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Explaining Adolescents' Delinquency and Substance Use: A Test of the Maturity Gap: The SNARE study

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Abstract

Objectives: One explanation for the increase in delinquency in adolescence is that young people are trapped in the so-called maturity gap: the discrepancy between biological and social maturation, which motivates them to engage in delinquency as a temporary means to bridge this gap by emphasizing their maturity. In the current study, we investigated to what extent the discrepancy between pubertal status (i.e., biological

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maturation) and autonomy in decision making (i.e., social maturation) is related to conflict with parents, which in turn predicts increasing levels of delinquency as well as substance use. *Methods:* Hypotheses were tested by means of path models in a longitudinal sample of adolescent boys and girls ($N = 1{,}844$; *M* age 13.02) from the Social Network Analyses of Risk behaviors in Early adolescence (SNARE) study using a one-year time interval. *Results:* Results indicate that biological maturation in interaction with social maturation predict conflict with parents, which in turn was related to higher levels of delinquency and substance use over time. No gender differences were found. *Conclusions:* These findings reveal that conflict with parents is an important mechanism, linking the interplay of biological and social maturation with delinquency and substance use in early adolescence for boys and girls.

Keywords
delinquency, substance use, maturity gap, longitudinal, adolescence

Introduction

> "It is almost as if the contemporary young person, in the absence of puberty rituals and ordeals, is moved to exclaim: If you don't care to test us, then we will test ourselves" (Bloch and Niederhoffer 1958 as cited by Moffitt 1993:688).

One of the most intriguing aspects of adolescence is the steady increase in delinquency at its onset (Agnew 2003; Hirschi and Gottfredson 1983; Moffitt 2006). A large number of adolescents get involved in some kind of delinquent act, varying from vandalism to violence, making delinquency almost normative in this age-group (Moffitt 1993, 2006). This apparently abrupt outburst of delinquency in adolescence and its eventual decline on moving into adulthood, as reflected by the age–crime curve, raises the question, what motivates young people to engage in delinquency in early adolescence?

According to Moffitt (1993), a minority of adolescents show a consistent pattern of problem behavior in their lives, starting in childhood and continuing after adolescence into adulthood. For this life-course persistent group, neuropsychological impairments in combination with adverse environments give rise to a lifelong history of problem behavior, including delinquency.

However, for the vast majority of adolescents, engagement in delinquency is only temporary and limited to the period of adolescence. Moffitt (1993) has argued that the delinquency of this adolescence-limited group is a reaction to the discrepancy between biological maturation, on the one hand, and being acknowledged as such socially, on the other hand: the so-called maturity gap (see also Agnew 2003; Bloch and Niederhoffer 1958; Greenberg 1977). As Moffitt (1993:687) stated, adolescents are "trapped in a maturity gap, chronological hostages of a time warp between biological age and social age." The strain resulting from the absence of legitimate means to express their maturity motivates adolescents to express it in alternative, illegitimate ways, such as delinquency.

Research so far has focused mainly on the etiology of delinquency in the life-course persistent group rather than on explaining why the bulk of adolescents, who are responsible for the peak in offending, engage in delinquency (Moffitt 2006). Few researchers have empirically tested (aspects of) the maturity gap and its impact on adolescents' delinquency (cf. DeLisi and Piquero 2011).

We aimed to contribute to the literature by investigating to what extent the discrepancy between pubertal status (i.e., biological maturation) and autonomy in decision making (i.e., social maturation) is related to conflict with parents (expressing strain and frustration), which in turn is related to increasing levels of delinquency, across one year in a large sample of adolescent boys and girls. We also examined this specific path for substance use (i.e., smoking, drinking, and cannabis use), which has been proposed as another means of expressing maturation and dealing with frustration arising from the maturity gap (Agnew 2003).

Background

The idea of the maturity gap originated from the observation that in Western industrialized societies, the period between childhood and adulthood has been stretched in recent decades (Greenberg 1977). Whereas historically, and still in non-Western archaic societies, rites de passage clearly demarcate the transition from childhood to adulthood, granting "new" adults adult privileges, adolescence in contemporary societies has increasingly emerged as a distinct life phase between childhood and adulthood (Agnew 2003; Moffitt 1993).

When young people enter adolescence, they are subject to biological, social, and cognitive changes (Steinberg 2007). The transition from

childhood to adolescence coincides with a process of biological maturation, reflected in physiological and physical changes, and sexual maturation. Socially, their peer world changes when adolescents enter larger peer networks in secondary education, and seek affiliation with more well-defined groups of peers. This also relates to cognitive changes when adolescents develop a sense of identity that is more independent from parents and become aware of adult privileges.

Together these changes not only amplify the importance of peers and sensitivity to their demands and expectations (Dijkstra and Veenstra 2011; Greenberg 1977), but also yield a desire for adult privileges and responsibilities (Agnew 2003). However, adult privileges are not within the reach of most adolescents and their behavior is still regulated to a large extent by adults, challenging their need for autonomy. As a consequence, the frustration and strain experienced by adolescents, who are biologically mature but not seen to be so socially, may translate into delinquent behaviors and substance use as a ''symbolic substitute'' for adult-like behaviors (Agnew 2003; Bloch and Niederhoffer 1958).

Although the maturity gap is an eloquent explanation for the onset and increase in adolescents' delinquency, empirical evidence is scarce (Agnew 1984; DeLisi and Piquero 2011; Moffitt 2006). Aspects of the maturity gap have been tested in relation to delinquency in several studies. Most prominently, biological maturation or pubertal development has been positively related to delinquency in adolescent boys and girls (Felson and Haynie 2002; Haynie 2003; Haynie and Piquero 2006; Sentse et al. 2010; Williams and Dunlop 1999). A somewhat different approach was used by Galambos and colleagues who related subjective experience of age (feeling younger or older than actual age) to delinquency and substance use (Arbeau, Galambos, and Jansson 2007; Galambos et al. 1999; Galambos and Tilton-Weaver 2000). Combining biological maturation with subjective age, they identified pseudo-mature adolescents as those who were trapped in the maturity gap as a result of being more biologically mature but also perceiving themselves as older, having older friends and siblings, spending more time with peers, and being low in school involvement and high in problem behaviors (Galambos, Barker, and Tilton-Weaver 2003).

Aspects of stress and frustration were also included in some studies in relation to adolescents' delinquency. For instance, Ge, Conger, and Elder (2001) found that early biological maturation was related to psychological distress among girls, which in turn was associated with higher levels of delinquency, and Aguilar et al. (2000) found that

adolescent-onset delinquents perceived higher levels of stress than non-delinquent peers. Agnew (1984) showed among adolescent boys that social maturation, measured using the need for autonomy, was related to frustration and anger, which in turn predicted status offenses, aggression, and theft and vandalism. Several studies have also shown, however, that granting autonomy (Agnew 2003; Reitz, Dekovic, and Meijer 2006) and particularly behavioral autonomy, measured using unsupervised time spending (Agnew 2003; Galambos and Maggs 1991; Piquero and Brezina 2001; Sentse et al. 2010; Stoolmiller 1994; Warr 2005), results in delinquency instead of reducing it, as would be expected from the maturity gap explanation.

These studies looked at distinct aspects of the maturity gap (biological maturation, social maturation, and/or stress) in relation to adolescents' delinquency. Few studies have examined the extent to which delinquency is predicted by the *discrepancy* between biological and social maturation, by looking at either the interaction (Piquero and Brezina 2001; Sentse et al., 2010) or the difference between biological maturation and social maturation (Barnes and Beaver 2010).

Sentse and colleagues (2010) found in a large sample of adolescent boys and girls that parental overprotection predicted delinquency particularly for biologically mature adolescents over time, suggesting that blocked opportunities for autonomy indeed give rise to delinquent behaviors. Piquero and Brezina (2001) examined the interplay between biological maturation and need for autonomy as well as behavioral autonomy (i.e., unsupervised time spending and exposure to peers) in a longitudinal sample of adolescent boys. Although they found that biological maturation increased delinquency (but not aggression) for boys who scored high on behavioral autonomy with peers, the interaction that one would expect between biological maturation and need for autonomy was not found. Finally, Barnes and Beaver (2010) assessed the maturity gap by calculating a difference score between biological maturation and social maturation (measured using parental permissiveness in decision making), showing that their measure of the maturity gap was cross-sectionally related to minor forms of delinquency for boys and drug use for boys and girls.

Overall, these previous studies yield a mixed picture of the empirical validity of the maturity gap explanation. We aimed to contribute to the literature by examining all aspects of the maturity gap (i.e., discrepancy between biological maturation and social maturation, and frustration) in a single model using a longitudinal design.

Hypothesis

The key assumption of the maturity gap is that strain resulting from the discrepancy between biological age and social age leads to delinquency. To our knowledge, no study so far has tested this. Although the interplay between biological maturation and autonomy has been examined (Barnes and Beaver 2010; Piquero and Brezina 2001; Sentse et al. 2010), it has been assumed but not tested that adolescents perceive a potential gap as stressful, pushing them toward delinquency. Hence, rather than examining the effect of the discrepancy between biological maturation and social maturation on delinquency directly, we assessed to what extent this discrepancy predicted delinquency as well as substance use indirectly via conflict with parents. Here, conflict reflects strain and frustration as caused by the discrepancy between biological and social maturation, that is, the maturity gap. Thus, our hypothesis was that lack of autonomy in decision making would predict conflict with parents, particularly for biologically mature adolescents, which in turn would be related to increasing levels of delinquency and substance use. We tested this hypothesis in a large sample of adolescent boys and girls across one school year. Furthermore, we controlled for age, educational level, and previous levels of delinquency and substance use.

Methods

Sample

The Social Network Analysis of Risk behavior in Early adolescence (SNARE) project is an ongoing longitudinal research project on the social development of adolescents, with a specific focus on adolescents' involvement in risk behavior. Two secondary schools, covering all academic tracks, were asked to participate, and were willing to do so: one in the middle and one in the north of the Netherlands. All first- and second-year students from these schools were approached for enrollment in SNARE (2011 to 2012). All eligible students received an information letter for themselves and their parents, in which they were asked to participate. If students or their parents wished to refrain from participation, they were requested to send a reply card or e-mail within 10 days. One year later (2012 to 2013), all new first-year students were again approached for participation in the study. In total, 67 students refused to participate for several reasons: parent and/or adolescent had no interest, adolescent was dyslectic, it was too time consuming, and so on. A total of 1,844 students participated in SNARE (M age = 13.02 years (SD = .70/range 11–15); 50.1 percent female).

In September 2011, just as the children entered the first or second year of secondary school, we started with a pre-assessment. There were three follow-up regular measurement waves in October, December, and March. The data collection in 2012 occurred in exactly the same periods. A teacher and one or more researchers/research assistants were present during these assessments. The researcher gave a brief introduction, following which the students filled in a questionnaire on the computer during class, containing both self-reports and peer nominations. The completion of the questionnaires took place during regular lessons and took approximately 45 minutes. The students who were absent that day were assessed within a month. The anonymity and privacy of the students were guaranteed. For the present study, we used data collected during the first three regular waves (October, December, and March) from both first- and second-year students. The study was approved by the Internal Review Board (IRB) of one of the participating universities.

Measures

Delinquency (T1/T3). Delinquency was measured by asking participants to indicate how often they had been involved in 18 types of delinquency during the previous three months, including stealing, vandalism, burglary, and violence (Scholte et al. 2007). Answer categories were measured on a five-point scale, running from never (1), 1–3 times (2), 4–6 times (3), 7–12 times (4), to more than 12 times (5). Answers were first dummy-coded into no (0) or yes (1) and subsequently summed, resulting in a variety score that showed the extent to which participants had been involved in various delinquent acts (Elliott and Huizinga 1983).

Substance use (T1/T3). Substance use was measured by asking participants three questions about whether they had been smoking, drinking, or using cannabis in the previous three months. Answer categories were coded as no (0) or yes (1) and subsequently summed, resulting in a measure indicating involvement in various forms of substance use.

Pubertal status (T1). To measure the pubertal status of adolescents, we used the self-reported physical development scale (Petersen et al. 1988). Participants were asked to indicate several aspects of their pubertal development on a four-point scale, ranging from not yet started (1), recently started (2), started a while ago (3), and already past (4). We asked girls four questions regarding their body growth spurt, body hair (pubic hair), changes in skin

(pimples), and breast growth. The question for girls about timing of their menarche was not used because of relatively high numbers of missing values. Answers were summed and divided by the number of questions, resulting in a scale with an acceptable internal consistency ($\alpha = .70$). We also asked boys about their body growth, body hair (pubic hair), and changes in skin (pimples). Furthermore, we asked male participants to indicate to what extent they experienced breaking of the voice and beard growth. Again, answers were summed and divided by the number of questions, yielding a scale with a good internal consistency ($\alpha = .76$).

Autonomy in decision making (T1). We assessed autonomy in decision making by asking participants to what extent their parents let them make their own decisions regarding 11 different topics, such as the clothes they wear, the amount of time they spend watching television, and the Internet sites they are allowed to visit (see also Barnes and Beaver 2010). Answer categories ranged from never (1), sometimes (2), now and then (3), often (4), to always (5). Answers were summed and divided by the number of questions, resulting in an internally consistent scale ($\alpha = .79$).

Conflict about decision making (T1 − T2). Participants were asked to indicate to what extent they had arguments/disagreements with their parents about the same 11 topics referred to in the questions about autonomy in decision making (see above). Answer categories ranged from absolutely not (1), mostly not (2), sometimes (3), mostly (4), to always (5). The answers were summed and divided by 11, resulting in an internally consistent scale indicating the extent to which participants experienced conflict with their parents ($\alpha = .89$).

Control variables (T1). Age was included as a control variable. We also controlled for educational level, which was divided by six academic tracks, running from vocational training to college preparatory, with track assignments based on school results in primary education.

Analytic Strategy

We computed path models in Mplus 7.2 (Muthén and Muthén 1998) separately for delinquency and substance use as dependent variables. Besides estimating the main effects of pubertal development and autonomy and their interaction, we controlled for baseline delinquency (and substance use, respectively) as predictor of delinquency at *T*3 as well as for baseline

conflict with parents in the prediction of conflict at *T*2. Thus, any significant effect of pubertal maturation and autonomy and their interaction on delinquency effectively suggests an effect of change in delinquency and any significant effect of pubertal maturation and autonomy and their interaction on conflict at *T*2 indicates an effect of change in conflict in relation to the baseline measure. The direction of change, that is, increase or decrease, is determined by the sign of the path coefficient. Moreover, we controlled for the effects of educational levels and age on delinquency and substance use, respectively.

All models were computed using maximum likelihood estimation with robust standard errors to account for the skewed distribution of delinquency and substance use. We applied a full information maximum likelihood procedure to avoid case- and listwise deletion of cases with missing data. Finally, we estimated effect sizes of indirect effects using the `model indirect` command.

We did not have any a priori hypotheses about gender differences in the mechanisms linking pubertal development, autonomy, conflict, and delinquency/substance use but computed our analyses also in a multiple group comparison framework. In detail, we estimated the models with paths free to vary across gender and compared those to models in which we constrained the relevant paths (main and interaction as well as indirect effects) to be equal across gender. We then compared the reduction in model fit in relation to gain in parsimony using the Satorra–Bentler procedure. Where unconstrained models fit the data significantly better, we report results separately for boys and girls.

Results

Descriptive statistics for all variables are given in Table 1. Most noteworthy is that the level of delinquency somewhat decreased over time, whereas substance use slightly increased. Looking at the correlations, we found that age was positively related to all other variables, expect for a negative relation with educational level. The latter was only related (negatively) to delinquency and substance use. Furthermore, we found that pubertal status was positively related to autonomy and conflict as well as to delinquency and substance use. Whereas autonomy and conflict were unrelated to each other and unrelated to educational level, both were positively related to delinquency and substance use. Finally, delinquency and substance use were correlated with each other.

To test our main hypothesis, we examined to what extent autonomy in decision making would predict conflict with parents, which then would

Table 1. Descriptives and Bivariate Correlations between Study Variables.

Variables	Mean	*SD*	1	2	3	4	5	6	7	8	9	10
1. Age	13.14	0.72	1.00									
2. Educational level	3.84	1.46	**−.10**	1.00								
3. Pubertal status (*T*1)	2.16	0.67	**.33**	.02	1.00							
4. Autonomy (*T*1)	3.28	0.67	**.14**	.04	**.20**	1.00						
5. Conflict (*T*1)	1.73	0.60	**.09**	.01	**.13**	−.01	1.00					
6. Conflict (*T*2)	1.74	0.66	**.10**	.04	**.09**	−.03	**.56**	1.00				
7. Delinquency (*T*1)	1.85	2.93	**.14**	**−.12**	**.10**	**.20**	**.29**	**.23**	1.00			
8. Delinquency (*T*3)	1.67	3.34	**.12**	**−.06**	**.06**	**.11**	**.15**	**.24**	**.54**	1.00		
9. Substance use (*T*1)	0.30	0.63	**.25**	**−.16**	**.19**	**.16**	**.24**	**.19**	**.58**	**.39**	1.00	
10. Substance use (*T*3)	0.43	0.78	**.23**	**−.10**	**.20**	**.16**	**.18**	**.18**	**.44**	**.54**	**.53**	1.00

Note: *SD* = standard deviation. $N = 1{,}844$. Significant correlations at the $p < .05$ level are in boldface.

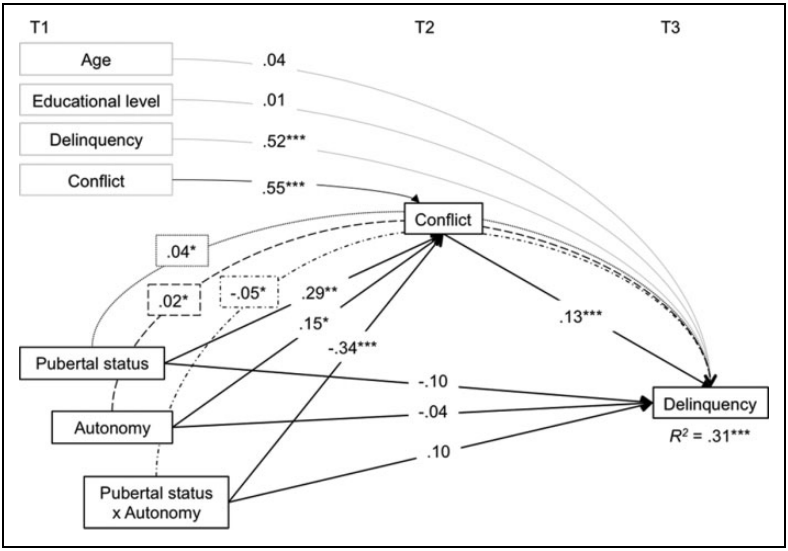

Figure 1. Standardized path coefficients for model with delinquency ($N = 1{,}844$).

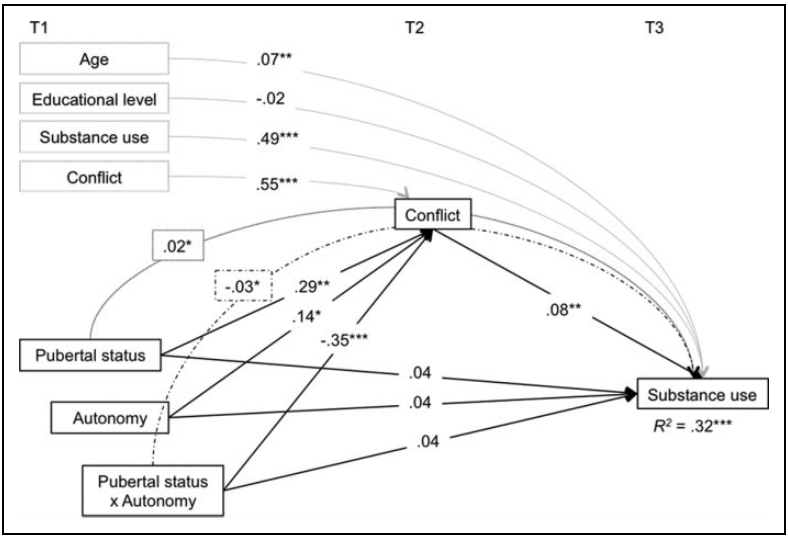

Figure 2. Standardized path coefficients for model with substance use ($N = 1{,}844$).

predict delinquency and substance use. The results of these analyses are presented in Figure 1 for delinquency and Figure 2 for substance use. For both forms of problem behavior, stability over time was significant but moderate and did not explain all of the variance in the dependent variables. Notably, however, neither autonomy nor pubertal status directly predicted change in delinquency when all other variables were accounted for. In contrast, *T*2 conflict accounted for variance both in delinquency and in substance use.

Importantly, while we did not observe direct effects from pubertal maturation, autonomy, or their interaction to delinquency or substance use, associations were detected between these variables and conflict at *T*2. That is, more matured adolescents reported greater conflict with parents as did those who were granted more autonomy at *T*1. Moreover, the interaction term between pubertal maturation and autonomy was a significant predictor, suggesting that adolescents who are more mature but experience low levels of autonomy experience more conflict. This association was found both for delinquency and for substance use.

Taken together, the associations of the interaction between pubertal maturation and autonomy with conflict and further to delinquency (and substance use, respectively) encouraged us to formally examine indirect effects. Conflict at *T*2 carried the effects of both pubertal maturation and autonomy in the prediction of delinquency (see dotted lines in Figure 1). That is, adolescents who were more mature and more autonomous experienced a greater increase in conflict with parents which in turn predicted increasing levels of delinquency. Notably, we also detected an indirect effect from the interaction term (autonomy $\times$ pubertal maturation) via conflict to delinquency, indicating that the double risk for conflict with parents that is inflicted by faster maturation and low autonomy ultimately affects delinquency risk. Note that the negative indirect effect coefficient results from multiplying the (negative) coefficient connecting the interaction term with conflict and the (positive) effects between conflict and delinquency.

With regard to substance use, conflict at *T*2 mediated the effect of pubertal maturation on substance use and also the interaction effect (see dotted lines in Figure 2), indicating that early maturers, and in particular those who report low autonomy, experienced more conflict with parents which in turn increased their risk for substance use.

Finally, we examined whether these mechanisms differed between boys and girls and computed constrained and unconstrained models. Both for delinquency and for substance use fit constrained models the data as well as unconstrained but are more parsimonious. Hence, we do not report separate results for boys and girls.

Discussion

An important challenge for scholars, policymakers, and society in general is to understand why adolescents engage in delinquency and substance use. In this study, we aimed to enhance understanding of what motivates adolescents to engage in delinquency and substance use by examining one potentially powerful explanation: the maturity gap. Problem behaviors in adolescence might be a temporary response to a discrepancy between biological maturation and being seen accordingly socially (Bloch and Niederhoffer 1958; Greenberg 1977; Moffitt 1993). As argued, the lack of opportunities for adolescents to express their biological maturation might result in frustration, which increases the chance of involvement in delinquency and substance use as alternative means to express their maturity.

This study adds to previous research by testing a mechanism underlying the link between the maturity gap and problem behaviors, that is, the extent to which a discrepancy between biological and social maturation is related to conflict with parents as indicator of frustration. Previous research has tapped into aspects of this mechanism by looking at the relation between biological maturation and delinquency (Felson and Haynie 2002; Galambos et al. 2003; Haynie 2003; Haynie and Piquero 2006; Sentse et al. 2010; Williams and Dunlop 1999), subjectively experienced age and problem behaviors (Arbeau et al. 2007; Galambos et al. 1999; Galambos and Tilton-Weaver 2000), biological maturation and delinquency mediated by stress (Ge et al. 2001), stress and delinquency (Aguilar et al. 2000), social maturation and delinquency mediated by frustration and anger (Agnew 1984) and biological maturation in interaction with parental overprotection (Sentse et al. 2010) or autonomy (Piquero and Brezina 2001) predicting delinquency, and differences between biological maturation and parental permissiveness predicting problem behaviors (Barnes and Beaver 2010).

In the current study, we however investigated a specific sequence derived from the maturity gap explanation in a single model by examining to what extent a discrepancy between biological maturation and social maturation (i.e., autonomy in decision making) was related to frustration (i.e., conflict with parents), which in turn predicted delinquency and substance use.

The results of our study revealed the hypothesized pattern. We found that biological maturation indeed interacted with social maturation in such a way that when participants were granted more autonomy, they experienced less conflict with their parents, especially when they were biologically more mature. Conflict with parents was in turn positively related to higher levels

of delinquency and substance use over time. Further, it appeared that these effects held while controlling for baseline levels of conflict, and delinquency and substance use. These findings highlight that it is particularly the interplay between biological and social maturation which is related to adolescent problem behaviors, however, only via conflict with parents. This indicates that conflict with parents as an indication of frustration or strain is an important factor linking the maturity gap and problem behaviors. Thus, in this study the maturity gap does not directly predict problem behaviors.

The patterns we found were similar for boys and girls. As it could have been the case that the maturity gap would be more pronounced for girls due to earlier biological maturation in combination with having less autonomy because of receiving more protection from parents. This was, however, not the case, suggesting that both boys and girls have conflict with parents when biologically maturing but experiencing a lack of autonomy in decision making. This in turn heightens the changes of involvement in problem behaviors.

Interestingly, our findings were consistent for delinquency and substance use, suggesting that involvement in both forms of problem behaviors was indeed partially triggered by biological and social maturation via conflict with parents. Although the maturity gap was originally aimed at explaining delinquency, these findings show that it is also suitable for explaining substance use among adolescents. Nevertheless, it should be kept in mind that delinquency and substance use were highly correlated, indicating that a considerable number of participants were involved in both forms of problem behavior simultaneously.

At the same time, some adolescents do not engage in delinquency or substance use. Arguing from the maturity gap, this group of abstainers apparently does not experience a discrepancy between their biological and social maturation as they are already granted with adult-like responsibilities and involved in adult-like activities (Chen and Adams 2010). Alternatively, this group might lack the opportunities to express their frustration originated from the maturity gap in the absence of having access to peers who engage in delinquency and function as role models (Young 2014), for instance, due to negative personal characteristics (Owens and Slocum 2012). This group might also perceive problem behaviors not representing an adult status compared to peers who experience the maturity gap.

Limitations

In the current study, we focused explicitly on the role of parents as authority figures restricting or granting autonomy and consequently inducing

conflict. In so doing, we focused on how parental behavior might push adolescents toward involvement in problem behaviors without looking at the other side of the coin: namely, the role of peers who pull adolescents toward them. Both forces are likely to work at the same time and strengthen each other, heightening adolescents' susceptibility to engagement in problem behaviors. As such, the maturity gap would not only induce conflict with parents but also pull adolescents toward their peers. Future research might benefit from also looking at this underlying mechanism of the maturity gap.

Furthermore, parents have different rearing styles, often distinguished as authoritarian, authoritative, neglectful, and indulgent (Steinberg 2001). In our study, we did not include parenting styles. However, future research on the maturity gap might benefit from the inclusion of parenting styles as moderator of the effect of the maturity gap on problem behaviors. One could expect that particularly authoritative parents are able to meet adolescents' need for autonomy and independence when biologically maturing while minimizing conflict. In that respect, adolescents might explore their independence without losing support and structure provided by authoritative parents (Steinberg 2001). Hence, research on parenting styles in the context of the maturity gap would be an interesting and fruitful avenue for future research. Parents are, however, not the only authority figures adolescents have to deal with. Also teachers, neighbors, employers, and adult colleagues might affect adolescents' feelings of frustration, hindering them in expressing their maturity, or providing them with opportunities to express their maturity. Future research might consider including information from additional contexts in order to improve understanding of to what extent adolescents are able to express their maturation.

Another line of reasoning concerns looking at individual factors such as temperamental factors, most prominently, effortful control and negative emotionality (DeLisi and Vaughn 2014). Both temperamental constructs have been linked to antisocial behavior directly but also to the ability to form positive relationships with others, such as parents and peers. In the context of this study, adolescents who are high in negative emotionality might interpret parental control and supervision more negatively and hostile, leading to more frustration and conflict with parents (DeLisi and Vaughn 2014). A next step in research would be to examine how these temperamental factors contribute to frustration experienced from a discrepancy between biological and social maturation in explaining delinquency and substance use.

Another promising line of research is the examination of genetic factors that underlie Moffitt's taxonomy of the adolescence-limited group and the life-course persistent group (Schwartz and Beaver 2013). As Schwartz and

Beaver (2013) showed genetic risk predicted belonging to one of these groups, while controlling for other factors including a difference score between biological maturation and parental permissiveness indicating the maturity gap (see also Barnes and Beaver 2010).

The focus of this study was on the maturity gap as an explanation for the involvement of adolescents in problem behaviors. However, there are several alternative explanations. One explanation is that delinquency and substance use are not so much the result of frustration and stress, but as behaviors that represent an adult status, attracting adolescents who biologically mature. Another alternative explanation for the increase in delinquency in adolescence is that opportunities for engaging in delinquency increase due to reduced parental supervision and increased unsupervised time spending with peers (Agnew 2003; Haynie and Osgood 2005). For instance, it has been argued that delinquency might be a by-product of hanging around with peers rather than the result of motivated, intentional behavior (Haynie and Osgood 2005; Osgood and Anderson 2004). As such, delinquency is not so much driven by strain resulting from the maturity gap but rather depends on exposure to peers.

The central claim of the maturity gap explanation is that delinquency and substance use help to bridge this gap. As argued elsewhere, other behaviors and characteristics might also contribute to closing this gap, such as physical attractiveness and athletic abilities signaling biological as well as sexual maturation. These characteristics of adolescents might weaken the effect of the maturity gap (Dijkstra et al. 2009, 2010) and might be worth taking into account in future studies.

We focused on delinquency and substance use as outcomes with conflict related to the maturity gap as underlying mechanism. However, it would also be interesting to explore how conflict in turn relates to autonomy granted to adolescents. If adolescents get in trouble and become involved in problem behaviors, they might face more supervision and less autonomy from their parents. How these patterns might affect the experience of the maturity gap by adolescents and the development of problem behaviors is open for future research. We did not explicitly address different forms of delinquency in this study. Following the argumentation of Moffitt (1993), associations of the maturity gap with delinquency might vary depending on the type of delinquency. Whereas the life-course-persistent group engages in more serious delinquency, such as severe aggression and robberies, the adolescence-limited group is more likely to be involved in minor delinquency, such as vandalism, status offenses, and conflicts with authorities, which all symbolize autonomy, independence, and maturity (Agnew

2003). It might be expected that (aspects of) the maturity gap only predicts involvement in these three forms of minor delinquency (status offenses, conflicts with authority, and instrumental delinquency) rather than serious delinquency. In future research, it would be interesting to untangle different forms of delinquency and substance use through investigating more offense-specific patterns underlying the functioning of the maturity gap.

Although our data were collected across only one school year at the onset of adolescence, they nevertheless overcome the lack of representative population sample data (Piquero and Brezina 2001) and extend our knowledge of the relation between the maturity gap and delinquency outside the United States (e.g., Barnes and Beaver 2010; Piquero and Brezina 2001) and for boys and girls (e.g., Agnew 1984; Piquero and Brezina 2001).

A final limitation is that all information was based on self-reports. Unfortunately, we did not have information from the parents. However, it could be argued that parental behaviors (in this study, the extent to which parents granted autonomy in decision making) are most likely to impact adolescents if they perceive these behaviors as restricting or frustrating. As such, the inclusion of self-reported conflict with parents about decision making exactly taps into how adolescents experience the behavior of their parents.

To summarize, in this study we investigated how the maturity gap might affect adolescents' delinquency and substance use by examining to what extent a discrepancy between biological maturation and autonomy in decision making (reflecting social maturation) was related to frustration (defined as conflict with parents), which in turn predicted delinquency and substance use. The results revealed that biological maturation in interaction with social maturation predicted conflict with parents, which in turn was related to higher levels of delinquency and substance use over time. These findings reveal that conflict with parents links the interplay of biological and social maturation with delinquency and substance use in early adolescence.

Author's Note

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References

Agnew, R. 1984. "Autonomy and Delinquency." *Sociological Perspectives* 27: 219-40.

Agnew, R. 2003. "An Integrated Theory of the Adolescent Peak in Offending." *Youth & Society* 34:263-99.

Aguilar, B., L. A. Sroufe, B. Egeland, and E. Carlson. 2000. "Distinguishing the Early-onset/persistent and Adolescence-onset Antisocial Behavior Types: From Birth to 16 Years." *Development and Psychopathology* 12:109-32.

Arbeau, K. J., N. L. Galambos, and S. M. Jansson. 2007. "Dating, Sex, and Substance Use as Correlates of Adolescents' Subjective Experience of Age." *Journal of Adolescence* 30:435-47.

Barnes, J. C. and K. M. Beaver. 2010. "An Empirical Examination of Adolescence-limited Offending: A Direct Test of Moffitt's Maturity Gap Thesis." *Journal of Criminal Justice* 38:1176-85.

Bloch, H. A. and A. Niederhoffer. 1958. *The Gang: A Study in Adolescent Behavior*. New York: Philosophical Library.

Chen, X. and M. Adams. 2010. "Are Teen Delinquency Abstainers Social Introverts?: A Test of Moffitt's Theory." *Journal of Research in Crime and Delinquency* 47:439-68.

DeLisi, M. and A. R. Piquero. 2011. "New Frontiers in Criminal Careers Research, 2000-2011: A State-of-the-art Review." *Journal of Criminal Justice* 39:289-301.

DeLisi, M. and M. G. Vaughn. 2014. "Foundation for a Temperament-based Theory of Antisocial Behavior and Criminal Justice System Involvement." *Journal of Criminal Justice* 42:10-25.

Dijkstra, J. K., A. H. N. Cillessen, S. Lindenberg, and R. Veenstra. 2010. "Same-gender and Cross-gender Likeability: Associations with Popularity and Status Enhancement: The TRAILS Study." *Journal of Early Adolescence* 30:773-802.

Dijkstra, J. K., S. Lindenberg, F. C. Verhulst, J. Ormel, and R. Veenstra. 2009. "The Relation between Popularity and Aggressive, Destructive, and Norm-breaking Behaviors: Moderating Effects of Athletic Abilities, Physical Attractiveness, and Prosociality." *Journal of Research on Adolescence* 19:401-13.

Dijkstra, J. K. and R. Veenstra. 2011. "Peer Relations." Pp. 255-59 in *Encyclopedia of Adolescence*, Vol. 2, edited by B. B. Brown and M. Prinstein. New York: Academic.

Elliott, D. S. and D. Huizinga. 1983. "Social-class and Delinquent-behavior in a National Youth Panel—1976-1980." *Criminology* 21:149-77.

Felson, R. B. and D. L. Haynie. 2002. "Pubertal Development, Social Factors, and Delinquency among Adolescent Boys." *Criminology* 40:967-88.

Galambos, N. L., E. T. Barker, and L. C. Tilton-Weaver. 2003. "Who Gets Caught at Maturity Gap? A Study of Pseudomature, Immature, and Mature Adolescents." *International Journal of Behavioral Development* 27:253-63.

Galambos, N. L., G. C. Kolaric, H. A. Sears, and J. L. Maggs. 1999. "Adolescents' Subjective Age: An Indicator of Perceived Maturity." *Journal of Research on Adolescence* 9:309-37.

Galambos, N. L. and J. L. Maggs. 1991. "Out-of-school Care of Young Adolescents and Self-reported Behavior." *Developmental Psychology* 27:644-192.

Galambos, N.L and L.C. Tilton-Weaver. 2000. "Adolescents' psychosocial maturity, problem behavior, and subjective age: In search of the adultoid." *Applied Developmental Science* 4:178-55.

Ge, X. J., R. D. Conger, and G. H. Elder. 2001. "The Relation between Puberty and Psychological Distress in Adolescent Boys." *Journal of Research on Adolescence* 11:49-70.

Greenberg, D. F. 1977. "Delinquency and Age Structure of Society." *Contemporary Crises* 1:189-223.

Haynie, D. L. 2003. "Contexts of Risk? Explaining the Link between Girls' Pubertal Development and Their Delinquency Involvement." *Social Forces* 82:355-97.

Haynie, D. L. and D. W. Osgood. 2005. "Reconsidering Peers and Delinquency: How Do Peers Matter?" *Social Forces* 84:1109-30.

Haynie, D. L. and A. R. Piquero. 2006. "Pubertal Development and Physical Victimization in Adolescence." *Journal of Research in Crime and Delinquency* 43:3-35.

Hirschi, T. and M. Gottfredson. 1983. "Age and the Explanation of Crime." *American Journal of Sociology* 89:552-84.

Moffitt, T. E. 1993. "Adolescence-limited and Life-course-persistent Anti social Behavior—A Developmental Taxonomy." *Psychological Review* 100:674-701.

Moffitt, T. E. 2006. "Life-course-persistent Versus Adolescence-limited Antisocial Behavior." Pp. 570-98 in *Developmental Psychopathology*, Vol. 3, edited by D. Cicchetti and D. J. Cohen. Hoboken, NJ: Wiley.

Muthén, L.K. and B.O. Muthén. 1998. "Mplus User's Guide. Sixth Edition.". Los Angeles, CA: Muthén & Muthén.

Osgood, D. W. and A. L. Anderson. 2004. "Unstructured Socializing and Rates of Delinquency." *Criminology* 42:519-49.

Owens, J. G. and L. A. Slocum. 2012. "Abstainers in Adolescence and Adulthood: Exploring the Correlates of Abstention Using Moffitt's Developmental Taxonomy." *Crime & Delinquency*. doi:0011128711427234.

Petersen, A. C., L. Crockett, M. Richards, and A. Boxer. 1988. "A Self-report Measure of Pubertal Status—Reliability, Validity, and Initial Norms." *Journal of Youth and Adolescence* 17:117-33.

Piquero, A. R. and T. Brezina. 2001. "Testing Moffitt's Account of Adolescence-Limited Delinquency." *Criminology* 39:353-70.

Reitz, E., M. Dekovic, and A. M. Meijer. 2006. "Relations between Parenting and Externalizing and Internalizing Problem Behaviour in Early Adolescence: Child Behaviour as Moderator and Predictor." *Journal of Adolescence* 29:419-36.

Scholte, R. H. J., R. C. M. E. Engels, R. A. T. de Kemp, Z. Harakeh, and G. Overbeek. 2007. "Differential Parental Treatment, Sibling Relationships and Delinquency in Adolescence." *Journal of Youth and Adolescence* 36:661-71.

Sentse, M., J. K. Dijkstra, S. Lindenberg, J. Ormel, and R. Veenstra. 2010. "The Delicate Balance between Parental Protection, Unsupervised Wandering, and Adolescents' Autonomy and its Relation with Antisocial Behavior: The TRAILS Study." *International Journal of Behavioral Development* 34:159-67.

Steinberg, L. 2001. "We Know Some Things: Parent-adolescent Relationships in Retrospect and Prospect." *Journal of Research on Adolescence* 11:1-19.

Steinberg, L. 2007. *Adolescence*. 8th ed. New York: McGraw-Hill.

Stoolmiller, M. 1994. "Antisocial-behavior, Delinquent Peer Association, and Unsupervised Wandering for Boys—Growth and Change from Childhood to Early Adolescence." *Multivariate Behavioral Research* 29:263-88.

Schwartz, J.A and K.M. Beaver. 2013. "A partial test of Moffitt's developmental taxonomy: Examining the role of genetic risk." *Justice Quarterly* 1:1-24.

Warr, M. 2005. "Making Delinquent Friends: Adult Supervision and Children's Affiliations." *Criminology* 43:77-105.

Williams, J. M. and L. C. Dunlop. 1999. "Pubertal Timing and Self-reported Delinquency among Male Adolescents." *Journal of Adolescence* 22:157-71.

Young, J. T. N. 2014. "'"Role Magnets"'? An Empirical Investigation of Popularity Trajectories for Life-course Persistent Individuals During Adolescence." *Journal of Youth and Adolescence* 43:104-15.

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