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The Influence of Differential Peer Associations on Delinquency Varies Depending on the Combination of Unstructured Socializing and Personal Morals

The current study explores implications of Situational Action Theory suggesting that the effect of crime-prone peer associates on delinquency is contingent on the combination of unstructured socializing and personal morals. I analyse this three-way interaction with data from a German adolescent sample, using predictions and (average) marginal effects that were calculated from a multilevel Bayesian negative binomial regression. In line with the implications of Situational Action Theory, the results indicate that criminogenic peer influence depends on unstructured socializing and personal morals. Peer effects on criminal behaviour were marginal among individuals who held strong personal morals against delinquency and among individuals who spent relatively little time in unstructured socializing. Peer effects were greatest among individuals who held weaker morals against delinquency and spent a relatively large amount of time in unstructured socializing. The results underline the importance of studying the contingencies of criminogenic peer effects on personal and environmental factors.

Keywords: average marginal effects, differential peer associations, juvenile delinquency, peer influence, person-environment-interaction, personal morals, Situational Action Theory, US socializing

Der Einfluss differenzieller Peerassoziationen auf Delinquenz variiert abhängig von der Kombination aus unstrukturiertem Freizeitverhalten und persönlichen Moralvorstellungen

Die vorliegende Studie untersucht Implikationen der Situational Action Theory, nach welchen die kriminogene Wirkung delinquenzgeneigter Peerassoziationen von der Kombination aus unstrukturiertem Freizeitverhalten und persönlichen Moralvorstellungen abhängt. Mit Hilfe einer Bayesianischen Negative-Binomial-Mehrebenenregression wird diese Dreifachaktion für eine Stichprobe deutscher Jugendlicher geschätzt. In Übereinstimmung mit den Implikationen der Situational Action Theory zeigen die Ergebnisse, dass der kriminogene Einfluss von Gleichaltrigen von unstrukturiertem Freizeitverhalten und persönlichen Moralvorstellungen abhängt. Für Personen, die starke persönliche Moralvorstellungen gegen Delinquenz vertraten, und Personen, die relativ wenig Zeit in unstrukturierten Aktivitäten verbrachten, waren lediglich marginale Peereffekte zu beobachten. Für Personen, die schwächere Moralvorstellungen hatten und relativ viel Zeit in unstrukturierten Freizeitaktivitäten verbrachten, waren die Peereffekte dagegen am stärksten. Die Ergebnisse unterstreichen, dass bei der Untersuchung von Peereinflüssen die moderierende Wirkung von persönlichen Faktoren und Umweltfaktoren zu berücksichtigen ist.

Schlagwörter: Differenzielle Peerassoziationen; Durchschnittliche marginale Effekte; Jugenddelinquenz; Peereinflüsse; Person-Umwelt-Interaktion; Persönliche Moralvorstellungen; Situational Action Theory; Unstrukturiertes Freizeitverhalten

1. Introduction

By introducing the concept of differential associations (i. e., the relative exposure to criminal and noncriminal patterns), Differential Association Theory (Sutherland, 1939) and its successor Social Learning Theory (Akers, 1973) triggered a surge of empirical research. This literature highlighted the crucial role of differential associations with peers¹ in explaining delinquency and produced a number of key findings: First, individuals who are associated with (more) delinquent peers commit substantially more crimes than those who have no (or fewer) delinquent peer associations (Hoeben et al., 2016). Second, the differential behaviour, attitudes, and reactions of peers are more predictive of criminal involvement than those of parents or other people, and have effects that are at least comparable in size to other well-known predictors of crime (Pratt et al., 2010). Third, individuals who are exposed to deviant peer modeling are more likely to behave in a deviant manner than individuals who are not exposed to such peer modeling in experimental settings (e. g., Gallupe et al., 2016; Mercer et al., 2018; Paternoster et al., 2013). To produce this evidence, the research relied on observational and (quasi-)experimental designs and self-report and network data, and in many cases controlled for an array of potential confounders. This laid a solid foundation for the claim that peer associates have a causal impact on individuals' delinquent behaviour (McGloin & Thomas, 2019).

Researchers studying peer influence have nevertheless urged the use of approaches that go beyond the monocausal analysis of peer effects. They have advocated for investigation of more complex questions, such as when (i. e., under what circumstances) peers lead to increased criminal involvement, and what individuals are particularly affected by peer influence (McGloin & Thomas, 2019; see also Agnew, 1991; Miller, 2010). This critique of monocausal approaches was sparked in part by previous interactional research indicating that the effect of peer associations on delinquency is not one-size-fits-all, but that it depends on the circumstances under which an individual spends (peer-oriented) time and on the individual's personal characteristics. One of the circumstances that appears to moderate the impact of differential peer associations on delinquency is that of *unstructured socializing*. Unstructured socializing refers to peer-oriented time spent on activities that are unstructured (i. e., with no particular agenda) and unmonitored (i. e., with no parents or guardians present) (Osgood et al., 1996; Hoeben et al., 2016). Research has found that differential peer associations have substantial effects on delinquency among individuals who spend (large amounts of) time in unstructured socializing, but no or significantly weaker effects among individuals who spend no (or less) time in unstructured socializing (e. g., Beier, 2018; Bernburg & Thorlindsson, 2001; Sentse et al., 2010; Svensson & Oberwittler, 2010; Wikström et al., 2012; for more mixed results, see Haynie & Osgood, 2005; McNeeley & Hoeben, 2017). A personal characteristic that appears to moderate the impact of differential peer associations on delinquency is that of *personal morals*. Personal morals comprise the attitudes and emotions that indicate how strongly a person has internalized a particular rule of conduct (see Hirtenlehner & Wikström, 2017; Kroneberg, Heintze, & Mehlkop, 2010; Tyler, 2006). Empirical evidence consistently suggests that crime-prone peer associates have a crime-promoting influence only or especially among individuals with weaker personal morals against delinquency (e. g., Bruinsma et al., 2015; Hannon, DeFronzo, & Prochnow, 2001; Mears, Ploeger, & Warr, 1998; Wikström & Svensson, 2008). Individuals with strong morals are, in contrast, barely affected by criminogenic peer influences.

¹ As in the majority of criminological peer influence research (McGloin & Thomas, 2019), the current study refers specifically to friends when speaking of peers. This contrasts with social scientists, who refer to peers more broadly as “associates of the same age” (Warr, 2002, p. 11).

Having shown that peer effects are contingent on individual characteristics and the circumstances in which the individual spends time, the previous research provides evidence that a monocausal approach to the study of peer influence on delinquency is not sufficient. Furthermore, a handful of recent studies suggest that separate investigations of environmental and personal characteristics also do not go far enough, as peer influence depends on the *combination* of both. Beier (2018) found that peers' alcohol misuse was most predictive of alcohol consumption in unstructured and unsupervised settings among respondents who held weak morals against alcohol consumption. Individuals with strong moral convictions against alcohol consumption, in contrast, were generally unsusceptible to peer influence and generally committed few crimes. Results reported by Wikström et al. (2012), furthermore, suggest that crime-prone peers are especially criminogenic when individuals with a high crime propensity (i. e., weak morals and weak self-control) spend time in risky environments. Individuals with a low crime propensity were again barely affected by crime-prone peers and committed almost no crimes. Apart from these two studies, that are both based on data from the Peterborough Adolescent and Young Adult Developmental Study, no other study to date has investigated how personal morals and unstructured socializing in combination moderate the influence of differential peer associations on delinquency.²

To address this research gap, the current study explores whether the effect of differential peer associations on criminal behaviour is contingent on the combination of unstructured socializing and personal morals.³ It derives implications from Situational Action Theory (SAT; Wikström et al., 2012) to describe how this three-way interaction occurs. Although SAT does not use the term differential peer associations, it acknowledges the criminogenic relevance of a person's exposure to crime-prone (versus crime-averse) peers. In particular, the theory implies that crime-prone peers, unstructured socializing, and weak personal morals against delinquency interact to explain criminal behaviour. The study examines SAT's implications using a sample of German adolescents. I chose adolescents as the population of interest as they spend a relatively large amount of time with their peers (e. g., Lam, McHale, & Crouter, 2014; Larson & Verma, 1999; Warr, 1993) and seem to be more susceptible to peer influences than individuals in other developmental phases (e. g., Berndt, 1979; Chein, Albert, O'Brien, Uckert, & Steinberg, 2011; Gardner & Steinberg, 2005; Warr, 1993).

2. Peer Influence in SAT

This section first introduces SAT's situational model by focusing on its key action mechanism: the perception-choice process. It then discusses how differential peer associations can (in interplay with unstructured socializing and personal morals) account for criminal behaviour through this mechanism.

² A few other scholars have, however, used unstructured socializing (instead of peer associations) as a focal variable when investigating the three-way interaction (Bernburg & Thorlindsson, 2001; Gerstner & Oberwittler, 2018).

³ I decided to study personal morals as a moderator instead of the composite crime propensity, as composites are criticized for potentially masking effect variation across its constituent elements (e. g., Pogarsky, 2007; Schulz, 2014).

2.1 Situational Action Theory's Perception-Choice Process

Situational Action Theory's situational model assumes that human beings decide on moral action (including delinquent action) through the processes of perception and choice (e. g., Wikström, 2014, 2019; Wikström et al., 2012; Wikström & Treiber, 2016b).

The *perception* of action alternatives is guided by the so-called moral filter, which consists of the interplay between personal morals and the moral norms that an individual perceives apply in a given setting (i. e., their immediate environment). Personal morals reflect a person's view of whether a particular action is right or wrong under a specific circumstance and how much she or he cares about engaging in the right or wrong behaviour.⁴ The perceived moral norms embody what kind of action people think or feel is expected of them in a given circumstance. According to the idea of the moral filter, people are likely to perceive crime as a potent action alternative if both personal morals and the perceived moral norms of a setting encourage such behaviour. People are unlikely to perceive crime as a potent action alternative if both personal morals and the perceived moral norms of a setting discourage such behaviour. People face a moral conflict over a particular crime if their morals encourage the behaviour, but the setting's norms discourage it, or vice versa. Under these moral conflict conditions, people typically perceive criminal behaviour as a potent action alternative, but they have usually also factored in other options.

Situational Action Theory suggests that individuals make *choices* finally only among those action alternatives that they perceive as potent options. When people see only one action alternative, they automatically (or habitually) "choose" this alternative. However, when people perceive multiple possible action alternatives, they typically *deliberate* before deciding.⁵ Only when people deliberate over their choice of action alternatives is it possible for control processes to influence their ultimate behaviour (principle of the conditional relevance of controls; Wikström et al., 2012). As an internal control process, *self-control* drives people to act according to their morals despite external pressure to do otherwise. The higher individuals' self-control capabilities, which depend on dispositional (e. g., executive functions) and momentary factors (e. g., stress levels), the more likely they will be to act in line with their own morals instead of giving in to the setting's moral norms. As an external control process, *deterrence* pushes people in circumstances of moral conflict to act according to the perceived moral norms of the setting. The capacity for deterrence depends on environmental cues that a person processes to infer how likely and severe the consequences (i. e., the enforcement) would be if they violated the setting's norms. The more likely and severe the perceived consequences are, the greater the chance that the individual will give in to the norms and act contrary to their own morals.

2.2 The Impact of Differential Peer Associations

Peers can affect the processes of perception and choice (and hence delinquent behaviour) by contributing to the setting's perceived moral norms and their enforcement, i. e., by contributing to the moral context (Hirtenlehner & Hardie, 2016; Wikström et al., 2012). They can

⁴ Composed of personal *moral rules* (a person's rules of conduct) and *moral emotions* (e. g., shame and guilt), a person's morals are essentially "internalized social norms" (Hirtenlehner & Wikström, 2017, p. 498).

⁵ For more information on the characteristics of automatic and deliberate choices and the circumstances in which each is relevant, see Wikström and Treiber (2016b).

shape this moral context by showing or proposing a particular behaviour or by talking about or reacting to behaviour in specific ways (Borsari & Carey, 2001; Brechwald & Prinstein, 2011; Dishion & Tipsord, 2011; Hoeben & Thomas, 2019). Within these situational peer processes, crime-prone peers, on the one hand, will frequently provide cues from which others will infer that the moral norms of a given setting support the violation of rules or laws. Crime-averse peers, on the other hand, will frequently signify to others that law-abiding behaviour is expected in a given setting. By providing crime-encouraging or crime-discouraging moral norms in a particular setting, peers increase or decrease the likelihood that an individual will perceive crime as a viable action alternative. When individuals perceive multiple action alternatives, peers may also exert pressure to enforce the moral norms for which they had previously shown their support. The strength of this peer pressure can be understood as the perceived severity of adverse peer reactions if the individual were to deviate from the perceived expectations. Generally, the stronger the perceived pressure, the more likely individuals will be to give in to it and act in ways that run contrary to their own morals.⁶ Overall, due to peers' differential influence on moral contexts, association with (or exposure to) crime-prone peers will increase the risk of delinquency, whereas the association with crime-averse peers will reduce it.

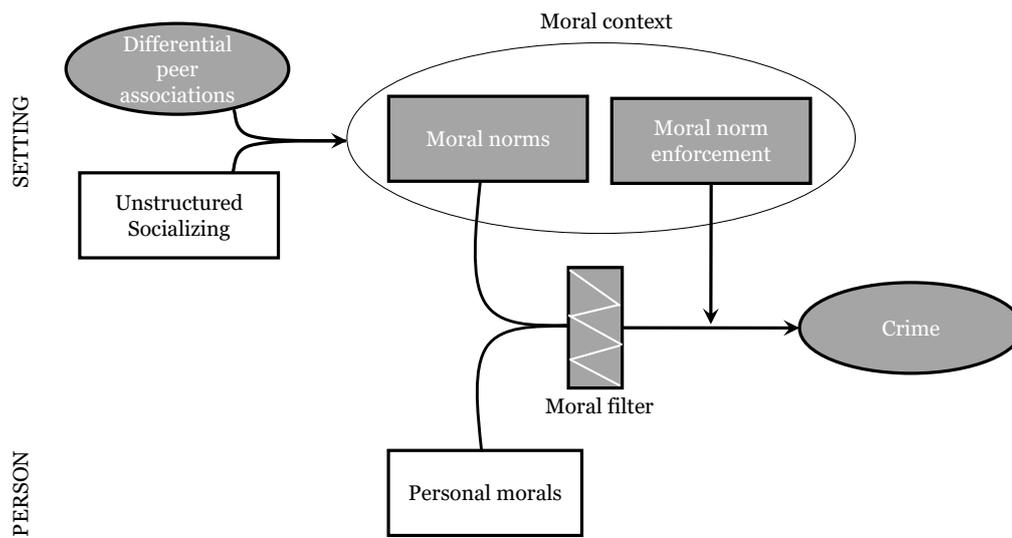
However, the influence of peers on moral contexts depends, according to SAT, on the peers' actual presence and on how the peer-oriented time is spent (Wikström et al., 2012). Generally, peer influence should be most relevant when the peers are present in the immediate environment. Only then can situational peer processes such as modeling or proposing a particular behaviour provide cues that an individual can process to infer the moral norms that apply in a given setting (see Beier, 2018). However, depending on other environmental aspects, the criminogenic impact of crime-prone peers on moral contexts varies even when the peers are present. In particular, SAT assumes that criminogenic peer influences may be strongly diminished in activities that are structured and monitored. Structured activities typically have a specific agenda (e. g., learning to play tennis) that restricts the set of proper action alternatives to a small, well-defined number, usually excluding criminal behaviour. Supervised activities include authority figures (e. g., tennis coaches) who generally expect rule abidance and increase the risk of detection and sanctioning for any rule-breaking, thereby strengthening the perception and enforcement of moral norms in line with established rules or laws. When faced with a distinct agenda and supervision that fosters law-abidance, peers are unlikely to influence a moral context in a criminogenic way. However, in unstructured and unmonitored activities, where these obstacles do not exist, peers may behave more freely, i. e., they are free to deviate. In these circumstances with fewer boundaries, crime-prone peers will much more likely provide crime-encouraging cues. Overall, unstructured socializing facilitates the criminogenic effect of crime-prone peers on the moral contexts that individuals encounter and hence on their delinquent behaviour.

As the setting's moral norms can, according to SAT, explain behaviour only through the moral filter, peer influence on delinquency should also depend on personal morals. If a person's morals align with the setting's moral norms, the person will generally act in line with the behaviour that is encouraged by both elements of the filter. Hence, in circumstances in which a person's morals and the perceived peer expectations (which may manifest themselves as the setting's moral norms) seem to encourage a crime, the person will most likely commit it. In circumstances in which the personal morals and perceived peer expectations, in contrast, discourage criminal behaviour (or encourage a particular law-abiding behaviour instead), a person will be

⁶ Whether a person can resist external pressure depends on their ability to exercise self-control. For more information on the interplay between peers and the ability to exercise self-control, see Hirtenlehner et al. (2015).

unlikely to perceive crime as a viable action alternative. Individuals will typically deliberate over what action decision to take when their morals and the perceived peer expectations are in conflict. Only in this latter instance would peer pressure (as an external control process) guide the action decision. Crime-prone peers may pressure a person who is strongly morally opposed to delinquent behaviour into committing a crime. In contrast, crime-averse peers may deter a person who morally approves of delinquent behaviour from breaking the law.⁷ Overall, the weaker an individual's morals against delinquency, the more strongly their criminal behaviour will be affected by criminogenic peer influences.

Figure 1: Influence of differential peer associations within Situational Action Theory



Note: The figure is restricted to those concepts that are investigated in the current study. It excludes other concepts (e. g., self-control capabilities) that may also be relevant for explaining peer influences with SAT.

By combining SAT's assumption about the formation of moral contexts and the mechanism of moral filtering, it is apparent that peer effects on delinquency are contingent on the combination of environmental *and* personal factors (see Figure 1). Criminogenic peer effects will be greatest when neither characteristics of the immediate environment (structure or supervision) nor personal morals oppose delinquent behaviour. Only under these circumstances can peers (1) shape the moral context in such a way that individuals perceive moral norms to clearly encourage crime, which then, (2) in interplay with personal morals that encourage crime, drastically increases the likelihood of criminal behaviour. However, when either the characteristics of the setting or the individual's personal morals counteract criminogenic peer influences, the individual's likelihood of perceiving and choosing crime declines rapidly. This may occur either because peers have a more difficult time shaping the moral context when they are in a structured and monitored environment, or because the individual's moral opposition to delinquency leads to a moral filter conflict. In these circumstances, individuals may at best deliberate about committing crimes, but the setting characteristics and the individual's morals will

⁷ This latter example is not explicitly discussed by SAT, and it may be that Wikström and colleagues would prefer not to speak of deterrence in this instance, as they discuss peer pressure mainly in relation to internal control processes in which a person exerts self-control to resist criminogenic peer influence (e. g., Wikström, 2014; Wikström & Treiber, 2016b).

facilitate the perception and choice of other law-abiding alternatives. Finally, criminogenic peer effects should be unlikely when individuals with crime-averse morals spend time in structured and supervised activities. In such contexts, it is highly unlikely that (even crime-prone) peers will model or propose delinquent behaviour, and the person's morals will clearly indicate that delinquent behaviour is not an option. In a nutshell, the weaker an individual's morals and the less structured and supervised the settings in which that individual spends peer-oriented time, the more substantial the impact differential peer associations are likely to have on individual delinquency.

In summary, the current study investigates the following hypotheses, which were derived from SAT:

H1: Differential peer associations (i. e., relative exposure to crime-prone versus crime-averse peers) have, on average, a substantial influence on delinquency.

H2: The less structured and monitored the settings in which the individual spends peer-oriented time, the stronger the influence differential peer associations will have on delinquency.

H3: The weaker an individual's personal morals against delinquency, the stronger the influence differential peer associations will have on delinquency.

H4: The less structured and monitored the settings in which the individual spends peer-oriented time and the weaker the individual's personal morals against delinquency, the stronger the influence differential peer associations will have on delinquency.

3. Methods

3.1 Sample

The empirical analyses use data from the panel study *Crime in the modern City* (CrimoC; Boers et al., 2010). CrimoC's objective is to explore the causes and development of deviant and delinquent behaviour throughout adolescence and young adulthood. The project includes measures of normative peer influence, personal normative attitudes, and routine activities, all key concepts of the current study. In its first panel wave in spring 2002, CrimoC attempted to sample all seventh-graders in Duisburg, an industrial city in Western Germany. After 40 (of the city's 57) schools were recruited for participation, 3 411 (61 %) of the then on average 13-year-old students completed self-administered questionnaires. In the follow-up waves that were conducted annually, CrimoC attempted to study the same students again. Although the school population shifted somewhat as families moved out of or into the study area, response rates remained satisfactorily high, with about 3 400 participants in subsequent waves.⁸

The current study includes only respondents who participated in at least two of the four panel waves that took place annually between 2003 (wave 2) and 2006 (wave 5). Information from four waves is used to increase the analytical power to detect interaction effects, not to study developments or intraindividual effects. After some data cleaning and the listwise deletion of cases with any missing data on the key measures, 9 654 observations (or interviews) from

⁸ For further information on the CrimoC study and its survey design, see www.crimoc.org.

3 290 students were available for analysis. Due to the specified conditions and the data cleaning, crime-prone individuals were disproportionately excluded from the investigation. However, differences between included and excluded respondents do not preclude unbiased analysis of statistical relationships, which are generally not suspected to differ systematically across included and excluded respondents (see Gerstner & Oberwittler, 2018; Osgood et al., 1996).

3.2 Measures

Like most of the previous research, the current study has only ordinary survey measures available that are not spatiotemporally linked but that generalize across time and place. Situational Action Theory, however, specifies its action processes on a situational level and hence can only be tested accurately with situational data (see Wikström, Mann, & Hardie, 2018). To test SAT's implications using ordinary data, the current study therefore had to make the following auxiliary assumptions: First, the *crimes in the current study actually occurred more likely in those circumstances in which the young people socialized with their peers in unstructured settings*. Second, and relatedly, *in the situations in which people committed their crimes, they were more likely exposed to crime-prone in contrast to crime-averse peers*. Empirical support for the first assumption comes from research showing that people indeed commit deviance much more likely when unstructured socializing than when spending time in a more structured and supervised manner (e. g., Beier 2018; Wikström et al., 2012, 2018). The second assumption is backed up by experimental studies indicating that deviant behaviour is more likely when confronted with deviant peer modeling than when unexposed to such models (e. g., Gallupe et al., 2016; Mercer et al., 2018; Paternoster et al., 2013). The third and final auxiliary assumption simply states that *the generalized measures in the current study materialize* (“have some bearing”) *in the real-life situations that individuals encounter* (see Wikström, 2014). I will briefly illustrate this transference from generalized data to situational realities when I present each measure in the following.

3.2.1 Self-Reported Delinquency

Delinquency, the outcome variable, was measured by asking participants how many times they had committed a variety of crimes since January of the previous year.⁹ The frequencies of 16 different offenses (doing graffiti, scratching, other vandalism, theft out of vending machines, shoplifting, bicycle theft, car theft, breaking into cars, bag-snatching, robbery, burglary, other theft, fencing, assault without a weapon, assault with a weapon, and drug-trafficking) were capped at ten and then summed to generate a total delinquency frequency score. The

⁹ Because delinquency is measured retrospectively, it refers to a time before the covariates. This design, hence, does not reflect a proper causal time order. Consequently, selection effects may be erroneously interpreted as peer influence effects (McGloin & Thomas, 2019). The current study still uses this “same-wave” design, as peer- and crime-related measures should refer to time points as concurrently as possible, a condition that cannot be fully satisfied by annually collected panel data anyway (Warr, 2002; Wikström, Mann, & Hardie, 2018). To at least consider the causal time order issue, I also ran the analyses with delinquency information from the subsequent wave, leading to similar, albeit less pronounced and much more uncertain statistical relationships (see Supplementary Material).

score ranges from 0 to 160.¹⁰ Individuals with higher frequencies are more likely to have been involved in delinquency in real life than individuals with lower crime frequencies.

3.2.2 Differential Peer Associations

Differential peer associations were measured by the respondents' assessments of their friends' moral approval or disapproval if the respondent would commit one of the following eight offenses: vandalism, shoplifting, bicycle theft, car theft, extortion, non-residential burglary, assault, and drug-trafficking. The participants assessed how their peers would view these offenses using the response categories (-2) "very bad", (-1) "rather bad", (0) "neither ... nor", (1) "rather harmless" (2) "totally harmless". A composite score was created by taking the mean across all eight items. The reliability of the score, reflected by Cronbach's alpha, ranged from 0.91 to 0.92 over the four waves. Individuals with a high differential peer association score were more likely to have been exposed to law-breaking cues when they spent time with their peers in real life. Individuals with a low differential peer association score, on the other hand, were more likely to have been exposed to law-abiding cues when they spent time with their peers.

Although this measure is not the classic peer delinquency measure that researchers usually use to operationalize differential peer associations (Pratt et al., 2010), it is a reasonable choice to assess peer effects within SAT. The theory suggests that peers mainly influence delinquency through their impact on the moral context. As this context is defined by the individual's perception of moral norms and their enforcement, perceived peer expectations regarding behaviour should be more relevant for individual delinquency than the peers' objective behaviour. However, at best, the study would include perceptions of the peers' law-relevant attitudes, behaviours, and reactions. All three may provide cues that can be processed by the individual to infer the moral norms of a given setting (see Hirtenlehner & Hardie, 2016, who included perceived peer attitudes and behaviour).¹¹

3.2.3 Unstructured Socializing

Unstructured socializing was operationalized by respondents' exposure to risky peer group activities in the following way: First, respondents reported whether they were part of a peer group (or not). Only those who reported being a peer group member were then asked how often they spent time in this group outside of school (response categories: "rarely" / "once or several times a month" / "1 to 3 times a week" / "daily or nearly daily"). Individuals were sorted into a first category if they either had no peer group or spent little time with that group (i. e., "rarely" or "once or several times a month"). The remaining respondents (i. e., those who spent a relatively large amount of time with their peer group outside of school) were asked whether they spent the time with their group (a) just hanging around, (b) going to bars, clubs, and concerts, and (c) drinking alcohol. Response categories ranged from (-2) "disagree" to (2) "totally agree". The

¹⁰ Sensitivity analyses with uncapped delinquency frequencies or a versatility index produced similar results (see Supplementary Material).

¹¹ For a more thorough review of measuring peer influences including a discussion about subjective versus objective peer delinquency measures, see McGloin and Thomas (2019; see also Hoeben, Meldrum, Walker, & Young, 2016).

three items were combined in a mean score, ranging from -2 to 2. This score was then trichotomized at the values -0.65 and 0.65 to generate three additional groups or categories.¹² Ultimately, the measurement for unstructured socializing has four categories: (1) spending no or little time with a peer group, (2) spending a relatively large amount of time in low-risk peer group activities, (3) spending a relatively large amount of time in medium-risk peer group activities, and (4) spending a relatively large amount of time in high-risk peer group activities. The likelihood of spending time with one's peers in unstructured and unmonitored settings (i. e., the likelihood of unstructured socializing) in real life should increase from category one to four.¹³

3.2.4 Personal Morals

The score for personal morals was constructed with the help of two item batteries. Whereas the first scale reflects a person's moral rules, the latter also captures some moral emotions. The first item battery asked the respondents for their moral approval or disapproval of particular criminal actions. Participants assessed eight offenses (vandalism, shoplifting, bicycle theft, car theft, extortion, non-residential burglary, assault, and drug-trafficking) using the response categories (-2) "totally harmless", (-1) "relatively harmless", (0) "neither ... nor", (1), "rather bad", and (2) "very bad". In the second item battery, the juveniles rated their agreement with seven moral reasons for abiding with the law (e. g., "it is worthwhile to have a clear conscience").¹⁴ The response categories varied from (-2) "strongly disagree" to (2) "strongly agree". The two item batteries were combined into a score by computing the mean across all 15 items. Cronbach's alpha of the score is 0.91 in each wave. Individuals with a low score on the personal morals measure should have more frequently held morals that encouraged delinquent behaviour in the real-life situations they encountered. Individuals with a high score on the personal morals measure, in contrast, should have held morals more frequently that discouraged delinquent behaviour.

3.3 Analytical Procedure

Most of the hypotheses in the current study refer to how interactions between multiple variables explain delinquency (see H2-H4). Usually, interaction effects are tested with product terms in an OLS regression (Aiken & West, 1991). However, the traditional OLS procedure is unsuitable for testing the current hypotheses because it does not account for the peculiar nature of crime frequencies (i. e., for the excess of zero and large crime counts). Applied to such

¹² These cut-off-points were chosen as they are equally spaced and allow the generation of subgroups that are sufficient in size to have enough power to detect the interaction effects.

¹³ Although similar routines were also considered by other researchers to operationalize unstructured socializing (e. g., Bernburg & Thorlindsson, 2001; Gerstner & Oberwittler, 2018; Svensson & Pauwels, 2010), the measure considers only two of the three crucial aspects of the concept, namely the presence of peers and the structuredness of the activities. The lack of information about whether the peer group activities were monitored (or not), makes it a rather conservative test of unstructured socializing (see Haynie & Osgood, 2005). For a more comprehensive discussion of measuring unstructured socializing, see Hoeben et al. (2016).

¹⁴ The other six reasons are: "you just shouldn't do that", "it is important to respect the law", "it is important to follow the rules that others should obey, too", "you are harming others who are innocent", "it is important to be a good example for others (e. g., children)" and "delinquency damages the reputation of one's family".

data, the procedure produces distorted standard errors and increases the danger of taking ceiling or floor effects for variable-specific interactions (Osgood, Finken, & McMorris, 2002). Poisson and negative binomial regressions are typically applied in criminology to consider the skewed nature of crime data. However, even these nonlinear models fail to provide a simple solution to study interaction effects (see Hirtenlehner & Hardie, 2016; Oberwittler & Gerstner, 2015; Svensson & Oberwittler, 2010) and produce regression coefficients that are more difficult to understand. This is especially true for coefficients of product terms, which are a combination of two effects: (1) a model-inherent effect that is due to the nonlinear nature of the model, and (2) a “true” interaction effect. Because the two cannot be disentangled easily and can operate in different directions, the regression coefficient of a product term (on its own) gives no reliable information about the true interaction effect in nonlinear models (Bowen, 2012; Mize, 2019).

To overcome these problems, the current study relies on approaches that Mize (2019) synthesized from the methodological literature as best practice to study interaction effects within nonlinear models (for a criminological application that uses similar techniques, see Gerstner & Oberwittler, 2018; Oberwittler & Gerstner, 2015). Mize generally advocates using the estimates from a nonlinear model to calculate predictions, marginal effects, and second differences (i. e., differences between two marginal effects). These quantities are not affected by the same problems as the regression coefficients (of the product terms). They also allow for investigation of interactions on the natural metric of the outcome variable, which makes them much easier for most readers to grasp.

To follow Mize’s advice, I first computed a multilevel Bayesian negative binomial regression with an inverse softplus link function using the R package *brms* (version 2.14.4; Bürkner, 2017). The model includes product terms to analyse the three-way interaction between differential peer associations, unstructured socializing, and personal morals. It furthermore considers the nested (panel) data structure by including a random intercept and controls for temporal effects by including wave dummies (for the full model formula, see Appendix).¹⁵

After computing this model, I used its estimates to calculate average crime frequency predictions, average marginal effects (AMEs), and second differences (between the AMEs). To facilitate the study of interaction effects, I calculated the predictions and AMEs for different subgroups and then compared the group-specific AMEs with second differences (see Mize, 2019). Predictions for different subgroups make it possible to investigate whether individuals who differ in their peer associates, peer-group activities, and personal morals are involved to differing degrees in criminal behaviour. To predict group-specific average crime frequencies, I applied the *observed-value approach* (Hanmer & Kalkan, 2013). This approach computes predictions for the different subgroups based on the actual observed values that respondents have on each independent variable, instead of relying on particular ideal types (such as a hypothetical person with a specific value on the focal covariate(s) but average values on all other covariates). Group-specific AMEs and second differences make it possible to explore more directly whether and how peer effects differ between various subgroups (varying in their level of unstructured socializing and personal morals). They have the advantage of being intuitive and assembling the interpretation of classical regression coefficients, and thus reflect how the out-

¹⁵ The results of a multilevel negative binomial model with an inverse softplus link are presented, as this model best fitted the data. I, however, also ran multilevel negative binomial models with a log link, multilevel Poisson models with a log and inverse softplus link, and traditional multilevel OLS regressions (with an identity link). Overall, the findings are similar across the procedures, but effects sizes and uncertainties vary (see Supplementary Material).

come (of some subgroups of individuals) would have changed, *on average*, if the focal independent variable had changed by some specified margin (Mize, 2019). In the current study, they express how delinquency would have changed on average if the peer associations score had increased by a margin of 0.5 (i. e., if the peers had been somewhat more crime-prone). I chose this margin of 0.5 because it seems to be a substantive but still realistic change in peer associations, with a score ranging from -2 to 2. Finally, calculating differences between the AMEs of different subgroups enables a more direct investigation of the interactional hypotheses. These so-called second differences can deliver insights into whether the average peer effects differ between individuals who vary in (the combination of) their unstructured socializing and personal morals.

4. Results

This section presents the findings on each hypothesis sequentially. It first reports the average effect of differential peer associations on delinquency (H1), then examines how peer effects are contingent on each unstructured socializing (H2) and personal morals (H3). Finally, it addresses the current study's central hypothesis that the peer effect depends on the combination of unstructured socializing and personal morals (H4).

4.1 The Average Peer Effect

To investigate hypothesis H1, I computed an AME of differential peer associations for the full sample. This estimate supports the hypothesis, indicating that individuals would have committed more delinquency on average if they had associated more with crime-prone peers. More precisely, according to the estimate, an increase of 0.5 on the differential peer associations score, i. e., a small rise in crime-prone peer associations, was associated with an increase of 0.45 [CI: 0.38 0.52] criminal offenses on average. The AMEs for the other covariates are also generally in line with SAT's expectations (see *Table 1*): First, the more likely an individual spent time in unstructured socializing, the more the risk of delinquency increased. Second, holding slightly more crime-averse morals was related to a substantially lower number of criminal offenses committed. Finally, the AME estimates for the wave dummies reflect that respondents' delinquency decreased over time.

Table 1: Average marginal effects (main effects)

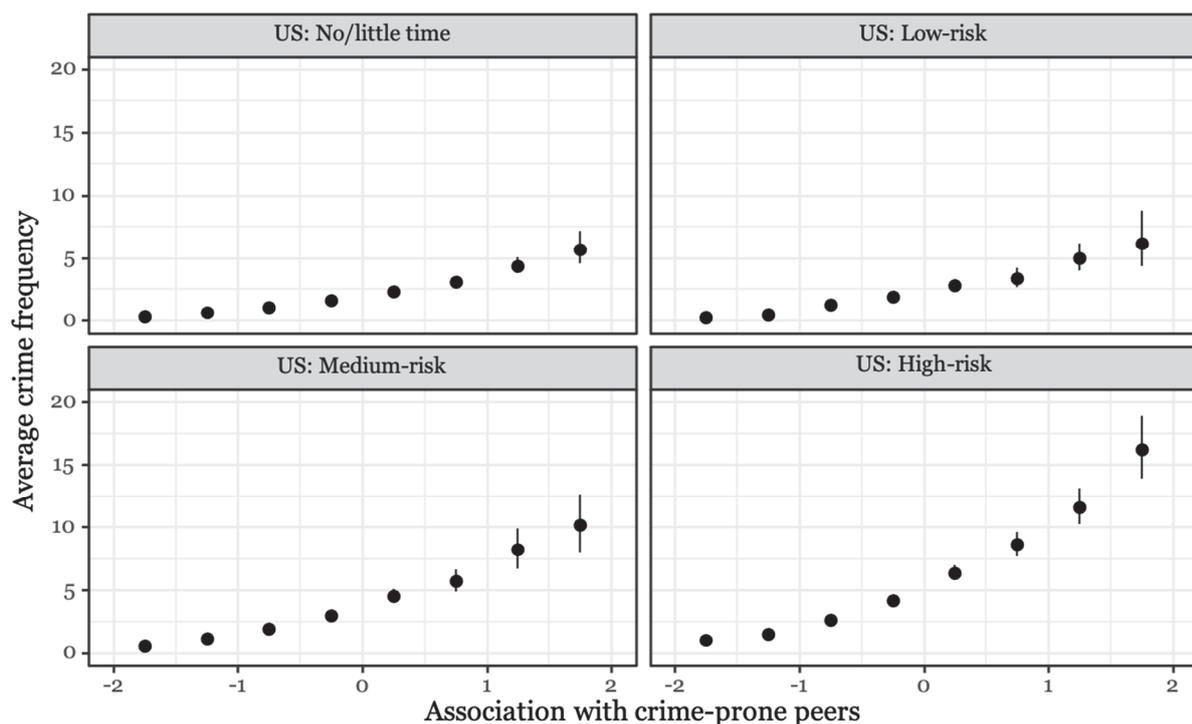
	AME
Differential peer associations	0.45 [0.38 0.52]
Unstructured socializing (ref. cat.: No/little time)	
Low-risk	-0.01 [-0.21 0.23]
Medium-risk	0.82 [0.59 1.09]
High-risk	1.48 [1.22 1.77]
Personal morals	-0.67 [-0.75 -0.59]
Panel wave (ref. cat.: 2003)	
2004	-0.42 [-0.61 -0.22]
2005	-0.84 [-1.04 -0.66]
2006	-1.13 [-1.33 -0.94]
N (interviews)	9,654

Note: The numbers in the brackets reflect 95 % credible intervals.

4.2 How Peer Effects Vary Depending on Unstructured Socializing

Figure 2 allows an initial exploration of hypothesis H2 that unstructured socializing moderates the peer effects. The plot includes the predictions of average crime frequencies (y-axis) depending on differential peer associations (x-axis) for the four unstructured socializing groups (panels). In line with H2, these predictions indicate that the more time an individual spent in unstructured socializing, the stronger the relationship between differential peer associations and delinquency was. For those who spent little time with their peers or spent their peer-oriented time in relatively low-risk activities, delinquency involvement varied relatively little (between zero and about five criminal offenses) depending on having crime-averse versus crime-prone peers. The differences in crime involvement were already stronger among individuals who spent a relatively large amount of time in medium-risk peer group activities and were most pronounced among those who spent peer-oriented time in the riskiest way. The latter group still committed very few crimes when associated with relatively crime-averse peers, but their predicted average number of crimes rose to about 15 when they reported crime-prone peer associations, suggesting that there may have been a substantial effect of differential peer associations on their delinquency.

Figure 2: Predictions of average crime frequencies (peer associations x unstructured socializing)



Note: The plot shows how the predictions of average crime frequencies vary along the dimension of differential peer associations, contingent on unstructured socializing. The black dots and lines reflect point and 95 % credible interval predictions. The focal peer association variable was categorized into eight evenly spaced subsets (-2 to -1.5, -1.5 to -1, ..., 1.5 to 2) to predict the average crime frequencies with the observed-value approach. US = Unstructured socializing.

In the next step, I investigated the differential impact of peer associates on delinquency more directly with the AME estimates of peer associations for each unstructured socializing group (see Table 2). The AMEs support hypothesis H2, indicating that the more likely an individual

is to spent time in unstructured socializing, the stronger the peer impact on criminal behaviour is. The peer effects increase from spending no or little time with peers to spending a relatively large amount of time with peers in high-risk activities. Peer influence is most pronounced among those individuals who spent a relatively large amount of high-risk time with their peers. If these individuals had associated with somewhat more crime-prone peers, they would have committed 0.89 [0.66 1.14] more crimes on average. The differences between the AMEs are captured by the estimates of the second differences presented in the right half of *Table 2*. These second differences underscore that the peer effects increase from the group spending no or little time with peers to the high-risk subgroup, allowing for the conclusion that individuals who spent the most time in unstructured socializing are affected more substantially by criminogenic peer influences.

Table 2: Average marginal effects (of peer associations, contingent on unstructured socializing)

Unstructured socializing			Second differences		
	N	AME	No/little time	Low-risk	Medium-risk
No/little time	4,065	0.21 [0.14 0.28]			
Low-risk	1,833	0.36 [0.26 0.47]	0.15 [0.03 0.27]		
Medium-risk	1,936	0.60 [0.43 0.78]	0.39 [0.20 0.57]	0.24 [0.05 0.44]	
High-risk	1,820	0.89 [0.66 1.14]	0.68 [0.44 0.94]	0.53 [0.28 0.80]	0.29 [0.00 0.59]

Note: The second differences reflect the difference between the AMEs of the subgroups in the first column of the table and the AMEs of the particular subset in the last three columns. The numbers in the brackets reflect 95 % credible intervals.

4.3 How Peer Effects Vary Depending on Personal Morals

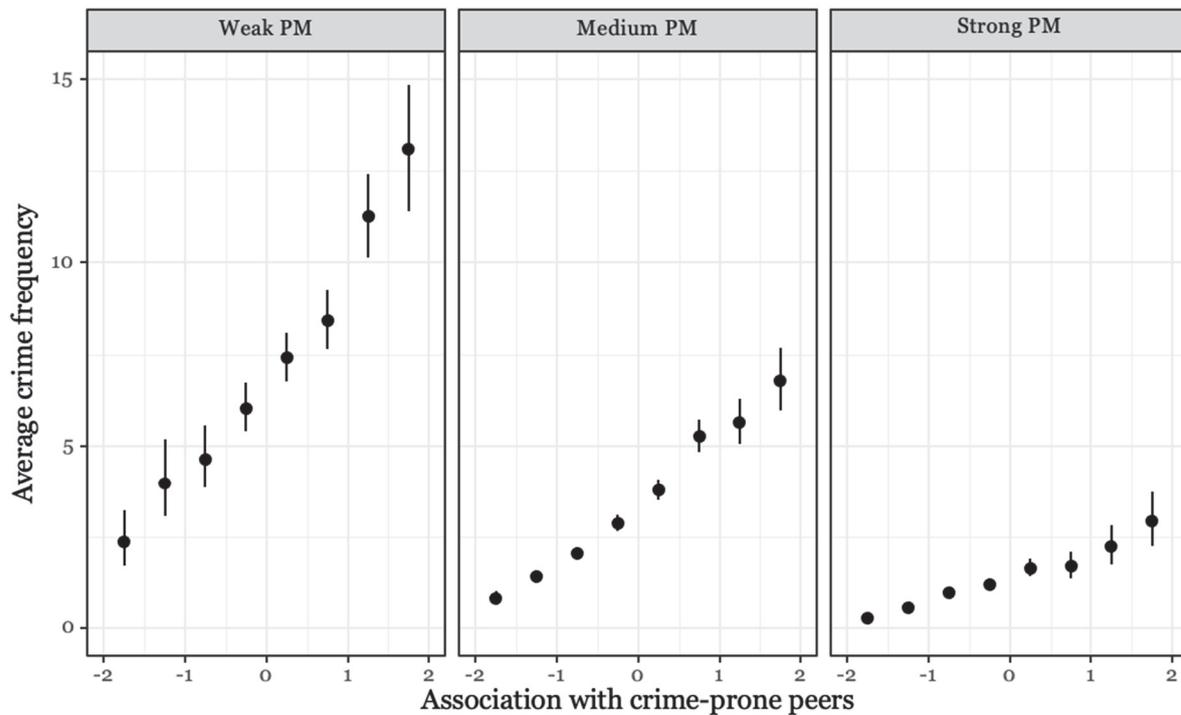
To investigate how personal morals moderate criminogenic peer effects (H3), I first divided the sample into three groups based on individuals' personal morals score: a weak (scores between -2 and 0), a medium (0 to 1), and a strong (1 to 2) personal morals group.¹⁶ This creation of ideal types or groups eases the presentation and interpretation of interaction effects that include a continuous moderator (see Gerstner & Oberwittler, 2018; Mize, 2019) and ensures that the presentation of the moderation results for personal morals resemble those for unstructured socializing.

In *Figure 3*, I show the predictions of the average crime frequencies (y-axis) depending on differential peer associations (x-axis) for each of the three personal morals groups (panels). These average predictions indicate, in line with hypothesis H3, that the weaker a person's morals, the more substantial the effect of differential peer associations on delinquency was. The differences in delinquent involvement between individuals with crime-prone and crime-averse peers were small among individuals with strong personal morals. Even those with crime-prone peers had typically committed relatively few (only about 2.5) crimes. For individuals with medium morals, crime-prone peer associates were related to substantially more criminal involvement. However, this relationship between delinquency and differential peer associations was even

¹⁶ Gelman and Park (2009) recommended discretizing variables into three instead of two categories to reduce efficiency loss when communicating scientific results. The personal morals score is trichotomized in an unequally spaced way to consider the skewed nature of the variable (see Kroneberg & Schulz, 2018).

more apparent among those with weak personal morals. Individuals in this group with crime-averse peers committed relatively few crimes on average (about 2.5), whereas those with crime-prone peers reported more than ten crimes on average.

Figure 3: Predictions of average crime frequencies (peer associations x personal morals)



Note: The plot shows how the predictions of average crime frequencies vary along the dimension of differential peer associations, contingent on personal morals. The black dots and lines reflect point and 95 % credible interval predictions. The focal peer association variable was categorized into eight evenly spaced subsets (-2 to -1.5, -1.5 to -1, ..., 1.5 to 2) to predict the average crime frequencies with the observed-value approach. PM = Personal morals.

Table 3: Average marginal effects (of peer associations, contingent on personal morals)

Personal morals	N	AME	Second differences	
			Medium	Strong
Weak	973	1.15 [0.87 1.43]	0.54 [0.33 0.75]	0.94 [0.66 1.23]
Medium	3,529	0.61 [0.51 0.71]		0.40 [0.32 0.49]
Strong	5,152	0.20 [0.16 0.25]		

Note: The second differences reflect the difference between the AMEs of the subgroups in the first column of the table and the AMEs of the particular subset in the last two columns. The numbers in the brackets reflect 95 % credible intervals.

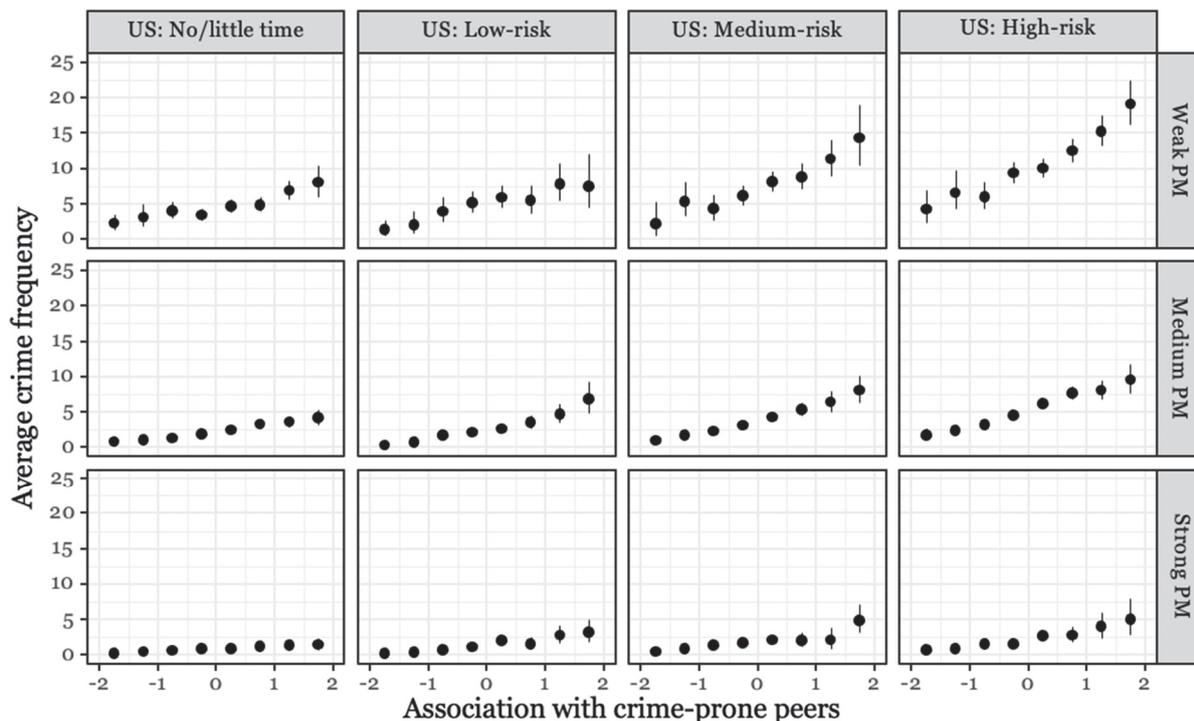
The AMEs again corroborate the findings from the prediction plot and hence lend support for hypothesis H3 (see Table 3). The peer effects increased the weaker a person’s morals against delinquency. Whereas individuals with strong morals against delinquency would have committed only 0.20 [0.16 0.25] more crimes on average if they had slightly more crime-prone peer associates, the estimated rise in crime was 1.15 [0.87 1.43] for those with weak morals. The second differences underscore that the differences in the peer effects across the personal

morals groups were substantial and that individuals with weaker morals were clearly most affected by peer influence (see the right half of *Table 3*).

4.4 How Peer Effects Vary Depending on Unstructured Socializing and Personal Morals

This section explores the fourth and central hypothesis of the current study, H4, which states that peer effects vary conditional on the combination of unstructured socializing and personal morals. It again relies on the three personal morals categories. Combining these three categories with the four unstructured socializing categories divides the sample into twelve different subgroups ($3 \times 4 = 12$). For these twelve subgroups, the relationship between differential peer associations and delinquency is explored again using average crime predictions, AMEs, and second differences.

Figure 4: Predictions of average crime frequencies (peer associations x unstructured socializing x personal morals)



Note: The plot shows how the predictions of average crime frequencies vary along the dimension of differential peer associations, contingent on the combination of unstructured socializing and personal morals. The black dots and lines reflect point and 95 % credible interval predictions. The focal peer association variable was categorized into eight evenly spaced subsets (-2 to -1.5, -1.5 to -1, ..., 1.5 to 2) to predict the average crime frequencies with the observed-value approach. US = Unstructured socializing. PM = Personal morals.

Figure 4 includes the predictions of average crime frequencies (y-axis) depending on differential peer associations (x-axis) for the twelve subgroups (panel; for a scatter plot that shows the same relationship, see Appendix, *Figure 4*). In line with H4, the predictions support the idea

that peer associations may have a differential impact on delinquency depending on the combination of unstructured socializing and personal morals. Among those who held strong morals against delinquency, the average number of delinquent acts is small (with the predictions barely exceeding five), irrespective of their peer associations and unstructured socializing (see panels at the bottom of *Figure 4*). This suggests that the relationship between peer associates and their delinquency is marginal at best. Crime involvement differs more substantially across the peer association dimension among individuals with medium morals. Generally, these individuals committed only a few crimes when they had crime-averse peer associates (irrespective of their unstructured socializing). However, when they had crime-prone peers, their crime involvement differed depending on how much time they spent in unstructured socializing. Individuals who spent little time with their peers committed fewer than five offenses on average. Similar individuals who spent a relatively large amount of time in high-risk peer activities, in contrast, reported about ten crimes. However, the differences in delinquency across the peer associations dimension are most pronounced for individuals with weak morals, and this is especially true for those who spent a relatively large amount of time in risky socializing with their peers. The latter individuals committed, on average, about five crimes when they were associated with crime-averse peers. Predictions suggest that they committed about 20 offenses on average when they had crime-prone peer associates, suggesting the peer associates may have had a particularly substantial impact on their delinquency.

Table 4: Average marginal effects (of peer associations, contingent on unstructured socializing and personal morals)

Unstructured socializing	Personal morals	N	AME
No/little time	Weak	336	0.59 [0.28 0.94]
Low-risk	Weak	127	0.78 [0.30 1.39]
Medium-risk	Weak	176	1.48 [0.87 2.14]
High-risk	Weak	334	1.66 [1.10 2.26]
No/little time	Medium	1,327	0.30 [0.20 0.40]
Low-risk	Medium	521	0.52 [0.37 0.70]
Medium-risk	Medium	852	0.76 [0.54 1.00]
High-risk	Medium	829	0.99 [0.73 1.27]
No/little time	Strong	2,402	0.11 [0.07 0.15]
Low-risk	Strong	1,185	0.24 [0.17 0.33]
Medium-risk	Strong	908	0.28 [0.16 0.41]
High-risk	Strong	657	0.38 [0.23 0.53]

Note: The numbers in the brackets reflect 95 % credible intervals.

The AME estimates underline the findings derived from the prediction plot and support hypothesis H4 (see *Table 4*). They point out that peer effects on delinquency are probably rather marginal for most individuals. According to the estimates, most people would increase their delinquent involvement by only 0.5 or fewer offenses if they associated with somewhat more crime-prone peers. The exception to this rule are individuals with somewhat weaker morals who spent a relatively large amount of time in medium-risk or high-risk peer group activities. In the case of individuals with medium morals who spent their time in such more risky activities, an increase of 0.5 on the differential peer associations score would have probably resulted in them committing about (nearly) one more crime (high-risk subgroup: 0.99 [0.73 1.27]). This rise in criminal behaviour may have even been higher for individuals with weak morals, committing about 1.5 more offenses on average if exposed to slightly more crime-prone peers (medium-risk subgroup: 1.48 [0.54 1.00]; high-risk subgroup: 1.66 [1.10 2.26]). The second difference estimates provide evidence that the peer effects among these latter individuals are indeed

substantially higher than the peer effects in most other subgroups (see Appendix, Table 6). They support the study's central hypothesis H4: Differential peer associations seem to have a particularly criminogenic impact on delinquency among individuals who spend a relatively large amount of time in unstructured socializing *and* hold weak(er) personal morals against delinquency.

5. Conclusion

Driven by previous research that showed that peer influence differs depending on personal and environmental characteristics, the current study explored to what extent peer effects are contingent on a person's morals and on spending the peer-related time in an unstructured way. To do this, it derived some implications from Situational Action Theory's situational model. Providing strong support for SAT, the current study produced the following findings: First, associating with crime-prone (versus crime-averse) peers substantially increased delinquent behaviour on average. This finding is in line with SAT's assumption that exposure to crime-prone (versus crime-averse) peers increases the risk of delinquency, as those peers more likely provide cues that shape the moral context in a criminogenic way. Besides supporting H1, this finding adds to an abundance of previous research highlighting the importance of (crime-prone) peers for criminal involvement (for reviews, see Hoeben et al., 2016; McGloin & Thomas, 2019; Pratt et al., 2010). Second, peer effects were particularly strong among individuals who spent a relatively large amount of time in unstructured peer group activities. This finding supports H2 and is consistent with SAT's presumption that structured and monitored settings counteract criminogenic peer influence by impeding the perception and choice of criminal action alternatives. It furthermore supplements previous research that found a similar two-way interaction between differential peer associations and unstructured socializing (e. g., Beier, 2018; Bernburg & Thorlindsson, 2001; Svensson & Oberwittler, 2010; Wikström et al., 2012). Third, the weaker a person's morals, the more substantial was the influence of differential peer associations on delinquency. This finding supports SAT's moral filter assumption, which indicates that the influence of environmental factors (such as peers) on the perception of action alternatives is contingent on a person's morals. In line with the findings, the filter suggests that the criminal involvement will be highest when both the setting's moral norms (e. g., provided by peers) and the personal morals are affirmative of crime. Providing some evidence for H3, the result aligns with several previous studies (e. g., Bruinsma et al., 2015; Hannon et al., 2001; Mears et al., 1998; Wikström & Svensson, 2008).

However, the current study's main finding is that associating with crime-prone peers drives crime conditional on the *combination* of exposure to unstructured socializing and personal morals. The results show marginal peer effects among individuals who held strong morals against delinquency and among individuals who spent little to no time in peer groups or spent time in their peer group in relatively non-risky ways. In support of hypothesis H4, the peer effects were, in contrast, much more substantial among individuals with weaker morals who spent a relatively large amount of time in risky socializing with their peers. This finding supports SAT's highly interactional implication that peer effects will be strongest if neither a person's morals nor a setting's features (particularly its structuredness and monitoredness) impede the peer influence. It furthermore supplements the previous research based on data from the Peterborough Adolescent and Young Adult Developmental Study that reported similar evidence of a three-way interaction between peer associations, unstructured socializing, and personal morals (Beier, 2018) or crime propensity (Wikström et al., 2012).

The results can be considered good news for policymakers in the field of criminal law and for their objective of preventing crime. The current study shows that there may be various ways to reduce juvenile delinquency (see Wikström & Treiber, 2016a). Policies can be designed not only with the aim of reducing a juvenile's association with delinquent peers but also with that of restricting activities with these peers to more structured and supervised settings. Furthermore, if changing a person's environmental exposure to particular peers and activities is not possible, measures can be designed to influence personal characteristics such as morals (or self-control capabilities). The study shows that delinquency can be reduced substantially if only one of these causal factors is successfully modified. There are two reasons for this. On the one hand, people are clearly at the most risk of delinquency if each factor is formed in a crime-encouraging way. If only one factor inhibits the risk of delinquent involvement, this is enough to diminish criminal participation substantially. On the other hand, delinquency can be strongly reduced by the modification of only one factor because positive changes in one cause of crime may influence other causes of crime over time. Processes such as selection and socialization may potentially cause positive cascading effects (Cairns & Cairns, 1994; Kandel, 1978). Suppose an intervention successfully reduces a person's exposure to crime-prone peers: This should result in the person being exposed to criminogenic learning contexts less frequently. In turn, as a result of being less exposed to such crime-facilitating environments, the person will be less likely to internalize crime-encouraging norms over time. Thus, the person's morals will be modified in such a way that she or he is less likely to see crime as a viable action alternative. Overall, reduced exposure to crime-prone peers may, in the long run, strengthen a person's morals through the respective socialization processes (see Wikström & Treiber, 2016a).

Although the results of this study are promising, they are limited in several crucial ways that call for future replication. First, the analyses relied on generalized measures and not on situational data, preventing a direct test of SAT. Future studies should supplement the relatively scarce previous research that used more appropriate designs such as the space-time budget, laboratory experiments, or vignettes to test how criminogenic peer effects are moderated on a situational level (e. g., Beier, 2018; Wikström et al., 2012). Second, the results of the current study are based on data from the 2000s. Adolescents' routine activities and social networks have changed since then, above all due to the rise of social media (McGloin & Thomas, 2019; Warr, 2002). Against this backdrop, future research should explore whether more recent data produce similar results. Third, although SAT considers a person's self-control capabilities as a vital force for withstanding external (e. g., peer) pressure (see Hirtenlehner, Pauwels, & Mesko, 2015), the current study does not consider self-control as an additional moderator of peer influence. To not further complicate the already complex analyses, it instead focuses on a person's morals, as SAT deems this personal factor as somewhat more fundamental to delinquency than self-control capabilities (Wikström & Svensson, 2010). Future research should investigate the theory's implications that peer processes are contingent on unstructured socializing, personal morals, *and* self-control abilities.¹⁷

Despite these limitations, the study results are valuable as they supplement other evidence implying that it is not enough to study a monocausal influence of peers. Peers seem to have a criminogenic impact only (or particularly) among some individuals, and only when these individuals are exposed to their peers in specific circumstances. This knowledge calls on future

¹⁷ In sensitivity analyses, I included an indicator of self-control abilities as an additional covariate to check how robust the results are to its inclusion (exclusion). The findings from this model (that also included all two-way interaction terms with the other key covariates) do not differ substantially from the presented ones (see Supplementary Material).

studies to consider these interactional aspects. The insight that interactional analyses are crucial is, however, far from new. About thirty years ago, Agnew (1991) urged the study of interactions when researching criminogenic peer influences. Sparked in part by the rise of SAT, some recent research has followed his advice to tackle the pervasive lack of interactional analyses (e. g., Beier, 2018; Hirtenlehner & Hardie, 2016; Hirtenlehner et al., 2015; Svensson & Oberwittler, 2010). Despite this increase in peer studies that specify non-additive effects, more remains to be done to satisfy those who still deem moderation analyses a critical research gap in the peer influence literature (e. g., Hoeben, 2016; McGloin & Thomas, 2019).

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Appendix

Model formula:

$$\begin{aligned}
 \text{Delinquency}_i &\sim \text{NegBin}(\mu_i, \phi) && \text{[Likelihood]} \\
 \text{invsoftplus}(\mu_i) &= \alpha_{\text{ID}[i]} + && \text{[Varying intercept]} \\
 &\beta_1 \text{DiffPeers}_i + && \text{[Main effects]} \\
 &\beta_2 \text{US_Low-Risk}_i + \beta_3 \text{US_Medium-Risk}_i + \beta_4 \text{US_High-Risk}_i + \\
 &\beta_5 \text{PMorals}_i + \\
 &\beta_6 \text{Year_2004}_i + \beta_7 \text{Year_2005}_i + \beta_8 \text{Year_2006}_i + \\
 &\beta_9 \text{DiffPeers}_i * \text{US_Low-Risk}_i + && \text{[Two-way interactions]} \\
 &\beta_{10} \text{DiffPeers}_i * \text{US_Medium-Risk}_i + \beta_{11} \text{DiffPeers}_i * \text{US_High-Risk}_i + \\
 &\beta_{12} \text{DiffPeers}_i * \text{PMorals}_i + \\
 &\beta_{13} \text{US_Low-Risk}_i * \text{PMorals}_i + \beta_{14} \text{US_Medium-Risk}_i * \text{PMorals}_i + \\
 &\beta_{15} \text{US_High-Risk}_i * \text{PMorals}_i + \\
 &\beta_{16} \text{DiffPeers}_i * \text{US_Low-Risk}_i * \text{PMorals}_i + && \text{[Three-way interactions]} \\
 &\beta_{17} \text{DiffPeers}_i * \text{US_Medium-Risk}_i * \text{PMorals}_i + \\
 &\beta_{18} \text{DiffPeers}_i * \text{US_High-Risk}_i * \text{PMorals}_i \\
 \phi &\sim \text{Exponential}(1) && \text{[Prior for shape parameter phi]} \\
 \alpha_{\text{ID}} &\sim \text{Normal}(\bar{\alpha}, \sigma) && \text{[Adaptive prior]} \\
 \bar{\alpha} &\sim \text{Normal}(0, 10) && \text{[Prior for average person]} \\
 \sigma &\sim \text{Normal}(0, 10) && \text{[Prior for standard deviation of persons]} \\
 \beta_k &\sim \text{Normal}(0, 5) && \text{[Prior for all } k = 1 \dots 18 \text{ beta coefficients]}
 \end{aligned}$$

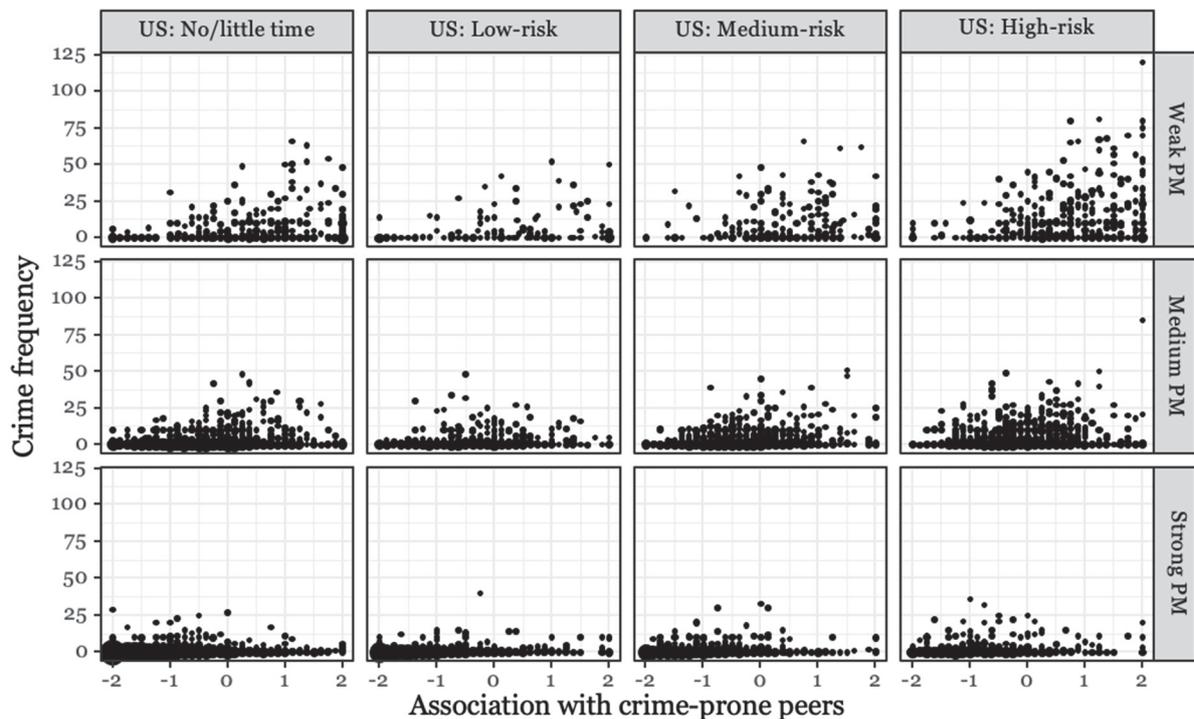
Note: i = individual observation (ranges from $i = 1 \dots 9,654$); ID = ID of each person (ranges from $i = 1 \dots 3,290$); DiffPeers = Differential peer associations; US_Low-Risk = Unstructured socializing: Low-risk; US_Medium-Risk = Unstructured socializing: Medium-risk; US_High-Risk = Unstructured socializing: High-risk; PMorals = Personal morals; Year_2004 = Panel wave 2004; Year_2005 = Panel wave 2005; Year_2006 = Panel wave 2006.

Table 5: Descriptive statistics

Variable	Mean	SD	Min	P05	P25	P50	P75	P95	Max
Delinquency frequency	2.32	6.95	0	0	0	0	1	14	120
Differential peer associations	-0.68	0.99	-2.00	-2.00	-1.50	-0.88	0.00	1.25	2.00
Unstructured socializing									
No/little time	0.42								
Low-risk	0.19								
Medium-risk	0.20								
High-risk	0.19								
Personal morals	0.93	0.74	-2.00	-0.43	0.50	1.00	1.47	1.93	2.00
Panel wave									
2003	0.22								
2004	0.26								
2005	0.27								
2006	0.25								

Note: n = 9,654.

Figure 5: Scatter plots (peer associations x unstructured socializing x personal morals)



Note: The scatter plots show how the crime frequencies vary along the dimension of differential peer associations, contingent on the combination of unstructured socializing and personal morals. The size of the black dots is proportional to the number of observations with precisely the same combination of values. US = Unstructured socializing. PM = Personal morals.

Table 6: Second (AME) differences (of peer associations, contingent on unstructured socializing and personal morals)

Group 1		Group 2		Second Differences
Unstructured socializing	Personal morals	Unstructured socializing	Personal morals	(AME _{Group1} - AME _{Group2})
High-risk	Weak	Medium-risk	Weak	0.17 [-0.65 1.03]
High-risk	Weak	High-risk	Medium	0.67 [0.26 1.08]
High-risk	Weak	Low-risk	Weak	0.88 [0.09 1.62]
High-risk	Weak	Medium-risk	Medium	0.90 [0.29 1.53]
High-risk	Weak	No/little time	Weak	1.06 [0.42 1.75]
High-risk	Weak	Low-risk	Medium	1.14 [0.55 1.75]
High-risk	Weak	High-risk	Strong	1.29 [0.70 1.89]
High-risk	Weak	No/little time	Medium	1.36 [0.79 1.96]
High-risk	Weak	Medium-risk	Strong	1.39 [0.80 1.99]
High-risk	Weak	Low-risk	Strong	1.42 [0.86 2.02]
High-risk	Weak	No/little time	Strong	1.55 [0.99 2.15]
Medium-risk	Weak	High-risk	Medium	0.48 [-0.18 1.21]
Medium-risk	Weak	Low-risk	Weak	0.69 [-0.14 1.50]
Medium-risk	Weak	Medium-risk	Medium	0.72 [0.26 1.23]
Medium-risk	Weak	No/little time	Weak	0.89 [0.19 1.63]
Medium-risk	Weak	Low-risk	Medium	0.95 [0.33 1.64]
Medium-risk	Weak	High-risk	Strong	1.10 [0.47 1.78]
Medium-risk	Weak	No/little time	Medium	1.17 [0.55 1.84]
Medium-risk	Weak	Medium-risk	Strong	1.19 [0.56 1.90]
Medium-risk	Weak	Low-risk	Strong	1.23 [0.62 1.89]
Medium-risk	Weak	No/little time	Strong	1.36 [0.76 2.02]
High-risk	Medium	Low-risk	Weak	0.21 [-0.43 0.78]
High-risk	Medium	Medium-risk	Medium	0.23 [-0.12 0.58]
High-risk	Medium	No/little time	Weak	0.40 [-0.02 0.83]
High-risk	Medium	Low-risk	Medium	0.47 [0.16 0.79]
High-risk	Medium	High-risk	Strong	0.62 [0.42 0.83]
High-risk	Medium	No/little time	Medium	0.69 [0.42 0.98]
High-risk	Medium	Medium-risk	Strong	0.71 [0.43 1.01]
High-risk	Medium	Low-risk	Strong	0.75 [0.48 1.04]
High-risk	Medium	No/little time	Strong	0.88 [0.62 1.16]

Group 1		Group 2		Second Differences
Unstructured socializing	Personal morals	Unstructured socializing	Personal morals	(AME_{Group1} - AME_{Group2})
Low-risk	Weak	Medium-risk	Medium	0.02 [-0.50 0.66]
Low-risk	Weak	No/little time	Weak	0.20 [-0.38 0.84]
Low-risk	Weak	Low-risk	Medium	0.25 [-0.12 0.74]
Low-risk	Weak	High-risk	Strong	0.40 [-0.10 1.03]
Low-risk	Weak	No/little time	Medium	0.48 [0.00 1.08]
Low-risk	Weak	Medium-risk	Strong	0.50 [0.01 1.12]
Low-risk	Weak	Low-risk	Strong	0.54 [0.04 1.17]
Low-risk	Weak	No/little time	Strong	0.66 [0.19 1.28]
Medium-risk	Medium	No/little time	Weak	0.17 [-0.23 0.55]
Medium-risk	Medium	Low-risk	Medium	0.23 [-0.04 0.51]
Medium-risk	Medium	High-risk	Strong	0.38 [0.11 0.64]
Medium-risk	Medium	No/little time	Medium	0.45 [0.22 0.70]
Medium-risk	Medium	Medium-risk	Strong	0.48 [0.29 0.69]
Medium-risk	Medium	Low-risk	Strong	0.52 [0.28 0.76]
Medium-risk	Medium	No/little time	Strong	0.65 [0.43 0.88]
No/little time	Weak	Low-risk	Medium	0.07 [-0.28 0.44]
No/little time	Weak	High-risk	Strong	0.21 [-0.14 0.59]
No/little time	Weak	No/little time	Medium	0.29 [0.04 0.56]
No/little time	Weak	Medium-risk	Strong	0.31 [-0.03 0.68]
No/little time	Weak	Low-risk	Strong	0.35 [0.02 0.70]
No/little time	Weak	No/little time	Strong	0.48 [0.16 0.83]
Low-risk	Medium	High-risk	Strong	0.15 [-0.09 0.37]
Low-risk	Medium	No/little time	Medium	0.22 [0.05 0.41]
Low-risk	Medium	Medium-risk	Strong	0.24 [0.04 0.45]
Low-risk	Medium	Low-risk	Strong	0.28 [0.15 0.44]
Low-risk	Medium	No/little time	Strong	0.41 [0.25 0.59]
High-risk	Strong	No/little time	Medium	0.07 [-0.10 0.26]
High-risk	Strong	Medium-risk	Strong	0.10 [-0.09 0.29]
High-risk	Strong	Low-risk	Strong	0.14 [-0.03 0.31]
High-risk	Strong	No/little time	Strong	0.27 [0.12 0.43]
No/little time	Medium	Medium-risk	Strong	0.02 [-0.13 0.18]

Group 1		Group 2		Second Differences
Unstructured socializing	Personal morals	Unstructured socializing	Personal morals	(AME_{Group1} - AME_{Group2})
No/little time	Medium	Low-risk	Strong	0.06 [-0.06 0.19]
No/little time	Medium	No/little time	Strong	0.19 [0.11 0.28]
Medium-risk	Strong	Low-risk	Strong	0.04 [-0.11 0.19]
Medium-risk	Strong	No/little time	Strong	0.17 [0.04 0.30]
Low-risk	Strong	No/little time	Strong	0.13 [0.05 0.22]

Note: The groups are sorted by the size of their respective AME (from large to small; see Table 4). The numbers in the brackets reflect 95 % credible intervals.