test causal relationships. Because the models contain no reciprocal effects and residuals for the various equations are assumed to be uncorrelated, recursive models are implemented.

For the models proposed in this dissertation, SEMs are beneficial because they are capable of estimating effects of an independent variable on an outcome as well as effects of an independent variable on another predictor. Since the multiplexity measures are hypothesized to affect both friend deviance (a predictor) and crime proclivity (an outcome), the ability to estimate effects to both outcome and predictor variables is necessary.

The SEM technique uses path analysis to estimate effects to both independent and dependent variables. Three types of effects can be estimated. Direct effects describe the causal relationship that a predictor variable has on a predictor or outcome variable. The pathway is said to be direct since it is not hypothesized to work through any other variable. An indirect effect, on the other hand, addresses the causal impact that a predictor variable has on an endogenous variable through another predictor variable. That is, indirect effects allow one to investigate if the effect of independent variable *X* works through independent variable *Z* to affect dependent variable *Y*. Finally, total effects can be estimated in SEM modeling. A total effect, which is the sum

of the direct and indirect effects of a model, describes the full causal effect of a predictor variable on an endogenous variable.

The term path modeling is generally used to describe models that estimate direct, indirect, and/or total effects between observed variables. The term SEM is used when employing at least one latent variable in the equation. While most exogenous variables in this project are observed, the dependent variable – crime proclivity – is latent. Additionally, the exogenous prior crime proclivity control variable is also latent. Thus, the outcome variable and prior crime control variables are the structural components to the current project's SEM models. The measurement components of these SEMs are the 2PL item-response models that were described in Chapter 4. The structural component of the model (the crime proclivity estimates) was estimated simultaneously with the path portion of the model. Since the various independent variables are measured on different metrics, all factor loadings reported in results are standardized. All SEM models were estimated in Mplus version 5.1.

### **The Stepwise Procedure**

The hypotheses laid out in the Chapter 3 require a stepwise procedure be implemented. Each developmental time period's model will be built in three steps. Since there are three developmental time periods under investigation in the current project, nine total structural equation models will be estimated.

The first step is designed to provide a baseline understanding of how the exogenous control variables affect crime proclivity without any of the modality or differential association measures in the model. Thus, the first SEM estimated at each developmental period will estimate the effect of the four control variables discussed in Chapter 4 (SES, black and Hispanic dummy variables, and gender) directly onto the

crime outcome. This model is necessary to be able to evaluate the control variable mediation hypotheses (the 18<sup>th</sup>, 19<sup>th</sup>, and 20<sup>th</sup> hypotheses). The first model is visually provided in Figure 5-1.

The second model, depicted in Figure 5-2, adds in the modality and friend deviance variables. This model can consequently be labeled the full theoretical model since it provides a direct test to many theoretical hypotheses (it may help the reader to refer back to the summary of hypotheses presented in Table 3-9).

The first of several hypotheses the second step model tests is hypothesis one, which proposes that the friend deviance variable will positively relate to crime proclivity. This is tested with the direct effect specified from the friend deviance variable to the outcome.

This model also tests the multiplexity hypotheses. The formal multiplexity construct is hypothesized to negatively affect both friend deviance (hypothesis two) and crime proclivity (hypothesis three), and the informal multiplexity construct is hypothesized to positively affect friend deviance (hypothesis four) and crime proclivity (hypothesis five). To test these hypotheses, direct effects are estimated between formal multiplexity and informal multiplexity, friend deviance, and crime proclivity. The sixth and seventh hypotheses propose that a portion of the total effect of the multiplexity measures will be indirect. These hypotheses are tested through indirect effects from the exogenous multiplexity measures to crime proclivity that operate through the friend deviance variable. If the indirect effect from the multiplexity measures at time one to crime proclivity at time three is significant, then we could conclude that a significant portion of the total effect of formal and/or informal multiplexity on crime would be

indirect, supporting the sixth and seventh hypotheses. In this dissertation, effects are determined to be statistically significant if the Fisher's  $p$ -value is .05 or less.

The eighth and ninth hypotheses propose that the effect of duration and intensity will amplify the relationship between friend deviance and crime proclivity, respectively. To test the eighth hypothesis, the friendship stability measure was grand mean centered to protect against potential severe multicollinearity (see Studenmund, 2001). The friend deviance factor score scale is already mean centered, meaning it can be used in its present form. An interaction term was created from the friend deviance factor score scale and the mean centered friendship stability measure. This interaction term, which will serve as a test of the eighth hypothesis, was then specified to exert a direct effect on crime proclivity. Though no hypothesis necessitates the direct effect between friendship stability and crime be estimated, this path was estimated simply to protect against spuriousness since the measure is used in an interaction term (see Studenmund, 2001; also see Baron and Kenny, 1986).

To test the ninth hypothesis, a similar procedure was used. The factor score scales of intensity and friend deviance (both having a mean of zero) were multiplied together to create a multiplicative interaction term. This interaction term was specified to have a direct effect on crime. The direct effect of intensity to crime was controlled to protect against spuriousness in the interpretation of the moderation effect. Significant, positive effects from these interaction terms would yield support to the eighth and ninth hypotheses, and would suggest that the modalities of duration and intensity 'amplify' the effect of friend deviance onto crime proclivity.

Finally, the second step model will evaluate the extent to which the control variable mediation hypotheses are supported. If the social learning-social structure hypotheses are supported, the inclusion of the friend deviance and modality measures should substantially reduce the effect of the modalities on crime. If this happens, support would be yielded to the 18<sup>th</sup>, 19<sup>th</sup>, and 20<sup>th</sup> hypotheses.

The purpose of the third and final model to be estimated at each developmental period is to investigate if the observed effects remain significant when crime at time one is controlled. Thus, the actor's prior proclivity for crime will be added into the model and specified to have a direct effect on the outcome (refer to Figure 5-3). These models will measure change in crime proclivity between the time one and time three measurement points in each developmental period's model. No theoretical hypotheses are tied to this model, meaning its inclusion is strictly for the purpose of protecting against spuriousness and reducing specification bias.

In structural equation modeling, the standard errors of indirect effects are often unreliable (Hayes and Scharkow, in press). As a result, this can affect the substantive interpretations regarding how much of a total effect is indirect. Because of this, replication methods are recommended when estimating indirect effects in structural equation models (Hayes and Scharkow, in press). A replication method is generally designed to copy, or replicate, the sampling procedure so that the standard error estimates become more accurate. Replication techniques are iterative procedures, meaning that many replications of the original sample are generated.

Since the influence of formal and informal multiplexity on crime is hypothesized to be partially transmitted through friend deviance, a replication technique is necessary.

Ideally, the standard errors of indirect effects could be calculated in the process of the simultaneous estimation of the structural and path portions of the SEM. However, the software that is used to estimate the SEMs – Mplus – is not yet capable of performing replication methods while estimating item response models (Muthén and Muthén, 2010).

Thus, the indirect effects of formal and informal multiplexity on crime proclivity during each developmental period will be estimated outside of Mplus using the Monte Carlo method for assessing mediation (MCMAM). The MCMAM, which was developed by MacKinnon and colleagues (2004), replicates the original sample  $j$  number of times to estimate the indirect effect of predictor  $x$  transmitted through mediator  $z$  on outcome  $y$ . That is, the method iteratively replicates the sample to compute the indirect effect of  $x$  on  $y$  through mediator  $z$ . The MCMAM relies on the assumption that the variables involved in the mediation effect ( $x$  and  $z$ ) are asymptotically normally distributed. Because of the use of factor score scales, this assumption is met.

Specifically, the method calculates the indirect effect by taking random draws from the unstandardized regression coefficients and standard errors of  $x - z$  ( $b_1$ ) and  $z - y$  ( $b_2$ ). The two effects are multiplied, and this process is repeated many times. The resulting  $b_1 * b_2$  product is iterated to produce a confidence interval around the mean of  $b_1 * b_2$  (Selig and Preacher, 2008).

In the current project, the MCMAM confidence interval is used to test the sixth and seventh hypotheses. The MCMAM's calculation of the confidence interval tests the null hypothesis that there is no indirect effect of  $x$  transmitted through  $z$  on  $y$ . This

hypothesis is rejected if the confidence interval does not contain zero and supported if the confidence interval does contain zero.

To provide an example as to how the MCMAM is used in the current project, consider the informal multiplexity construct during middle adolescence, which is tied to the seventh hypothesis. The unstandardized regression coefficients of informal multiplexity on friend deviance (b1) and friend deviance on crime proclivity (b2) will be incorporated into the MCMAM replication technique. If the resulting confidence interval does not contain zero, the conclusion would be that a portion of the total effect of informal multiplexity on crime works through the friend deviance construct, supporting the seventh hypothesis. On the other hand, if the confidence interval does contain zero, the seventh hypothesis would not be supported since this would indicate that there is no indirect effect. Thus, the MCMAM procedure and resulting confidence interval will provide a concise and direct test of the sixth and seventh hypothesis.

Because many iterations are needed when using the MCMAM (MacKinnon et al., 2004), the current project follows the work of Wehrens and colleagues (2000, p. 46) and estimates the indirect effect's point estimate and confidence interval using 100,000 replications. The package developed by Selig and Preacher (2008) in the software R (v. 2.10.1) was used to estimate the indirect effects of the formal and informal multiplexity constructs.

### **Testing for Age Moderation**

The second major part of this analysis has the goal of determining whether age moderates the strengths of the modalities and friend deviance variables. The age-grading hypotheses (the tenth through the 17<sup>th</sup> hypotheses) are tested in this analysis.

Since models are estimated separately at all three age groups, coefficients and standard errors of the effects of the modalities and friend deviance construct need to be compared. Though the regression-based coefficient and standard error comparison test developed by Clogg and colleagues (1995) and used by Paternoster et al. (1998) is commonly used, it is inappropriate given the current situation because the same individuals are nested over time. As such, implementing the uncorrected Clogg et al. test would result in a comparison strategy that violates the assumption of independence.

Instead of using the Clogg et al. test, the coefficient and standard error comparison test developed in 2009 by staff at the University of California at Los Angeles' Institute for Digital Research and Education (UCLA IDRE) is used. This test, which can be performed in Stata, is conceptually similar to the Clogg test, but corrects for the lack of independence in the comparisons.

To perform this test, several steps were necessary. First, the test calls for the data to be transformed into a long file where individuals are nested within time. Thus, individuals were put into a long file where the time measure is a three-category variable that denotes whether the actor was in middle adolescence (coded "1"), late adolescence (coded "2"), or emerging adulthood (coded "3").

The test calls for measures tied to over-time hypotheses to be included in the long data file. As such, the factor score scales of formal multiplexity, informal multiplexity, friendship closeness, and friend deviance were moved into the new data file. The friend-weighted friendship stability item was also included, as were the

moderation effects of friendship stability and friendship closeness (the interaction terms between duration / intensity and friend deviance).

Second, the test requires that dummy variables be created at each time period. As such, the three-category age variable was transformed into dummy variables to denote if the actor was in late adolescence (1 = late adolescence; 0 = not late adolescence) or emerging adulthood (1 = emerging adulthood; 0 = not emerging adulthood). Middle adolescence, when friend influence is the strongest (e.g., Steinberg and Monahan, 2007), is treated as the comparison group.

The third step of the tests calls for the creation of interaction terms between predictors and the developmental period dummy variables. The formal multiplexity, informal multiplexity, and friend deviance measures were interacted with the late adolescence dummy variable, creating three multiplicative interactions. The moderation effects of friendship stability multiplied by friend deviance and friendship closeness multiplied by friend deviance were also interacted with the late adolescence dummy variable. Thus, five total interactions were created. Similar interactions were created using the emerging adulthood dummy variable.<sup>1</sup>

The coefficient comparison is performed in the fourth step. The two age dummy variables, ten multiplicative interaction terms, and main effects of the multiplexity, stability, closeness, and friend deviance variables were inserted into an ordinary least squares (OLS) regression model using Stata (v. 11.2). The outcome of this model, crime proclivity, was generated from a 2PL IRT model in Mplus which was imported into

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<sup>1</sup> Formal multiplexity was measured with six items at waves two and six, but only two items at wave ten. Because the change in the number of items affects the range and standard deviation of the formal multiplexity factor score scales, this measure is standardized.

Stata (descriptive statistics were reported in Tables 4-5 and 4-6). The use of the crime proclivity measure is beneficial since it is identical to the outcomes in the SEM models, thus allowing for consistency in the dependent variables in all models in this project. The OLS regression model was chosen since the outcome measure is normally distributed.

The first reported result from this comparison is a series of general post-hoc tests that evaluate the null hypothesis that the coefficient of  $X_1$  is not significantly different at the three developmental periods (testing the null hypothesis that  $bX_{1 \text{ MIDDLE ADOLESCENCE}} = bX_{1 \text{ LATE ADOLESCENCE}} = bX_{1 \text{ EMERGING ADULTHOOD}}$ ). If these tests reach statistical significance, this would suggest that the effect of  $X_1$  is not the same at all three developmental periods. However, these are general tests and will not reveal whether the coefficients differ over specific developmental periods. To evaluate this possibility, the regression results will be reported themselves to determine any observed significant differences. In this type of coefficient comparison test, substantive interpretations can only be drawn from the interaction terms (UCLA IDRE, 2009). A significant t-statistic from interaction  $Age * X_1$  indicates that  $X_1$  has a significantly different effect on crime proclivity over time. For instance, if the late adolescence-friend deviance interaction were to be negative and significant, this would indicate that the effect of friend deviance on crime proclivity would be significantly less in magnitude at late adolescence than middle adolescence (the comparison group). If a negative effect were also found for the emerging adulthood-friend deviance interaction, the conclusion would be that friend deviance has a significantly weaker impact on crime proclivity during emerging

adulthood than middle adolescence. Such a finding would offer support for the 15<sup>th</sup> hypothesis.

Note that the first comparison test treats middle adolescence as the comparison group. This means that this first comparison test can only evaluate how the predictors may vary in strength 1) in late adolescence compared to middle adolescence and 2) in emerging adulthood compared to middle adolescence. The age-grading hypotheses additionally necessitate that the same effects be compared between the period of late adolescence and emerging adulthood. Thus, a conceptually similar coefficient comparison test is used that treats late adolescence as the comparison category. The substantive comparisons from this model are drawn from the emerging adulthood interaction terms, as they indicate whether the modality and friend deviance variables affect crime significantly differently between the developmental periods of late adolescence and emerging adulthood.<sup>2</sup>

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<sup>2</sup> I would like to thank Dr. Raymond Paternoster for his guidance on how to perform these coefficient comparison tests.

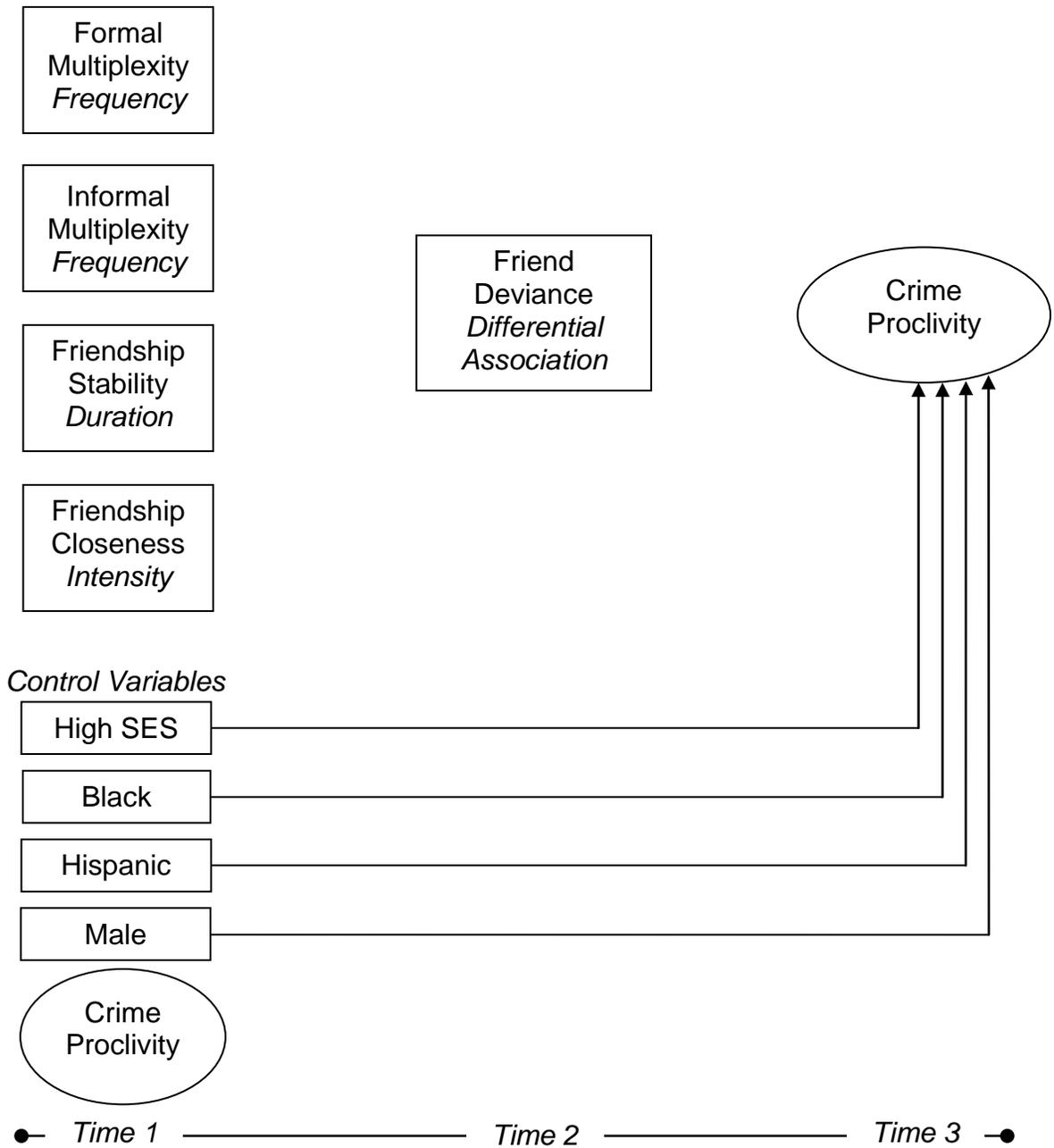


Figure 5-1. The first step of the stepwise procedure at each developmental period: The controls only mode. Notes: Direct effects represented by solid lines

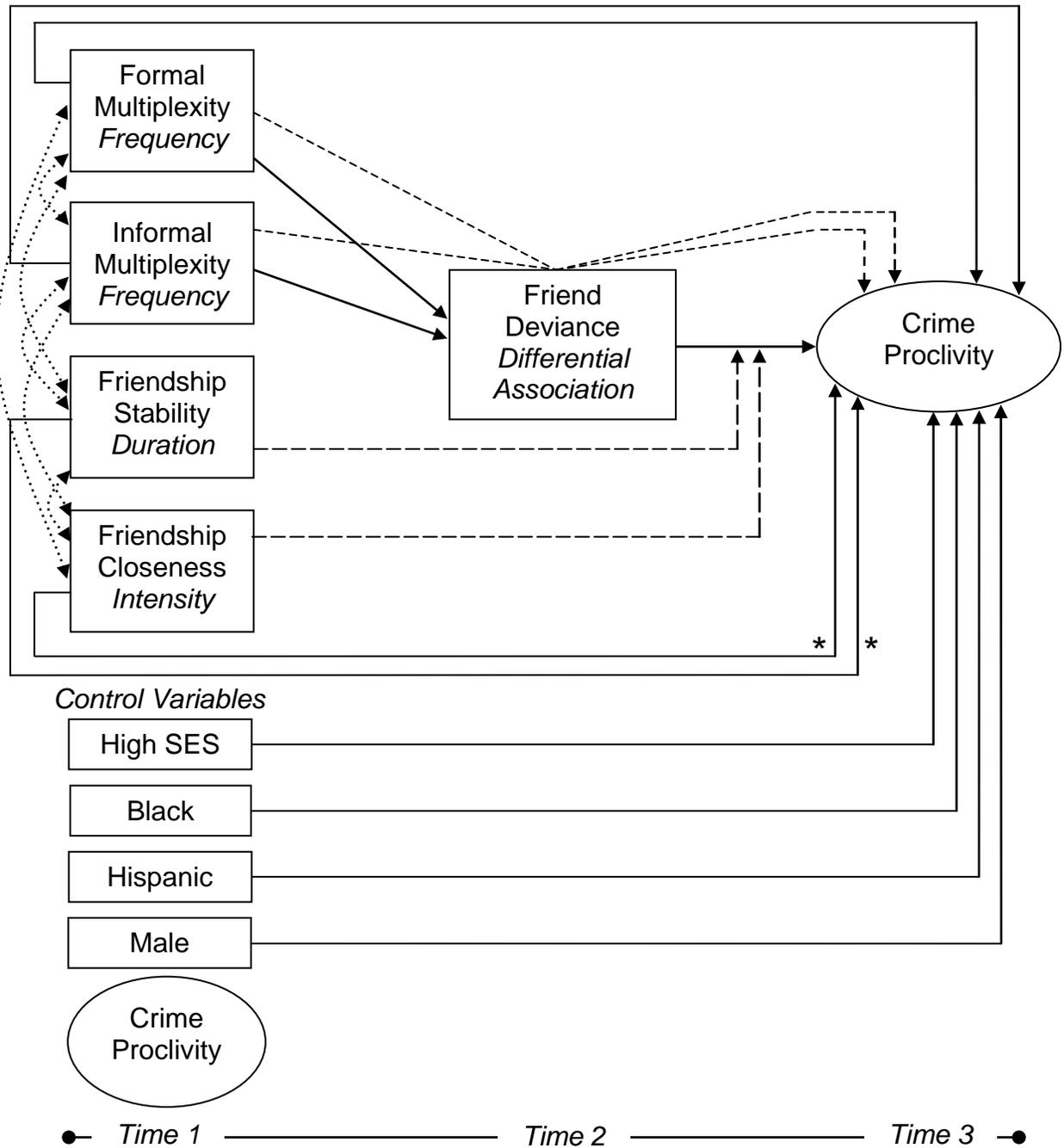


Figure 5-2. The second step of the stepwise procedure at each developmental period: The full theoretical model. Notes: Direct effects represented by solid lines. Indirect effects represented by short-dashed lines. Moderation effects represented by long-dashed lines. Total effects = Sum of direct and indirect effects (not pictured). A \* indicates that a path is estimated to protect against specification bias

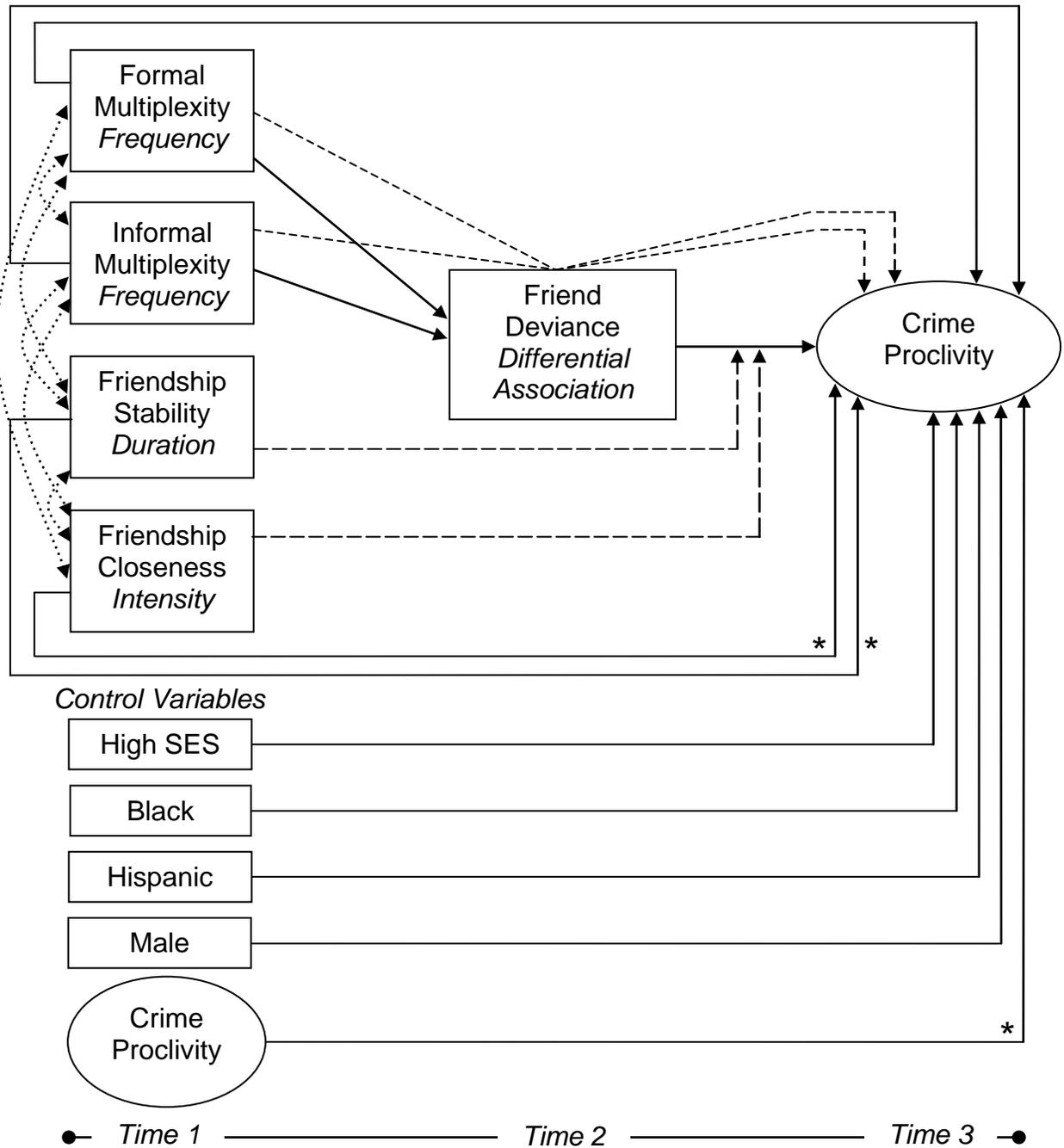


Figure 5-3. The third step of the stepwise procedure at each developmental period: The full theoretical model, plus the prior prime proclivity control variable. Notes: Direct effects represented by solid lines. Indirect effects represented by short-dashed lines. Moderation effects represented by long-dashed lines. Total effects = Sum of direct and indirect effects (not pictured). A \* indicates that a path is estimated to protect against specification bias

## CHAPTER 6 RESULTS

### Analysis Part One: Structural Equation Modeling

#### Middle Adolescence Results

Table 6-1 presents results from structural equation models for the developmental period of middle adolescence. This model estimates the relationships of four exogenous control variables – high SES, black, Hispanic, and male – with crime proclivity at wave four. All reported factor loadings are standardized.<sup>1</sup>

Two of the four control variables reach levels of significance. The SES variable has a significant, negative association with crime proclivity ( $b = -0.271$ ,  $SE = 0.131$ ,  $p < .05$ ), indicating that actors with lower SES have a higher proclivity towards crime than those with a higher SES. While the black and Hispanic race controls fail to reach significance, there is a relationship between gender and crime proclivity. Males have a significantly higher crime proclivity than females ( $b = 0.418$ ,  $SE = 0.151$ ,  $p < .01$ ).

Table 6-2 presents the next structural equation model, which includes variables to test theoretically derived hypotheses. The first portion of the table shows the direct effects of exogenous variables that are theorized to have a relationship with the friend deviance variable. Formal multiplexity has a non-significant association with friend deviance, failing to support the second hypothesis. However, informal multiplexity does.

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<sup>1</sup> There are relatively minor amounts of missing data in the current project. The average missingness on all items was between 0% and 5%, with the exception of two measures. The measure of welfare receipt at W6, which was reported by the parents of the G2 actors, had 9.1% missing responses. Additionally, for the 623 actors who reported three friends at W3, 60 (9.6%) failed to indicate if their third friendship had been stable. Under the assumption that the RYDS satisfies the conditions of having data missing at random, missing responses were imputed through the full information maximum likelihood (FIML) technique, which is sometimes referred to as direct maximum likelihood imputation. Generally, FIML uses the respondent's non-missing data to impute a missing value that would have been the most likely response, given available information in the dataset. Specifically, the technique uses beta weights of all the variables in an equation to generate the probability of all responses to a measure with missing data. The most likely response option – or, the one with the highest probability – is then imputed for the actor.

The relationship between informal multiplexity and friend deviance is positive ( $b = 0.055$ ,  $SE = 0.018$ ,  $p < .01$ ), supporting the fourth hypothesis and indicating that more informal

The next section shows the direct effects of exogenous and endogenous variables to the crime proclivity outcome. While formal multiplexity fails to have a significant relationship with crime proclivity, informal multiplexity is significant ( $b = 0.559$ ,  $SE = 0.106$ ,  $p < .001$ ). The positive coefficient suggests that higher informal multiplexity is associated with higher crime proclivity. These results do not support the third hypothesis, but do support the fifth hypothesis. The endogenous friend deviance variable also has a strong, positive, significant relationship with crime proclivity ( $b = 2.105$ ,  $SE = 0.245$ ,  $p < .001$ ), indicating that higher amounts of friend deviance are related to higher proclivities towards crime and offering support for hypothesis one. Finally, although the friendship stability and friendship closeness main effects are not tied to theoretical hypotheses, they are controlled for statistical purposes. They both fail to reach significance.

The relationships of the control variables from model one are largely unchanged when the theoretical predictors are added into the model. Socioeconomic status is negative and significantly related to crime ( $b = -0.251$ ;  $SE = 0.125$ ;  $p < .05$ ), the race controls are not significant, and males ( $b = 0.461$ ;  $SE = 0.172$ ;  $p < .01$ ) have a significantly higher crime proclivity than females. Overall, these results yield no support for the 18<sup>th</sup> through 20<sup>th</sup> hypotheses.

The next section of Table 6-2 shows the results of the moderation effects that friendship stability and friendship closeness are hypothesized to have on crime.<sup>2</sup>

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<sup>2</sup> Because there are interaction terms used with main effect variables, careful steps were taken to ensure that the models were able to distinguish between the effects of the predictor variables. Prior to the

Neither the interaction between friendship stability and friend deviance nor between friendship closeness and friend deviance approach statistical significance, thus yielding no support for the eighth or ninth hypotheses.

The final section of Table 6-2 shows results from an empirical test of the possibility that a portion of the total effect of formal and informal multiplexity is transmitted through friend deviance. The 95% confidence interval (CI) for the formal multiplexity construct from the Monte Carlo method for assessing mediation (MCMAM) contains zero, which indicates there is no significant, indirect effect of formal multiplexity on crime. This fails to support hypothesis six. On the other hand, the informal multiplexity confidence interval (95% CI lower limit [LL] = 0.040, upper limit [UL] = 0.199) does not contain zero. This suggests that a significant portion of the total effect of informal multiplexity on crime operates indirectly through the friend deviance measure, and supports hypothesis seven.

Structural equation modeling results presented in Table 6-3 show a conceptually similar model to that presented in Table 6-2, with the important change that prior crime proclivity is controlled in order to see if the same results are observed. Thus, this is a 'change model,' as it assesses change in crime proclivity across the developmental period.

Generally, the significant relationships that were observed in the prior model remain significant in the change model. Though formal multiplexity does not approach

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estimation of all models, variance inflation factors, tolerance statistics, and correlation statistics were all investigated to determine if the models were suffering from symptoms of severe multicollinearity. The variance inflation factors (VIFs) were all low (average VIF in middle adolescence = 1.24; late adolescence = 1.22; emerging adulthood = 1.27), the tolerances were all high (average tolerance in middle adolescence = 0.824; late adolescence = 0.836; emerging adulthood = 0.807), and the correlations were all within acceptable ranges (no inter-independent variable correlations above |0.6|). Thus, the models showed no symptoms of suffering from severe multicollinearity.

statistical significance, informal multiplexity has a significant, positive relationship with friend deviance ( $b = 0.035$ ,  $SE = 0.017$ ,  $p < .05$ ) and crime proclivity ( $b = 0.666$ ,  $SE = 0.101$ ,  $p < .001$ ). Friend deviance also is positive and significant, indicating that higher amounts of friend deviance are related to increases in crime proclivity ( $b = 2.430$ ,  $SE = 0.234$ ,  $p < .001$ ). The main effects of friendship stability and friendship closeness do not significantly relate to crime proclivity.

The control variables function similarly in the change model as they did in the first two models. Higher SES is related to decreases in crime proclivity ( $b = -0.264$ ,  $SE = 0.115$ ,  $p < .05$ ), and being male is related to increases in crime proclivity ( $b = 0.315$ ,  $SE = 0.138$ ,  $p < .05$ ). As in the prior two middle adolescence models, neither race dummy variable is significant. Prior crime proclivity at wave two, though, is positively and strongly related to crime proclivity at wave four ( $b = 0.795$ ,  $SE = 0.044$ ,  $p < .001$ ).

The moderation effects demonstrate that neither friendship stability nor friendship closeness moderates the relationship between friend deviance and crime. Additionally, there is no indirect effect of formal multiplexity on crime, as the MCMAM confidence interval contains zero. Informal multiplexity, however, does have a positive, indirect effect on crime proclivity through friend deviance (95% CI LL = 0.004, UL = 0.017). While significant, this indirect effect is small in magnitude since the confidence interval nearly contains zero.<sup>3</sup>

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<sup>3</sup> Given that there was variability around the mean age during the three developmental periods, all models were also reanalyzed with age as a control variable. The only time age reached levels of statistical significance was during the three middle adolescence structural equation models (corresponding with Tables 6-1 through 6-3). The direction of the relationship between age and crime proclivity was positive, indicating that older individuals during middle adolescence had a significantly higher crime proclivity than their younger counterparts. Despite being significant, the inclusion of the age control measure had no substantive impacts on any other variables in the models.

Table 6-4 reports zero-order correlations among the exogenous modality indicators. Formal multiplexity is positively and significantly related to both informal multiplexity ( $r = 0.187, p < .001$ ) and friendship closeness ( $r = 0.249, p < .001$ ). Additionally, informal multiplexity is significantly and positively correlated to friendship closeness ( $r = 0.263, p < .001$ ). None of the other modalities are significantly related to one another.

### **Late Adolescence**

The first structural equation model estimated during late adolescence is presented in Table 6-5. None of the control variables have a significant relationship with crime proclivity at wave eight (the outcome).

The second late adolescence model is presented in Table 6-6. Although formal multiplexity is negative and nearly significant, its  $p$ -value (.06) is above the .05 criteria, indicating that it shares no significant relationship with friend deviance. Informal multiplexity also does not share a significant relationship with friend deviance; collectively, this yields no support to the second or fourth hypotheses. The relationship between formal multiplexity and crime proclivity is also not significant, failing to support hypothesis three. However, the fifth hypothesis receives support since informal multiplexity does share a significant and positive association with crime proclivity ( $b = 0.560, SE = 0.130, p < .001$ ). Friend deviance also shares a significant, positive relationship with crime proclivity ( $b = 2.287, SE = 0.268, p < .001$ ), once again supporting the first hypothesis.

Aside from the direct effects of informal multiplexity and friend deviance to crime proclivity, no other statistical relationship in the second model during late adolescence reaches statistical significance. This includes the moderation effects of stability and

closeness and the indirect effects of formal and informal multiplexity (both confidence intervals contain zero). Collectively, this yields no support for hypotheses six through nine.

The results from the second model change slightly when prior crime proclivity is added into the model (see Table 6-7). The nearly significant association that was previously observed between formal multiplexity and friend deviance becomes significant in the third model ( $b = -0.056$ ,  $SE = 0.026$ ,  $p < .05$ ). The relationship is negative, indicating that more time spent with friends in supervised, formal contexts is related to less deviant acts committed by friends. Informal multiplexity ( $b = 0.565$ ,  $b = 0.129$ ,  $p < .001$ ) and friend deviance ( $b = 2.322$ ,  $SE = 0.264$ ,  $p < .001$ ) have statistically significant relationships with crime proclivity. The gender control variable also becomes significant when change in crime proclivity is addressed ( $b = 0.598$ ,  $SE = 0.253$ ,  $p < .05$ ), indicating that males are more likely to have had increases in crime proclivity than females during this developmental period. Recall that the gender control variable was not significant in the prior two late adolescence models. The significant relationship between gender and crime proclivity that emerges when prior crime proclivity is controlled does not support the 20<sup>th</sup> hypothesis because the significant relationship between gender and crime is not substantially mediated, but instead introduced. Crime proclivity at wave six also reaches statistical significance and is positively related to crime proclivity at wave eight ( $b = 0.705$ ,  $SE = 0.029$ ,  $p < .001$ ). Again, the duration and intensity modalities do not significantly moderate the association between friend deviance and crime proclivity. While informal multiplexity has no indirect effect, the indirect effect of formal multiplexity reaches significance when prior crime proclivity is

controlled. It has a significant, negative relationship with crime proclivity via friend deviance (95% CI LL = -0.257, UL = -0.012).

Table 6-8 presents the correlations among and between the four exogenous modality measures in the late adolescence structural models. Results demonstrate that friendship closeness is positively correlated with formal multiplexity ( $r = 0.214, p < .001$ ), informal multiplexity ( $r = 0.128, p < .001$ ), and friendship stability ( $r = 0.118, p < .01$ ). No other correlations are statistically significant.

### **Emerging Adulthood**

The first of the structural models estimated during emerging adulthood is presented in Table 6-9. Socioeconomic status is significantly related to crime proclivity ( $b = 2.701, SE = 1.241, p < .05$ ). Interestingly, the association between high SES and crime proclivity at wave twelve is positive, suggesting that actors who are not receiving government assistance are more likely to have a high crime proclivity than actors who are receiving government assistance. Additionally, gender is significant and positively related to crime proclivity ( $b = 2.168, SE = 1.088, p < .05$ ), indicating that males have higher crime proclivities than females during emerging adulthood. Race variables do not reach statistical significance.

The second structural equation model for emerging adulthood is presented in Table 6-10. Although formal multiplexity does not have a significant association with friend deviance, informal multiplexity does ( $b = 0.087, SE = 0.025, p < .001$ ). Higher informal multiplexity is associated with having significantly more deviant friends. This supports hypothesis four, but not hypothesis two.

Since formal multiplexity does not have a significant relationship with crime proclivity, the third hypothesis is not supported during the developmental period of

emerging adulthood. However, informal multiplexity does reach significance ( $b = 0.828$ ,  $SE = 0.131$ ,  $p < .001$ ), once again offering support for the fifth hypothesis. The direction of this relationship is positive; more time spent with friends in unsupervised activities and contexts is related to a higher proclivity for crime. Friend deviance also has a positive relationship with crime proclivity ( $b = 1.110$ ,  $SE = 0.357$ ,  $p < .01$ ), supporting the first hypothesis. Friendship stability is not significantly related to crime proclivity, but friendship closeness is ( $b = -1.330$ ,  $SE = 0.251$ ,  $p < .001$ ). Less perceived friendship closeness is related to higher crime proclivity.

Several control variables are also significant. As observed in the previous model, the SES variable is once again significant ( $b = 2.187$ ,  $SE = 0.310$ ,  $p < .001$ ); higher SES during emerging adulthood is related to higher crime proclivity. Both race variables are significantly associated with crime proclivity in the second model. Blacks are less likely to have a high crime proclivity than others ( $b = -0.833$ ,  $SE = 0.335$ ,  $p < .05$ ), and Hispanics are more likely to have a high crime proclivity than others ( $b = 0.835$ ,  $SE = 0.419$ ,  $p < .05$ ). On the other hand, the male control variable drops from significance when the theoretical measures are included. Thus, the 20<sup>th</sup> hypothesis is supported since the previously observed significant association between gender and crime proclivity becomes non-significant in the second model. However, the 18<sup>th</sup> and 19<sup>th</sup> hypotheses are not supported because the theoretical measures do not substantially mediate the association between SES or race on crime, respectively.

The friendship stability and friendship closeness variables do not moderate the association between friend deviance and crime proclivity. Once again, this fails to support hypotheses eight and nine. However, one indirect effect is observed. The

confidence interval of informal multiplexity does not contain zero (95% CI LL = 0.026, UL = 0.191), suggesting that a significant portion of the total effect of informal multiplexity on crime is transmitted through friend deviance. Like in other models, there is no observed indirect effect of formal multiplexity. Though this fails to support hypothesis six, it does support hypothesis seven.

The third model during emerging adulthood adds in the actor's prior crime proclivity estimate from wave ten (see Table 6-11). The significant relationships observed in the second model are all observed when prior crime proclivity is statistically controlled. Informal multiplexity has a significant, positive relationship with both friend deviance ( $b = 0.068$ ,  $SE = 0.025$ ,  $p < .01$ ) and crime proclivity ( $b = 0.889$ ,  $SE = 0.129$ ,  $p < .001$ ). Higher amounts of friend deviance are also related to increases in crime proclivity ( $b = 1.300$ ,  $SE = 0.403$ ,  $p < .001$ ). Though the main effect of friendship stability has no direct relationship with crime proclivity, friendship closeness again does ( $b = -1.388$ ,  $SE = 0.232$ ,  $p < .001$ ). Specifically, lower friendship closeness perceived by an actor is related to increases in the actor's proclivity towards crime.

The high SES variable is once again positively, significantly related to crime proclivity ( $b = 2.088$ ,  $SE = 0.303$ ,  $p < .001$ ). The crime proclivity of blacks is more likely to decrease than other races ( $b = -0.780$ ,  $SE = 0.293$ ,  $p < .01$ ), and the crime proclivity of Hispanics is more likely to increase ( $b = 0.754$ ,  $SE = 0.360$ ,  $p < .05$ ). Though gender does not reach statistical significance, the prior crime proclivity measure is positively and significantly related to crime proclivity at wave twelve ( $b = 0.290$ ,  $SE = 0.097$ ,  $p < .01$ ).

As shown in the prior models, the friendship stability and closeness variables do not moderate the friend deviance-crime proclivity relationship during emerging adulthood. And while formal multiplexity does not have an indirect effect on crime proclivity, the informal multiplexity construct does since its MCMAM confidence interval does not contain zero (95% CI LL = 0.017, UL = 0.187).

The correlations among the exogenous modality indicators during emerging adulthood are presented in Table 6-12. Only two observed significant correlations are observed. Friendship stability is positively related to both formal multiplexity ( $r = 0.125$ ,  $p < .01$ ) and friendship closeness ( $r = 0.105$ ,  $p < .01$ ).

### **Analysis Part Two: Evaluating the Age-Grading Hypotheses**

Using a longitudinal coefficient comparison test (UCLA IDRE, 2009), the analyses here explore whether the modalities and friend deviance variables have different influences on crime proclivity at three developmental periods. This analysis empirically tests the age-grading hypotheses (the tenth through 17<sup>th</sup> hypotheses).

The F-statistics of the post-hoc tests presented in Table 6-13 test the basic null hypothesis that the magnitude of the coefficient of an independent variable on crime proclivity does not vary across the three developmental periods ( $H_0 = bX_1 \text{ MIDDLE ADOLESCENCE} = bX_1 \text{ LATE ADOLESCENCE} = bX_1 \text{ EMERGING ADULTHOOD}$ ).<sup>4</sup> The F-statistic of formal multiplexity is weak ( $F = 0.14$ ) and does not approach significance, suggesting that the association between formal multiplexity and crime proclivity does not vary across

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<sup>4</sup> Since these models were estimated in Stata instead of Mplus, missing data was handled differently. In these comparison tests, a Markov Chain Monte Carlo (MCMC) imputation with 1,000 iterations was implemented. The MCMC imputation is a replication and iteration based technique that creates different datasets within the main dataset. It is a robust method when used in normally distributed regression models under the assumption that data are missing at random (Gelman et al., 2004; Little and Rubin, 2002).

developmental period. However, informal multiplexity has a significantly different association with crime proclivity at different periods of development, as the F-statistic reaches significance ( $F = 3.68, p < .05$ ). Results also show that friend deviance has significantly different associations with crime proclivity across developmental periods ( $F = 10.24, p < .001$ ), failing to support the eleventh hypothesis and instead supporting the 13<sup>th</sup> hypothesis.

Though the friend deviance variable has a significantly different association with crime proclivity across adolescence and into emerging adulthood, the interaction effect between friendship stability and friend deviance does not. The coefficient of this interaction effect demonstrates that friendship stability does not moderate the friend deviance-crime relationship with different strengths over the time periods investigated here ( $F = 0.03$ ). However, friendship closeness does moderate the friend deviance-crime proclivity relationship differently during some developmental periods ( $F = 3.51, p < .05$ ).

Overall, three of four measures of the modalities investigated have significantly different associations with crime proclivity over time. These results yield partial support for both the tenth and twelfth hypotheses.

While the post-hoc tests indicate that some coefficients vary in magnitude over the developmental periods, they do not indicate between which developmental periods the significant differences are present. An OLS-based coefficient comparison test presented in Table 6-14 probes into where significant differences are located across developmental periods. This model interacts variables tied to the age-grading hypotheses with two dummy variables denoting whether actors were in late

adolescence or emerging adulthood. The comparison group is middle adolescence, when the influence of friends is the strongest (Steinberg and Monahan, 2007).

The first series of comparisons presented in Table 6-14 test for the possibility that the magnitude of the coefficients of theoretical predictors may be significantly weaker or stronger during the period of late adolescence than middle adolescence.

The first interaction, which investigates the relationship of formal multiplexity with crime proclivity at late adolescence compared to middle adolescence, does not reach significance, suggesting that the association between formal multiplexity and crime proclivity is not significantly different between the two time periods. The association of informal multiplexity, however, does reach low levels of statistical significance ( $b = -.034$ ,  $SE = .018$ ,  $p = .05$ ). The negative direction of the coefficient suggests that informal multiplexity has a significantly weaker relationship with crime proclivity in the developmental period of late adolescence than it does middle adolescence. Neither friend deviance nor the interaction of friendship stability-friend deviance reach significance, meaning they do not vary in magnitude between middle and late adolescence. However, friendship closeness does have a significantly different relationship on the association between friend deviance and crime proclivity during middle and late adolescence ( $b = .004$ ,  $SE = .001$ ,  $p < .05$ ). The positive direction of this coefficient indicates that friendship closeness moderates the friend deviance-crime relationship more strongly during late adolescence than middle adolescence.

The next set of interactions investigates the potential for significant differences in coefficient strength at the developmental period of emerging adulthood compared to middle adolescence. Again, the formal multiplexity interaction does not reach

significance, but the informal multiplexity interaction does. The coefficient is significant and negative ( $b = -.046$ ,  $SE = .017$ ,  $p < .01$ ), revealing that informal multiplexity has a significantly weaker relationship with crime in emerging adulthood than in middle adolescence. The coefficient of friend deviance is also negative and significant ( $b = -.029$ ,  $SE = .007$ ,  $p < .001$ ), indicating that this construct has a significantly weaker association with crime proclivity during emerging adulthood than middle adolescence. While the duration modality does not moderate the friend deviance-crime proclivity relationship at the developmental periods of middle adolescence and emerging adulthood, the friendship closeness measure does. Friendship closeness has a significantly stronger moderating influence on the friend deviance-crime proclivity relationship in emerging adulthood than middle adolescence ( $b = .004$ ,  $SE = .001$ ,  $p < .05$ ).

Although the main effects of all variables used in an interaction are controlled, they offer no extra information for the age-grading hypotheses. As such, these results are not discussed.

Overall, results from the first comparison tests demonstrate that informal multiplexity is significantly stronger during middle adolescence than during late adolescence and emerging adulthood, supporting the 14<sup>th</sup> hypothesis. Additionally, friendship closeness amplifies the relationship between friend deviance and crime more strongly during late adolescence and emerging adulthood compared to middle adolescence. However, the age-grading differences in the friendship closeness-friend deviance interaction are of little importance since this interaction term was never significantly related to crime proclivity in the structural equation models. Thus, the 14<sup>th</sup>

hypothesis receives only minute support. Finally, the coefficient of friend deviance on crime proclivity is significantly stronger during emerging adulthood compared to middle adolescence. This association is not present during the period of late adolescence compared to middle adolescence, however, yielding partial support to the 15<sup>th</sup> hypothesis.

The prior comparison test was able to explore where some age differences may be. However, it was only able to compare the developmental periods of 1) late adolescence to middle adolescence and 2) emerging adulthood to middle adolescence. Since the 16<sup>th</sup> and 17<sup>th</sup> hypotheses propose that there may be significant differences between late adolescence and emerging adulthood, a similar comparison test is performed that treats late adolescence as the comparison group (see Table 6-15).

The first part of this model examines the magnitude of coefficients for the modalities and friend deviance variables during late adolescence compared to middle adolescence. Results are identical to the prior model, but with opposite directional associations because the comparison groups are switched. The substantive interpretations to be drawn come from the late adolescence compared to emerging adulthood portion of the test. Neither the association between formal or informal multiplexity and crime proclivity significantly varies between these two periods. However, the magnitude of the associations between friend deviance and crime proclivity does significantly differ ( $b = -.026$ ,  $SE = .007$ ,  $p < .001$ ). The negative direction of the friend deviance coefficient indicates that the association between friend deviance and crime proclivity is significantly lower during emerging adulthood than late adolescence, offering support to the 17<sup>th</sup> hypothesis. The moderating influences of the

duration and intensity modalities on the friend deviance-crime proclivity relationship do not vary between these developmental periods. Overall, none of the coefficients of the modalities vary between late adolescence and emerging adulthood, which fails to support the 16<sup>th</sup> hypothesis.

### **Summary of Results**

Using structural equation models and longitudinal coefficient comparison tests, this analysis has tested a series of developmental hypotheses derived from differential association and social learning theories. Two consistent results have appeared. First, the construct of differential association, operationalized through a measure of friend deviance, is positively related to crime proclivity across all three developmental periods. Second, informal multiplexity is positively and consistently related to both friend deviance and crime proclivity during the developmental stages.

Two other findings are relevant to the friend deviance and informal multiplexity constructs. First, the effects of friend deviance and informal multiplexity were found to vary across the different developmental stages, meaning they hold different associations with crime at different points in the life-course. Specifically, the magnitude of the strength of the coefficients for friend deviance and informal multiplexity is stronger during adolescence than emerging adulthood. Second, significant indirect effects with the MCMAM procedure suggest that the effect of informal multiplexity on crime is partially transmitted through the friend deviance construct. In summary, there is much support for the friend deviance and informal multiplexity constructs being important correlates of crime during several developmental periods.

The remainder of the results was characterized by sporadic combinations of significant relationships. While friendship stability never reaches levels of statistical

significance, formal multiplexity, friendship closeness, and the control variables occasionally reached significance during various developmental periods. However, the moderations of friendship stability and friend deviance and friendship closeness and friend deviance never reached levels of significance. Perhaps due to mostly non-significant effects, the relationship that these variables had with crime proclivity did not change over time. Overall, this portion of the results yields only moderate support to the notion that these variables are associated with criminal behavior at all developmental stages – a point which is a primary focus of Chapter 7.

Table 6-1. Results from the first structural equation model estimated during the developmental period of middle adolescence: Crime proclivity outcome (n = 670).

	b	SE	t-value
Direct Effects to Friend Deviance			
Formal multiplexity	--	--	--
Informal multiplexity	--	--	--
Direct Effects to Crime Proclivity			
Formal multiplexity	--	--	--
Informal multiplexity	--	--	--
Friend deviance	--	--	--
Friendship stability	--	--	--
Friendship closeness	--	--	--
High SES	-0.271	0.131	-2.073*
Black	-0.211	0.180	-1.170
Hispanic	0.210	0.226	0.930
Male	0.418	0.151	2.767**
Prior crime proclivity	--	--	--
Moderation Effects			
Friendship stability * Friend deviance	--	--	--
Friendship closeness * Friend deviance	--	--	--
	95% CI Lower Limit	95% CI Upper Limit	
Indirect Effects (with MCMAM)			
Formal multiplexity	--	--	
Informal multiplexity	--	--	

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table 6-2. Results from the second structural equation model estimated during the developmental period of middle adolescence: Crime proclivity outcome (n = 670).

	b	SE	t-value
<b>Direct Effects to Friend Deviance</b>			
Formal multiplexity	-0.033	0.035	-0.936
Informal multiplexity	0.055	0.018	3.047**
<b>Direct Effects to Crime Proclivity</b>			
Formal multiplexity	0.285	0.271	1.049
Informal multiplexity	0.559	0.106	5.279***
Friend deviance	2.105	0.245	8.596***
Friendship stability	-0.052	0.070	-0.746
Friendship closeness	-0.092	0.259	-0.355
High SES	-0.251	0.125	-2.014*
Black	-0.031	0.196	-0.157
Hispanic	0.025	0.256	0.098
Male	0.461	0.172	2.682**
Prior crime proclivity	--	--	--
<b>Moderation Effects</b>			
Friendship stability * Friend deviance	0.023	0.380	0.059
Friendship closeness * Friend deviance	0.861	1.525	0.564
	<u>95% CI Lower Limit</u>	<u>95% CI Upper Limit</u>	
<b>Indirect Effects (with MCMAM)</b>			
Formal multiplexity	-0.219	0.075	
Informal multiplexity	0.040	0.199	

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table 6-3. Results from the third structural equation model estimated during the developmental period of middle adolescence: Crime proclivity outcome (n = 670).

	b	SE	t-value
<b>Direct Effects to Friend Deviance</b>			
Formal multiplexity	-0.013	0.035	-0.385
Informal multiplexity	0.035	0.017	2.034*
<b>Direct Effects to Crime Proclivity</b>			
Formal multiplexity	0.320	0.262	1.222
Informal multiplexity	0.666	0.101	6.601***
Friend deviance	2.430	0.234	10.403***
Friendship stability	-0.072	0.066	-1.097
Friendship closeness	0.119	0.243	0.489
High SES	-0.264	0.115	-2.287*
Black	0.201	0.172	1.166
Hispanic	-0.242	0.242	-1.004
Male	0.315	0.138	2.289*
Prior crime proclivity	0.795	0.044	18.181***
<b>Moderation Effects</b>			
Friendship stability * Friend deviance	-0.020	0.390	-0.052
Friendship closeness * Friend deviance	0.894	1.509	0.592
	95% CI Lower Limit	95% CI Upper Limit	
<b>Indirect Effects (with MCMAM)</b>			
Formal multiplexity	-0.202	0.135	
Informal multiplexity	0.004	0.017	

\* p ≤ .05 \*\* p ≤ .01 \*\*\* p ≤ .001

Table 6-4. Correlations among exogenous modality indicators: Middle adolescence (n = 670).

	FM	IM	FS	FC
Formal multiplexity (FM)	1.000			
Informal multiplexity (IM)	0.187***	1.000		
Friendship stability (FS)	-0.041	-0.044	1.000	
Friendship closeness (FC)	0.249**	0.263***	-0.011	1.000

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table 6-5. Results from the first structural equation model estimated during the developmental period of late adolescence: Crime proclivity outcome (n = 670).

	b	SE	t-value
<b>Direct Effects to Friend Deviance</b>			
Formal multiplexity	--	--	--
Informal multiplexity	--	--	--
<b>Direct Effects to Crime Proclivity</b>			
Formal multiplexity	--	--	--
Informal multiplexity	--	--	--
Friend deviance	--	--	--
Friendship stability	--	--	--
Friendship closeness	--	--	--
High SES	-0.147	0.202	-0.730
Black	0.091	0.720	0.126
Hispanic	-0.123	0.910	-0.135
Male	0.287	0.414	0.692
Prior crime proclivity	--	--	--
<b>Moderation Effects</b>			
Friendship stability * Friend deviance	--	--	--
Friendship closeness * Friend deviance	--	--	--
	95% CI Lower Limit	95% CI Upper Limit	
<b>Indirect Effects (with MCMAM)</b>			
Formal multiplexity	--	--	
Informal multiplexity	--	--	

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table 6-6. Results from the second structural equation model estimated during the developmental period of late adolescence: Crime proclivity outcome (n = 670).

	b	SE	t-value
<b>Direct Effects to Friend Deviance</b>			
Formal multiplexity	-0.055	0.029	-1.937
Informal multiplexity	0.028	0.020	1.428
<b>Direct Effects to Crime Proclivity</b>			
Formal multiplexity	0.183	0.328	0.556
Informal multiplexity	0.560	0.130	4.324***
Friend deviance	2.287	0.268	8.530***
Friendship stability	-0.080	0.099	-0.814
Friendship closeness	-0.192	0.429	-0.447
High SES	-0.081	0.157	-0.517
Black	0.080	0.394	0.204
Hispanic	-0.113	0.470	-0.240
Male	0.515	0.335	1.537
Prior crime proclivity	--	--	--
<b>Moderation Effects</b>			
Friendship stability * Friend deviance	-0.400	0.665	-0.602
Friendship closeness * Friend deviance	-1.447	2.514	-0.576
	95% CI Lower Limit	95% CI Upper Limit	
<b>Indirect Effects (with MCMAM)</b>			
Formal multiplexity	-0.265	0.004	
Informal multiplexity	-0.025	0.159	

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table 6-7. Results from the third structural equation model estimated during the developmental period of late adolescence: Crime proclivity outcome (n = 670).

	B	SE	t-value
<b>Direct Effects to Friend Deviance</b>			
Formal multiplexity	-0.056	0.026	-2.159*
Informal multiplexity	0.026	0.019	1.369
<b>Direct Effects to Crime Proclivity</b>			
Formal multiplexity	0.222	0.282	0.788
Informal multiplexity	0.565	0.129	4.366***
Friend deviance	2.322	0.264	8.797***
Friendship stability	-0.080	0.106	-0.752
Friendship closeness	-0.321	0.363	-0.885
High SES	-0.069	0.141	-0.493
Black	0.050	0.280	0.177
Hispanic	-0.077	0.331	-0.233
Male	0.598	0.253	2.365*
Prior crime proclivity	0.705	0.029	24.530***
<b>Moderation Effects</b>			
Friendship stability * Friend deviance	-0.380	0.612	-0.620
Friendship closeness * Friend deviance	-0.850	2.180	-0.390
	95% CI Lower Limit	95% CI Upper Limit	
<b>Indirect Effects (with MCMAM)</b>			
Formal multiplexity	-0.257	-0.012	
Informal multiplexity	-0.026	0.152	

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table 6-8. Correlations among exogenous modality indicators: Late adolescence (n = 670).

	FM	IM	FS	FC
Formal multiplexity (FM)	1.000			
Informal multiplexity (IM)	0.046	1.000		
Friendship stability (FS)	0.060	0.056	1.000	
Friendship closeness (FC)	0.214***	0.128***	0.118**	1.000

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table 6-9. Results from the first structural equation model estimated during the developmental period of emerging adulthood: Crime proclivity outcome (n = 670).

	b	SE	t-value
<b>Direct Effects to Friend Deviance</b>			
Formal multiplexity	--	--	--
Informal multiplexity	--	--	--
<b>Direct Effects to Crime Proclivity</b>			
Formal multiplexity	--	--	--
Informal multiplexity	--	--	--
Friend deviance	--	--	--
Friendship stability	--	--	--
Friendship closeness	--	--	--
High SES	2.701	1.241	2.175*
Black	-1.233	1.236	-0.998
Hispanic	1.366	1.574	0.867
Male	2.168	1.088	1.992*
Prior crime proclivity	--	--	--
<b>Moderation Effects</b>			
Friendship stability * Friend deviance	--	--	--
Friendship closeness * Friend deviance	--	--	--
	95% CI Lower Limit	95% CI Upper Limit	
<b>Indirect Effects (with MCMAM)</b>			
Formal multiplexity	--	--	
Informal multiplexity	--	--	

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table 6-10. Results from the second structural equation model estimated during the developmental period of emerging adulthood: Crime proclivity outcome (n = 670).

	B	SE	t-value
<b>Direct Effects to Friend Deviance</b>			
Formal multiplexity	-0.001	0.020	-0.035
Informal multiplexity	0.087	0.025	3.411***
<b>Direct Effects to Crime Proclivity</b>			
Formal multiplexity	0.114	0.145	0.785
Informal multiplexity	0.828	0.131	6.322***
Friend deviance	1.110	0.357	3.111**
Friendship stability	-2.976	3.282	-0.907
Friendship closeness	-1.330	0.251	-5.304***
High SES	2.187	0.310	7.065***
Black	-0.833	0.335	-2.485*
Hispanic	0.835	0.419	1.995*
Male	4.658	2.841	1.640
Prior crime proclivity	--	--	--
<b>Moderation Effects</b>			
Friendship stability * Friend deviance	9.879	19.916	0.496
Friendship closeness * Friend deviance	-0.924	1.651	-0.560
	95% CI Lower Limit	95% CI Upper Limit	
<b>Indirect Effects (with MCMAM)</b>			
Formal multiplexity	-0.049	0.046	
Informal multiplexity	0.026	0.191	

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table 6-11. Results from the third structural equation model estimated during the developmental period of emerging adulthood: Crime proclivity outcome (n = 670).

	B	SE	t-value
<b>Direct Effects to Friend Deviance</b>			
Formal multiplexity	0.002	0.020	0.077
Informal multiplexity	0.068	0.025	2.763**
<b>Direct Effects to Crime Proclivity</b>			
Formal multiplexity	0.101	0.126	0.799
Informal multiplexity	0.889	0.129	6.915***
Friend deviance	1.300	0.403	3.229***
Friendship stability	-2.527	3.300	-0.766
Friendship closeness	-1.388	0.232	-5.983***
High SES	2.088	0.303	6.894***
Black	-0.780	0.293	-2.659**
Hispanic	0.754	0.360	2.097*
Male	5.965	5.491	1.086
Prior crime proclivity	0.290	0.097	2.984**
<b>Moderation Effects</b>			
Friendship stability * Friend deviance	10.406	21.167	0.492
Friendship closeness * Friend deviance	-1.155	1.916	-0.603
<b>Indirect Effects (with MCMAM)</b>			
	95% CI Lower Limit	95% CI Upper Limit	
Formal multiplexity	-0.052	0.059	
Informal multiplexity	0.017	0.187	

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table 6-12. Correlations among exogenous modality indicators: Emerging adulthood (n = 670).

	FM	IM	FS	FC
Formal multiplexity (FM)	1.000			
Informal multiplexity (IM)	0.066	1.000		
Friendship stability (FS)	0.125**	0.070	1.000	
Friendship closeness (FC)	0.084	0.001	0.105**	1.000

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table 6-13. Comparison tests evaluating the null hypothesis that the coefficients of predictors do not vary in magnitude across developmental period: Crime proclivity outcome (n = 670).

Construct	F-statistic of comparison	Does magnitude of coefficient vary across the developmental periods?
Formal multiplexity	0.14	No
Informal multiplexity	3.68*	Yes
Friend deviance	10.24***	Yes
Friendship stability – friend deviance moderation	0.03	No
Friendship closeness – friend deviance moderation	3.51*	Yes

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$ . Note: Testing  $H_0 = bX_1 \text{ MIDDLE ADOLESCENCE} = bX_1 \text{ LATE ADOLESCENCE} = bX_1 \text{ EMERGING ADULTHOOD}$

Table 6-14. Regression based coefficient comparison test evaluating change in coefficient magnitude between middle adolescence and late adolescence and middle adolescence and emerging adulthood: Crime proclivity outcome (n = 670).

	B	SE	t-value
Late Adolescence (LA) Compared to Middle Adolescence			
Formal multiplexity * LA dummy	.003	.009	0.37
Informal multiplexity * LA dummy	-.034	.018	-1.96*
Friend deviance * LA dummy	-.003	.007	-0.47
Friendship stability – friend deviance moderation * LA dummy	-.000	.001	-0.17
Friendship closeness – friend deviance moderation * LA dummy	.004	.001	2.19*
Emerging Adulthood (EA) Compared to Middle Adolescence			
Formal multiplexity * EA dummy	.007	.015	0.47
Informal multiplexity * EA dummy	-.046	.017	-2.64**
Friend deviance * EA dummy	-.029	.007	-4.16***
Friendship stability – Friend deviance moderation * EA dummy	-.000	.000	-0.00
Friendship closeness – Friend deviance moderation * EA dummy	.004	.001	2.43*
Controls			
Late adolescence (LA) dummy	-.012	.035	-0.35
Emerging adulthood (EA) dummy	.036	.048	0.74
Formal multiplexity	.000	.006	0.07
Informal multiplexity	.076	.013	5.82***
Friendship stability	-.000	.000	-1.11
Friendship closeness	-.003	.003	-0.88
Friend deviance	.045	.005	8.92***
Friendship stability – friend deviance moderation	-.000	.000	-0.23
Friendship closeness – friend deviance moderation	-.003	.001	-3.08**
Model Statistic			
F	13.32***		

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table 6-15. Regression based coefficient comparison test evaluating change in coefficient magnitude between late adolescence and middle adolescence and late adolescence and emerging adulthood: Crime proclivity outcome (n = 670).

	B	SE	t-value
Late Adolescence Compared to Middle Adolescence (MA)			
Formal multiplexity * MA dummy	-.003	.009	-0.37
Informal multiplexity * MA dummy	.034	.018	1.96*
Friend deviance * MA dummy	.003	.007	0.47
Friendship stability – friend deviance moderation * MA dummy	.000	.001	0.17
Friendship closeness – friend deviance moderation * MA dummy	-.004	.001	-2.19*
Late Adolescence Compared to Emerging Adulthood (EA)			
Formal multiplexity * EA dummy	.003	.015	0.22
Informal multiplexity * EA dummy	-.011	.017	-0.68
Friend deviance * EA dummy	-.026	.007	-3.76***
Friendship stability – Friend deviance moderation * EA dummy	.000	.000	0.25
Friendship closeness – Friend deviance moderation * EA dummy	.001	.001	0.40
Controls			
Middle adolescence (MA) dummy	.012	.035	0.35
Emerging adulthood (EA) dummy	.048	.047	1.02
Formal multiplexity	.004	.007	0.56
Informal multiplexity	.041	.012	3.44***
Friendship stability	-.000	.000	-1.11
Friendship closeness	-.003	.003	-0.88
Friend deviance	.041	.005	8.59***
Friendship stability – friend deviance moderation	-.000	.000	-0.51
Friendship closeness – friend deviance moderation	-.000	.001	-0.29
Model Statistic			
F	13.32***		

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

## CHAPTER 7 DISCUSSION AND CONCLUSIONS

Friend influence is central to Sutherland's (1947) differential association theory, social learning theory, social network research, and the developmental/life-course approach to studying crime. Drawing on this key similarity between the various perspectives, this dissertation has provided a developmentally sensitive empirical test of differential association theory, which incorporated concepts from social network studies. Chapter 7 provides a discussion of the empirical results as they relate to theory and policy, identifies limitations, offers ideas for future research, and provides some concluding remarks.

In general, the hypotheses proposed in Chapter 3 received mixed support as a whole. Some hypotheses were completely supported, some were partially supported, and others were not supported.

Several of the hypotheses that received nearly complete support were hypotheses one, 13, and 17. The first hypothesis, which stated that friend deviance would positively relate to crime, was rooted in the theoretical work of Sutherland (1947) and Akers (e.g., Burgess and Akers, 1966), as well as a tremendous amount of empirical literature that finds such a relationship (e.g., see Pratt et al., 2010). Consistent with Sutherland and Akers, results revealed that friend deviance is consistently and positively related to crime. Given the plethora of studies showing support for this relationship (see Pratt et al., 2010), this conclusion by itself is not a substantial advancement to crime literature.

The advancement instead comes from the finding that the friend deviance construct has an age-varying association with crime proclivity (hypothesis 13). While

the relationship of friend deviance with crime was significant in each model, the magnitude was stronger during middle and late adolescence compared to emerging adulthood (hypothesis 17).

The finding of an age-graded association between friend deviance and crime is important for at least three reasons. First, this finding validates past research that speculates and/or suggests that such an association would exist (e.g., Giordano et al., 2003; Piquero et al., 2003; Warr, 1998; 2002). It also meshes nicely with research on the inverted, U-shaped friend influence curve observed in social psychology (see Brown, 2004; Steinberg and Monahan, 2007). This research concludes that the most influential time for the transmission of social influence is middle adolescence (also see Simons and colleagues' research on early and late starters [1994]). Indeed, the same appears true for behavioral transmission, as well. Considered together, friends seem to be most influential on an actor's characteristics and behavior during adolescence (see Warr, 1993).

Second, the finding of an age-graded influence of friend deviance is theoretically important. In his social learning-social structure model, Akers (1998 [2009]) hypothesizes that the effects of social learning variables, and differential association specifically, should not vary in strength over time (this was the eleventh hypothesis). While it is true that the association between friend deviance and crime was significant during all developmental periods, the strength of the association did vary, suggesting that more research is needed to examine the validity of the social learning-social structure component of social learning theory.

If future studies were to reach similar conclusions, a potential suggestion would be to age-grade the social learning construct. An age-graded social learning theory would have three immediate advantages. First, a change that reformulates the theory's stance on the age-grading of theoretical variables would follow empirical evidence here and elsewhere (e.g., Steinberg and Monahan, 2007; Warr, 1998; 2002) that suggests friend influence may vary over the life-course, making it a more comprehensive theory. Second, such an alteration would also closely follow the developmental paradigm as well as Cullen's (2011) perspective. Third, and perhaps most importantly, altering social learning theory to include age-graded hypotheses would aid the developmental paradigm by providing another perspective through which to think about crime over the life-course. Given the mixed support regarding Moffitt's (1993) influential dual taxonomy paradigm (Blokland et al., 2005; Gottfredson, 2005; Krohn et al., 2001), another theoretical approach seems quite warranted (even though there is support for other constructs, such as Sampson and Laub's [1994] social control theory and Thornberry's [1987] interactional theory [see Matsueda and Anderson, 1998; Paternoster and Brame, 1997; Sampson and Laub, 2005]).

Akers and Cullen have both been outspoken supporters of the developmental and life-course paradigms. They both recognize the empirical and pragmatic need to investigate how criminological variables, constructs, and theories function across various stages of the life-course. To this end, Akers (1998 [2009]) has offered specific hypotheses which propose one way through which the modalities of association and friend deviance constructs may influence behavior across development. Drawing on the approach echoed in the life-course paradigm and Warr's (1993) and Simons and

colleague's (1994) research, I have proposed alternative hypotheses that offer another way of thinking about how friends may be influential over the life-course. Results on the age-grading hypotheses have demonstrated that certain constructs (friend deviance, informal multiplexity) exert different influences over time. However, some constructs (duration, formal multiplexity) do not.

Perhaps an important trend in results relevant to the age-grading hypotheses is that the effect sizes of the constructs that *did not* reach statistical significance in the SEMs did not vary over time. Inversely, the theoretically derived measures that *did* reach statistical significance in the SEMs were found to have an age-graded effect (with the exception of formal multiplexity, which was significant in only one model). This suggests that the friendship-related variables that are associated with crime proclivity matter more in some developmental stages compared to others. Thus, results from the age-graded hypotheses found in this dissertation support the need for exploring developmentally sensitive influences on crime.

Third, crime policy and prevention and intervention programs may be aided by the understanding that friends do not influence crime in the same ways across the life-course. This is especially true for friend-based programming (e.g., Granic and Dishion, 2003; see Chamberlain et al., 2002). Friend-based programming differs from individual programming because the intervention or prevention strategies attempt to influence the behavior of groups of friends rather than individual actors. Because the behavioral influence of friends is the strongest during adolescence, these programs seem especially important during this developmental stage. Additionally, there seems to be a

gradual decrease in the need for friend-based programming as an actor ages since the influence of friend deviance decreases over time.

Understanding that friend-based programming may be less necessary during particular developmental periods is important since research has recently documented how unintended, deleterious effects can arise when an actor and a friend (or friends) jointly participate in a program (Dishion and Tipsord, 2011). The main reason for deleterious effects in friend-based programming is the rise of 'deviant talk' (Dishion and Tipsord, 2011; Granic and Dishion, 2003; also see Piehler and Dishion's [2007] work with dyadic mutuality and deviant talk). Deviant talk is a form of mocking communication between the actor and the friend(s) that belittles the purpose of the program. When deviant talk develops, the actor and his/her friend(s) develop deviant definitions that they probably did not previously hold. These definitions are both theoretically (e.g., Akers, 1985; Sutherland, 1947) and empirically (Akers and Jensen, 2006) linked to increases in criminal behavior.

A word of caution regarding policy implications is necessary, however. Given the limitations of the current research (which are discussed in the next pages), replications and extensions of the topics of this dissertation are critical before policy recommendations are implemented.

The empirical examination of the eighth and ninth hypotheses provided the first test of which I am aware that addressed the possibility that the modalities of duration and intensity may moderate the association between differential association and crime. In the process, these tests have provided an alternative way of thinking about how the modalities of association may influence criminal behavior. None of these interactions

were statistically significant, meaning evidence from this dissertation does not suggest that these modalities function in the manner that I developed based off of Sutherland's writings. The question remains as to whether these null findings were due to limitations in measurement (see the concluding remarks of Chapter 7). As such, future research is needed to reach any impactful conclusions on whether the modalities work as I have specified.

Research on the modalities and crime should proceed in at least two ways. First, the modalities need to be measured with more precision and validity. In the process, they could be reconceptualized to affect crime in different ways over development. For instance, does friendship closeness (intensity) have the same meaning to a 15 year old as a 30 year old? Though some research points to similarities between positive support in adolescent and adult friendships (e.g., Berndt, 1989), there is little research on adult friendship closeness and crime (see Andrews et al., 2002). Given the maturational differences that are occurring over development, it is quite possible that the answer to this question is no. Second, different modalities could be proposed. Without controlling for other theoretical measures, it is difficult at this time to say what these modalities may be. However, this is an avenue for future research.

The friendship closeness-friend deviance interaction is relevant to social psychology research. The magnification hypothesis that is frequently tested in social psychology states that the characteristics of a friend have a stronger effect on the actor when the friend is highly valued (see Berndt, 2004). Though it was not the intention of this project to provide a specific test of magnification, the moderation effect explored between friendship closeness and friend deviance did follow this general approach.

Results in this dissertation do not support the magnification hypothesis and further contributes to the “scant” evidence that seems to be ultimately leading to the general conclusion that magnification rarely has an effect on an actor’s characteristics or behavior (Berndt, 2004, p. 218).

It is worth noting that friendship closeness was negatively related to crime during emerging adulthood. Though this direct effect was not tied to a hypothesis, its significance speaks to a growing body of literature on friendship closeness and crime. To date, results from these studies are inconsistent, with some scholars finding that high quality friendships are not related to offending (Giordano et al., 1986, 2010) or are related to more offending (Boman et al., 2012; Kandel and Davies, 1991; Krohn and Thornberry, 1993).

One possible explanation for the inconsistency in results was discovered by Giordano and colleagues (1986), who found that blacks trusted their friends less, but had more stable friendships than whites. The current study is able to suggest another reason for the inconsistency in results. Since friendship closeness was only related to offending during emerging adulthood, the effect of friendship closeness on crime may only exist during particular developmental stages. If this is the case, then past studies that have not specifically addressed this possibility (e.g., Boman et al., 2012; Giordano et al., 1986; 2010; Kandel and Davies, 1991) may have aggregated age-specific effects, thus affecting overall conclusions. Future research would benefit from a study which specifically addresses the potential for age-grading in the friendship closeness-crime relationship. In the meantime, researchers should at least acknowledge that their

findings regarding the effect of friendship closeness on crime may vary across developmental stage.

Research has concluded that a high proportion of crime is committed by groups of friends during adolescence (e.g., see the discussion of Reiss, 1986), but the likelihood of group-based offending decreases as an actor ages (Warr, 2002). The fact that friendship closeness became significant and negatively related to crime during emerging adulthood may indirectly indicate that actors are shifting away from offending with friends to offending alone as they age. If this is the case, then Warr's argument would be supported. This finding, however, may not be a change in an actor's closeness to his or her friends in general; instead, it could indicate that the closeness to one specific friend has dramatically been altered. Future research in the area of stability and change in co-offending is necessary to disentangle these potential relationships (see McGloin and colleagues' recent work [2008]).

Borrowing from social network research, two separate multiplexity mechanisms have been argued to be important for testing the frequency modality. Drawing on Krohn's (1986; Krohn et al., 1988) and Osgood's research (Osgood et al., 1996; Osgood and Anderson, 2004), I have conceptualized formal and informal multiplexity under the assumption that they are measures of frequency because they capture time-use, interpersonal contexts, social roles, and environment. Further, time-use provides opportunity, and when opportunity exists in the company of one's friends it is likely that the actor and the friends will all participate in the offending activity (Osgood and Anderson, 2004; Reiss, 1986). For this reason, I specified direct effects from formal and informal multiplexity to both friend deviance and crime.

Results relevant to the multiplexity hypotheses yielded mixed results. The hypotheses relevant to formal multiplexity received either partial support (hypotheses two and six) or were not supported at all (hypothesis three). Formal multiplexity reached significance in only one model (late adolescence, model three), where it was negatively related to friend deviance. The results shown are consistent with Krohn and colleagues (1988), who concluded that the amount of time spent in supervised contexts had no influence on crime. There was also a significant, negative relationship between formal multiplexity and crime that was transmitted through friend deviance. While both of these relationships were in the expected direction, formal multiplexity had non-significant paths otherwise, and its association with crime did not vary across developmental stage.

Though most research has treated multiplexity as a single construct (although see Krohn et al., 1988; Krohn and Thornberry, 1993), formal and informal multiplexity have proven to be only moderately related. This speaks to the need for researchers to use separate measures of formal and informal multiplexity in the future. Results demonstrated that the multiplexity constructs were not significantly correlated during two of three developmental periods (late adolescence and emerging adulthood). This further validates the argument that the multiplexity construct contains two distinct elements. If the formal and informal multiplexity constructs were aggregated into a single measure, the effect estimates could have been seriously affected since they would be composed of a non-significant construct (formal multiplexity) counterbalancing the effect of a frequently significant construct (informal multiplexity).

Informal multiplexity was positively related to friend deviance in all but the late adolescence models. It was also positively related to the actor's crime proclivity in all models. This has produced complete support to the fifth hypothesis and large, but not complete, support for the fourth hypothesis. Collectively, this suggests that informal multiplexity may be an important correlate of both friend deviance and an actor's deviance.

A portion of the total effect of informal multiplexity was also transmitted through the friend deviance construct, supporting the seventh hypothesis. This indirect effect demonstrates that the informal multiplexity construct may affect crime in more intricate ways than through standard direct effects. As such, future research is needed to explore how informal multiplexity may affect crime through indirect effects or multiplicative interactions. A number of potential mediation or moderation hypotheses consistent with differential association or social learning theories could be proposed. For instance, one could hypothesize that the construct affects behavior because it moderates the friend deviance construct. Other modalities could also interact with it; to provide an example, informal multiplexity may affect friendship closeness (intensity). Alternatively (or additionally), informal multiplexity may be a result of an earlier priority and longer duration. In short, informal multiplexity is a diverse construct that carries many potential uses.

Evidence from this project suggests that informal multiplexity has a stronger relationship with crime during middle adolescence than late adolescence and emerging adulthood. Since informal multiplexity has been formulated around the concepts of both frequency (Sutherland, 1947) and crime opportunity (following Osgood et al., 1996), the

developmentally sensitive associations observed in this dissertation may indicate that both time with friends and crime opportunity have different meanings for behavior as an actor ages.

If time spent with friends and opportunities to commit crime differ across developmental stages, this is likely a reason why a significant portion of crime occurs within the four hours after adolescents get out of school (e.g., Gottfredson and Soulé, 2004). To this point, it may be wise for criminal justice practitioners, school officials, and youth group organizers to seek ways for adolescents to use their time constructively. Programs that reduce opportunity for crime, such as structured after-school activities, organized sports, and so forth, seem potentially beneficial, especially during middle adolescence. Research supports their crime reduction potential, as well (Gottfredson et al., 2004). However, based on the results of the current study, the purpose of these programs should *not* be to increase formal multiplexity, as this has no consistent effect on crime. Rather, the purpose should be to *reduce* the amount of time an actor would have to spend in informal contexts (see the overlap between Denise Gottfredson's [e.g., Gottfredson et al., 2004; Gottfredson and Soulé, 2004] and Osgood and Anderson's work [2004, p. 527]). A word of caution, though, is necessary. While these recommendations make a good deal of logical sense, recall that the formal and informal multiplexity constructs were not significantly correlated for two of three developmental periods. This may suggest that changing the levels of one may have no effect on the other. Thus, while there is potential for the multiplexity constructs to inform policy and programming, research must first develop a better understanding of the interrelationship between formal and informal multiplexity.

Limited support was garnered for Akers's social learning-social structure (1998 [2009]) propositions regarding the effects of SES, race, and gender (hypotheses 18 through 20). These variables remained significant with very similar coefficients when theoretical variables were added, although the coefficients did decrease minutely in some models. In some instances, control variables became significant when theoretical measures were added, indicating they were in a suppression effect with a variable (or variables) which was (were) added into the model. The suppression effects suggest that after controlling for the modalities and (occasionally) prior crime proclivity, the control variables are related to crime proclivity. The reason why this was observed is unclear, although a likely scenario is there are hidden interaction effects between the control variables, the modality and friend deviance measures, and/or prior crime proclivity. Regardless, the control measures are not substantially mediated and are only sometimes partially reduced, providing limited support to Akers's mediation hypotheses.

To best understand the meaning of the results of the control variable mediation hypotheses, two limitations must be acknowledged. First, the RYDS data are probably not the most ideal dataset to use to address this issue. The RYDS sample is overwhelmingly comprised of black males, and many of the individuals are living in poverty. This is likely the reason why many of the control variables in the SEMs did not reach levels of statistical significance. This may be most important for gender, since gender differences in the development of social cognition and emotional intelligence (see Salovey et al., 2004; Salovey and Mayer, 1990) have been linked to differences in both violent and non-violent crime (Bennett et al., 2004).

Recall that the SES variable in the emerging adulthood models was significant and positively related to crime proclivity and was not mediated by the differential association measures. This indicates that actors who are not receiving governmental assistance are more likely to have a higher crime proclivity than actors who are receiving aid. This particular finding is unusual and may be an artifact of using a binary SES measure that simply tapped receiving government assistance (0 = low SES) or not receiving governmental assistance (1 = high SES), which is not an ideal strategy to measure income. Coincidentally, emerging adulthood was the only time in which the actors (and not their parents) reported receipt of government assistance. Given the overall poverty of the sample, there is a good chance that this SES finding would not have been observed in other populations.

Second, the empirical tests of the control variable mediation hypotheses do not capture all elements of Akers's theory. Instead, these are partial tests of social learning because only one of the four elements of social learning theory – differential association – has been investigated in this research. Research supports the notion that more support will be given to these tests when differential reinforcement, imitation, and definitions are included in the analysis (see Lee et al., 2004). As such, the lack of empirical support from these hypotheses may have been observed because a full social learning model has not been subjected to empirical examination. Expanding this test to account for all four social learning elements would follow Lee and colleagues' (2004) research and is a logical future direction of research that should stem from this dissertation.

Several other limitations should be acknowledged. First, the current project analyzed data on personal networks that include up to three friends at each measurement period. While this method has been used in other panel datasets (most notably, the National Youth Survey; see Elliott et al., 1985), it is unreasonable to believe that most individuals have only three friends (e.g., Haynie, 2002; Tilton-Weaver et al., 2013; Weerman and Smeenk, 2005). Consequently, the reported results may have been influenced by not capturing information regarding the identity or characteristics of a potentially large portion of an actor's friends. Research shows even more 'peripheral' friends can be important for behavior (Weerman and Smeenk, 2005). Further, the RYDS data have a unique racial and ethnic distribution. This may be of considerable importance since some research points to there being differences in friendships between blacks and whites (Giordano et al., 1986). Consequently, the results may be somewhat specific to this particular dataset and may not be generalizable to other, high-risk populations, a point which further speaks to the necessity of more research on this topic.

The measurement of friendship stability over time was affected by the inability to track individual friendships. The measures of friendship stability in phase one of the RYDS are binary and quite different from the measure of this construct in emerging adulthood. This compromises the validity of the results from coefficient comparison tests, as these tests have compared a measure of short-term stability to a measure of short-term and long-term stability. The fact that the stability measure did not exert a significantly different impact on crime or across the three developmental periods examined may be due to a lack of measurement validity. In reality, it may be that very

short, fleeting friendships have a very different impact on criminal behavior than long-term, stable friendships (see Warr's [1993] findings on recency; also Berndt and colleagues' [1999] findings on stability and adolescent adjustment). Future research should consider the current results as preliminary and continue to examine friendship stability in the longitudinal framework.

There are two important points to emphasize regarding the measurement strategy of the multiplexity constructs. First, the formal multiplexity items may not have changed over time in a manner which actually captures the actor's most critical supervised contexts during emerging adulthood. During this developmental stage, two items capture shared religious and exercise-based activities with friends. Instead, the most important formal contexts or roles an actor may play during emerging adulthood may not be with friends, but instead with a significant other or spouse (see Sampson et al., 2006). While this is certainly a limitation of the formal multiplexity construct, it is not the only variable that may have failed to meet conditions of heterotypic continuity. Unsupervised contexts and roles may vary over the life-course as well; instead of lacking parental or teacher supervision as in adolescence, an adult may be most unsupervised away from a spouse (Sampson et al., 2006; Warr, 1998). Items measuring informal multiplexity, friendship closeness, friend deviance, and even the outcome variable of crime may also have changed (or failed to change) in a manner that taps the same respective constructs over time. Measurement research is needed to determine if measures similar to those used in this project function similarly throughout development.

Second, the current operationalization of the informal multiplexity construct is extremely similar to the measure used by Osgood and colleagues (1996). Both unsupervised time with friends and informal multiplexity are necessarily measures of both time-use and environment, making them extremely similar in concept. While both measures capture time-use, the informal multiplexity measures also capture interpersonal roles that the actor plays in the network (in accordance with Krohn, 1986; see Chapter 3). This implies that unsupervised time with friends should be a unidimensional construct while informal multiplexity should be multidimensional.

Of course, only the role of being a 'friend' is actually captured in the measures used in this dissertation. This indicates that the operationalizations of the unsupervised time with friends and informal multiplexity constructs are potentially highly similar. However, there is at least one distinction between unsupervised time with friends and informal multiplexity. Osgood and colleagues used an item measuring the amount to which an actor "[got] together with friends informally" (1996, p. 653; also see Osgood and Anderson, 2004). Because they made no attempt to capture the size of the network or the identity of the friends, their measure probably captures time spent with anyone in an actor's entire friendship network. The current project uses measures collected across an identifiable personal network of up to three specific friends. While this may be a somewhat dubious distinction, the measures could differ in important ways. Notably, the measurement strategy used by Osgood could result in respondents indicating *more* time spent with friends because the identity of 'friends' in their measure is not restricted to only three people. This may indicate that a measure such as Osgood's would produce stronger effect sizes for the relationship between

unsupervised time with friends and crime. However, a counterargument could be made. The current study inquires about the actor's closest friends, which may indicate that the nature of the time spent with friends is of greater importance because the friends are presumably very close to one another (a Sutherland-inspired argument). From this standpoint, one could expect that the measures in this project would result in a *stronger* effect of informal multiplexity on crime, even if the *amount* of time spent with friends is less. This raises attention to the important future question of how much overlap exists between unsupervised time with peers and informal multiplexity (and multiplexity in general). The measures could potentially differ, but could also be very similar. Regardless, they most certainly would be significantly, positively related.

Extending this logic, the indicators of friendship closeness in this project may have been inflated by asking about the closeness to three "closest" friends. This procedure may have also decreased the variation around the mean of these items. While this study cannot test whether this occurred specifically, circumstantial evidence supports this observation because the means of the friendship closeness items were all high with small standard deviations (see Table 4-16). If this is the case, the friendship closeness measures may not have moderated the friend deviance-crime relationship because they had too little variability to find an effect.

An additional limitation regarding the friendship closeness measures is that they reflect a traditional, unidimensional measure of closeness. After data collection for the RYDS began, research moved away from the use of unidimensional measures of friendship closeness in favor of multidimensional measures of friendship quality (Bukowski et al., 1994). Friendship closeness is only one dimension of friendship

quality (Bukowski et al., 1994). Thus, there is a possibility that results may have differed if a more comprehensive measure of friendship quality had been used.

Another measurement limitation is that the friend deviance measures captured the proportion of all of an actor's friends who engaged in deviance. Despite this being a common method of measuring the construct (e.g., Pratt et al., 2010), it is not ideal since it reflects the deviance of an actor's complete network while the modality measures reflect the characteristics of only part of an actor's network.

The analysis in this project also has limitations. While the SEMs have effectively addressed developmental period-specific relationships, they have addressed relative change and not within-person change. As such, testing inner-personal change is a logical future direction of the current dissertation. A future extension of this kind should also seek to refine the age ranges that were investigated in the current project. While most actors were within nine or ten months of the mean age at each developmental period, there were outliers (for instance, several actors were twelve years old in the middle adolescence models). Prior research has suggested that the RYDS data have several distinct age cohorts (Bushway et al., 2003). Thus, accounting for these cohorts, or 'age-waves,' would be an important part of a developmentally focused, inner-personal change type of analysis.

An empirical limitation that holds theoretical implications is that this analysis has not included measures of competing theoretical constructs. This means that the current analysis has provided the best possible scenario for finding significant results with Sutherland's theory (pending that the constructs were validly measured). Still, results have been mixed. While the significant relationships that were observed were not

proven spurious when prior crime proclivity was controlled, measures of other theoretical constructs may very well partially or completely mediate the significant effects observed.

There are several other theoretical limitations in this project. First and foremost, only three of the four modalities of association have been captured (priority was not measured). Given the inconsistent results in prior research regarding how priority affects crime (compare Short, 1957; Warr, 1993), future research investigating this issue seems especially warranted.

While I have tried to provide a comprehensive discussion of the potential meanings of the modality concepts, it is important to reiterate that there may be other valid definitions. The operationalizations presented in this dissertation are only one set of several possible interpretations. They are not necessarily the best way to test differential association principles. Drawing upon the emergent research testing the modalities, I echo Short's (1958) observation that the definitions of Sutherland's modalities are hardly set in stone, and there is still considerable room for additional interpretation, expansion, and refinement.

To expound on this point, future research investigating the modalities of association should be informed by the idea that considerable overlap may exist between the modalities and concepts from social network studies. Frequency is not the only modality that could fit into a network concept. For instance, the modalities of frequency and/or intensity may also be represented by network density, which is defined as the extent to which an actor is friends with all other potential individuals in a network. The network concept of homophily (or similarity between friends) may be a proxy measure of

(or a result of) friendship stability and/or frequency since friends may become more similar when they spend lots of time together. In short, there is potential for integration between Sutherland's theory and social network research (see Haynie, 2001).

Though Sutherland (1947) and Akers (e.g., 1998 [2009]) believe that the primary behavioral influence comes from friends, their writings reflect the viewpoint that the identity of differential associates can vary. Any of an actor's associates or patterns can potentially exert an influence on the actor's behavior (Akers, 1985; Sutherland, 1947). The specific focus on friends in this dissertation was limiting due to the fact that other differential associates were not investigated. This limitation may be eased by the finding that peers and/or friends exert a stronger influence on behavior than other differential associates (see Harris, 1995; cf. Warr, 2002, p. 28-29).

In considering the identity of other potential differential associates, a future study would benefit by drawing from other theoretical perspectives. For instance, Judith Harris's (1995) group socialization theory proposes that the influence of parents on the long-term development of their offspring is strictly genetic. Instead, personality characteristics develop as a result of environmental and social processes that occur within an actor's social networks. Haynie's (2002) research with friendship webs also emphasizes the intricate nature of friendship networks and leads to the very pragmatic conclusion that actors are probably nested within multiple networks. Drawing on this in conjunction with Harris's theory, some networks may be more important for an actor's characteristics and behaviors than others. When it is considered that "criminals may benefit from being friends with other criminals" or "from belonging to the same network of relationships" (Calvó-Armengol and Zenou, 2003, p. 940), variations of the internal

composition within and between one's many networks may be of incredible importance in predicting crime. To my knowledge, the consideration of multiple social networks has not been addressed extensively in the crime literature (see Calvó-Armengol and Zenou, 2003). This would appear to be a necessary future direction, and one which would add an extra level of consideration to the standard model that investigates how friends influence crime.

Another limitation in this dissertation concerns the developmental periods investigated. When the actors in this study were in the developmental period of emerging adulthood, they were less than a decade older than when they were in middle adolescence. Consequently, this study has hardly captured the entirety of the life-course. Given that there were differences in predictors observed across age for the short period of development investigated here, the differences may be even more pronounced if the period of development was extended to earlier and/or later developmental stages.

Despite the limitations, the current project advances our theoretical understanding in three major arenas. Aside from Haynie's (2001) research, this is the first project of which I am aware that seeks to advance the definitions of Sutherland's modalities using a concept from social networks. Second, another major advancement is that this is the first study of which I am aware to test Sutherland's modalities in a developmental framework aside from work by Krohn and colleagues (1985), Warr (1993), and Simons and colleagues (1994). Given the interwoven history between the life-course perspective and friendship research in criminology, this is somewhat surprising. Third, and importantly, this is also the first project of which I am aware that

has addressed the possibility that the modalities of association moderate the friend deviance-crime relationship. Given that this perspective is quite in line with Sutherland's writings, it is surprising that over sixty years have passed without utilizing the modalities in this manner.

It is also noteworthy that there are very few studies which have specifically addressed the possibility that the friend deviance-crime relationship could be mediated and/or moderated by a third variable (see Haynie, 2001; Meldrum et al., 2009). More research in this arena is needed. Drawing on a differential association inspired approach is the logical starting point.

In conclusion, perhaps the most surprising observation when looking at the "bigger picture" of research on differential association theory is that there is very little empirical research that has tested the modalities of association. While part of the reason for this is probably due to Sutherland's lack of definitions (see Halbasch, 1979), the modalities of association are theoretically capable of accomplishing a great deal. Namely, they are capable of potentially answering three critical questions. First, *who* are the friends who influence crime? Second, *how* does the influence friends exert on crime operate? And third, *why* does this influence exist?

These three seemingly basic questions formulated the backbone of this dissertation. I have tried to resolve them, but their answers have remained elusive. While insight was gained, there has not been a 'miracle breakthrough' that opens the 'golden gates' on how friends influence crime. Instead, this research contributes to a larger and steadily growing body of studies that have sought to answer these and related questions. This research, which is largely being conducted by Akers, Kandel,

Krohn, Haynie, Warr and their associates, is incredibly important because it seeks to resolve how one of the most empirically supported constructs – friend influence – affects crime. Attempting to better understand the nature of who, how, and why friends influence offending over development should be a priority for criminologists. As Akers (2010) emphasizes, the fundamental objective of this line of research is applying theoretical and empirical findings to policy and practice in order to ultimately improve the quality of lives.

APPENDIX  
DETERMINING THE SAMPLE SIZE: A SUPPLEMENT

**Supplemental Analysis Series One**

This Appendix shows results from supplemental analyses conducted to investigate whether there were differences in criminal behavior and demographic characteristics among those who were removed from the sample and those who were not.

The first set of tests sought to determine whether there were behavioral differences between the actors who were excluded from the sample and the actors who were included in the sample. The original 1,000 person RYDS datafile was used.

To tap criminal involvement at each wave, variety indices of crime were constructed. Their descriptive statistics of the measures are reported in Table A-1. To test reliability of these measures, Cronbach's alpha reliability statistics with Kuder-Richardson 20 corrections were estimated. The reliabilities of these measures were acceptable (see Table 4-4).

If an actor was dropped for any reason (attrition, missing data, or not having friends), they were given a score of '1' on a binary variable that denoted whether they were removed. Respondents who were retained were given scores of '0.' This binary variable was used as a classification measure in a series of one way analysis of variance (ANOVA) models joined with Bonferroni corrections. These ANOVAs compared whether there were significant differences in crime depending on whether or not the respondent was excluded. These models are presented in Table A-2.

All ANOVA F-statistics failed to reach significance, except at wave 12, where actors who were removed from analyses were significantly ( $p < .05$ ) less likely to have

committed crime (it may be worth noting that the reliability statistic of crime at wave 12 was lower than all other investigated waves). Despite this lone significant effect, the consistent pattern points to there being no significant differences between actors who were removed and those who were not.

### **Supplemental Analysis Series Two**

Using the full sample of 1,000 respondents once again, the same dropped/retained measure was employed in a series of analyses that compared demographic differences across the control variables used in analyses. As can be seen in Table A-3, no differences were detected in socioeconomic status between respondents who were removed and retained. Differences did, however, arise between race and gender controls. While black respondents were significantly more likely to be retained than other respondents, Hispanic respondents were more likely to be lost than other respondents. Further, males were also slightly more likely to be dropped than females. Regarding these differences, past work with this dataset shows that both Hispanic and male respondents are the most likely to be lost over time (Krohn and Thornberry, 1999). Thus, these results are not surprising and correspond with prior research.

What was not expected, however, is the observation that black respondents were more likely to be retained than other respondents. Peggy Giordano's research may be able to suggest an explanation for this. Giordano and colleagues' (1986) have found that blacks have more friends, and more stable friendships, than whites and Hispanics. Perhaps the fact that blacks were more likely to be retained is because they were significantly more likely than others to have friends. Support for this possibility is found

in the fourth model of Table A-5, which demonstrates that black respondents were significantly more likely to have friends than others in the RYDS data.

### **Supplemental Analysis Series Three**

The third series of analyses drops the 214 respondents lost due to missing data or attrition (the sample size is 786). As discussed in the Chapter 4, the analytical sample size for the project is 670. Thus, the focus here is specifically on the 116 people who are lost because they have no friends. If the number of friendless actors were to be summed across the three developmental periods ( $5 + 37 + 87 = 129$ ), one may notice a discrepancy between the raw number of friendless actors (129) and the number of friendless actors who were removed (116). The discrepancy exists because 13 actors failed to report friends at multiple developmental periods. Thus, only 116 unique individuals reported not having friends in the data.

During late adolescence, 37 actors failed to nominate friends. During emerging adulthood, this number increased to 87. Using the same crime indices as in the first set of models, a series of ANOVAs was estimated to determine if actors who had no friends at late adolescence and emerging adulthood behaved significantly differently than those who had one, two, and three friends. Since only five individuals did not have friends during middle adolescence, no empirical tests were performed during this developmental period. Results are displayed in Table A-4.

Once again, the consistent pattern is that crime did not vary across the number of friends the actors had, with one exception. Actors who had zero and one friends at wave ten committed significantly less crime than actors with two and three friends. This may suggest that actors with lots of friends are more likely to be criminally inclined during the developmental stage of emerging adulthood. This trend, however, did not

appear at the next measurement point (wave twelve) or any other time period. Overall, then, no consistent behavioral differences emerged between those who were and were not socially isolated in the RYDS data.

#### **Supplemental Analysis Series Four**

The final series of analyses explored how the number of nominated friends varied across the demographic control variables included in the analyses at waves six and ten. Once again, those who dropped out because of attrition or a monotone missing data pattern were not included (the sample size is 786). Analyses from wave two were once again excluded since only five people reported being friendless at this time.

A series of ANOVAs presented in Table A-5 demonstrate that no significant socioeconomic differences existed at wave six based on the number of friends that an actor nominated. At wave ten, individuals with two friends were less likely to have had a high socioeconomic status than individuals with three friends. However, no differences were detected between individuals who did and did not have friends.

There were significant differences in race that emerged between individuals who were socially isolated and those who were not. At wave ten, black respondents were less likely to have zero friends than other racial groups (as discussed in conjunction with Giordano and colleagues' [1986] research in the preceding second supplemental analysis section).

At both waves six and ten, Hispanics were more likely to have had zero friends than whites and blacks combined. A likely explanation for this is found in cultural assimilation research. Vigil (1990) finds that second-generation Hispanics have a difficult time assimilating into United States culture; not having friends may be a

symptom of acculturation difficulty (also see Freng and Esbensen, 2007; Lopez and Brummett, 2003). Other research shows that Hispanics have difficulty fitting into peer groups in schools (Curry and Spergel, 1992), suggesting that Hispanics may be more likely to be socially isolated. Considering these observations together, it is quite possible that difficulty in peer interactions in school may also be a result of difficulty in cultural assimilation.

Finally, males at wave ten were more likely to have had zero friends than two friends. This finding follows past research that shows that males are most likely to be socially isolated (Kreager, 2004; although see Cairns et al., 1988).

Table A-1. Summary statistics of variety indices of crime.

Crime Index Wave	N	Mean	SD	Min.	Max.
Wave 2	947	1.303	2.019	0	19
Wave 4	928	0.914	1.710	0	19
Wave 6	907	0.751	1.604	0	19
Wave 8	877	0.716	1.419	0	19
Wave 10	854	0.656	1.291	0	19
Wave 12	846	0.353	0.825	0	19

Table A-2. Behavioral differences between actors who were retained and removed from analyses.

<u>Wave 2 Crime</u>					
	N	Mean	SD	F	Group Differences
Retained	670	1.230	1.923	3.02, <i>NS</i>	<i>None</i>
Removed	277	1.480	2.227		
<u>Wave 4 Crime</u>					
	N	Mean	SD	F	Group Differences
Retained	670	0.906	1.693	0.05, <i>NS</i>	<i>None</i>
Removed	258	0.934	1.753		
<u>Wave 6 Crime</u>					
	N	Mean	SD	F	Group Differences
Retained	670	0.722	1.525	0.81, <i>NS</i>	<i>None</i>
Removed	237	0.831	1.810		
<u>Wave 8 Crime</u>					
	N	Mean	SD	F	Group Differences
Retained	670	0.704	1.392	0.19, <i>NS</i>	<i>None</i>
Removed	207	0.754	1.508		
<u>Wave 10 Crime</u>					
	N	Mean	SD	F	Group Differences
Retained	669	0.665	1.257	0.16, <i>NS</i>	<i>None</i>
Removed	185	0.622	1.409		
<u>Wave 12 Crime</u>					
	N	Mean	SD	F	Group Differences
Retained	670	0.316	0.739	6.52*	Retained < Removed*
Removed	176	0.494	1.085		

\*  $p \leq .05$

Table A-3. Demographic differences between actors who were retained and removed from analyses.

		<u>W2 High SES (= 1)</u>				
	N	Mean	SD	F	Group Differences	
Retained	642	0.706	0.456	2.93, NS	None	
Removed	264	0.648	0.479			
		<u>W6 High SES (= 1)</u>				
	N	Mean	SD	F	Group Differences	
Retained	609	0.632	0.483	1.67, NS	None	
Removed	198	0.581	0.495			
		<u>W10 High SES (= 1)</u>				
	N	Mean	SD	F	Group Differences	
Retained	670	0.775	0.418	0.06, NS	None	
Removed	184	0.766	0.424			
		<u>Black (= 1)</u>				
	N	Mean	SD	F	Group Differences	
Retained	670	0.707	0.455	6.75**	Retained > Removed**	
Removed	329	0.626	0.485			
		<u>Hispanic (= 1)</u>				
	N	Mean	SD	F	Group Differences	
Retained	670	0.122	0.328	32.65***	Retained < Removed**	
Removed	329	0.264	0.442			
		<u>Male (= 1)</u>				
	N	Mean	SD	F	Group Differences	
Retained	670	0.704	0.457	6.08*	Retained < Removed*	
Removed	329	0.778	0.416			

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

Table A-4. Behavioral differences between actors depending on how many friends were nominated.

<u>Wave 6 Crime</u>					
# Friends at wave 6	N	Mean	SD	F	Group Differences
0	37	0.811	2.644	0.34, NS	<i>None</i>
1	31	0.807	1.815		
2	80	0.563	1.017		
3	638	0.729	1.553		
<u>Wave 8 Crime</u>					
# Friends at wave 6	N	Mean	SD	F	Group Differences
0	37	0.486	0.989	1.44, NS	<i>None</i>
1	31	1.161	2.934		
2	80	0.675	1.430		
3	638	0.697	1.285		
<u>Wave 10 Crime</u>					
# Friends of wave ten	N	Mean	SD	F	Group Differences
0	87	0.299	0.749	5.51**	0 < 2 and 3* 1 < 2 and 3*
1	103	0.330	0.746		
2	155	0.748	1.380		
3	440	0.727	1.341		
<u>Wave 12 Crime</u>					
# Friends at wave ten	N	Mean	SD	F	Group Differences
0	87	0.414	1.084	2.22, NS	<i>None</i>
1	103	0.184	0.480		
2	155	0.413	0.881		
3	441	0.311	0.717		

\*\*  $p \leq .01$

Table A-5. Demographic differences between actors depending on how many friends were nominated.

<u>W6 High SES (= 1)</u>					
# Friends at wave 6	N	Mean	SD	F	Group Differences
0	31	0.419	0.502	1.99, NS	None
1	30	0.600	0.498		
2	69	0.667	0.475		
3	577	0.622	0.485		

<u>W10 High SES (= 1)</u>					
# Friends at wave 10	N	Mean	SD	F	Group Differences
0	87	0.747	0.437	4.60**	2 friends < 3 friends**
1	103	0.718	0.452		
2	155	0.684	0.466		
3	441	0.816	0.388		

<u>Black (= 1)</u>					
# Friends at wave 6	N	Mean	SD	F	Group Differences
0	37	0.676	0.475	0.46, NS	None
1	31	0.774	0.425		
2	80	0.713	0.455		
3	638	0.683	0.466		

<u>Black (= 1)</u>					
# Friends at wave 10	N	Mean	SD	F	Group Differences
0	87	0.540	0.501	5.38**	0 friends < 1*** friend, and 2 and 3 friends*
1	103	0.806	0.397		
2	155	0.710	0.455		
3	441	0.685	0.465		

Table A-5. Continued

# Friends at wave 6	N	<u>Hispanic (= 1)</u>		F	Group Differences
		Mean	SD		
0	37	0.324	0.475	2.91*	0 friends > 3 friends*
1	31	0.129	0.341		
2	80	0.188	0.393		
3	638	0.149	0.356		

# Friends at wave 10	N	<u>Hispanic (= 1)</u>		F	Group Differences
		Mean	SD		
0	87	0.425	0.497	19.89***	0 friends > 1, 2, and 3 friends***
1	103	0.165	0.373		
2	155	0.168	0.375		
3	441	0.104	0.306		

# Friends at wave 6	N	<u>Male (= 1)</u>		F	Group Differences
		Mean	SD		
0	37	0.784	0.417	0.75, NS	None
1	31	0.645	0.486		
2	80	0.675	0.471		
3	638	0.718	0.450		

# Friends at wave 10	N	<u>Male (= 1)</u>		F	Group Differences
		Mean	SD		
0	87	0.759	0.430	6.90***	0 friends > 2 friends* 2 friends < 3 friends***
1	103	0.670	0.473		
2	155	0.581	0.495		
3	441	0.762	0.426		

\*  $p \leq .05$  \*\*  $p \leq .01$  \*\*\*  $p \leq .001$

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## BIOGRAPHICAL SKETCH

After receiving two Bachelor of Arts degrees (History and Sociology/Criminology) from Ohio University in 2007, John Boman earned his Master of Arts (2010) and Doctorate of Philosophy (2013) in Criminology from the University of Florida. His research efforts focus predominantly on the behavioral influences exerted by friends and friendships throughout the life-course, gender, substance use, criminological theory, and measurement and construct validation. His recent research has appeared in journals such as the *Journal of Research in Crime and Delinquency*, *Criminal Justice and Behavior*, *Substance Use and Misuse*, the *Journal of Criminal Justice*, and the *Journal of Youth and Adolescence*. John has recently begun an assistant professorship at the University of Wyoming in the Department of Criminal Justice.