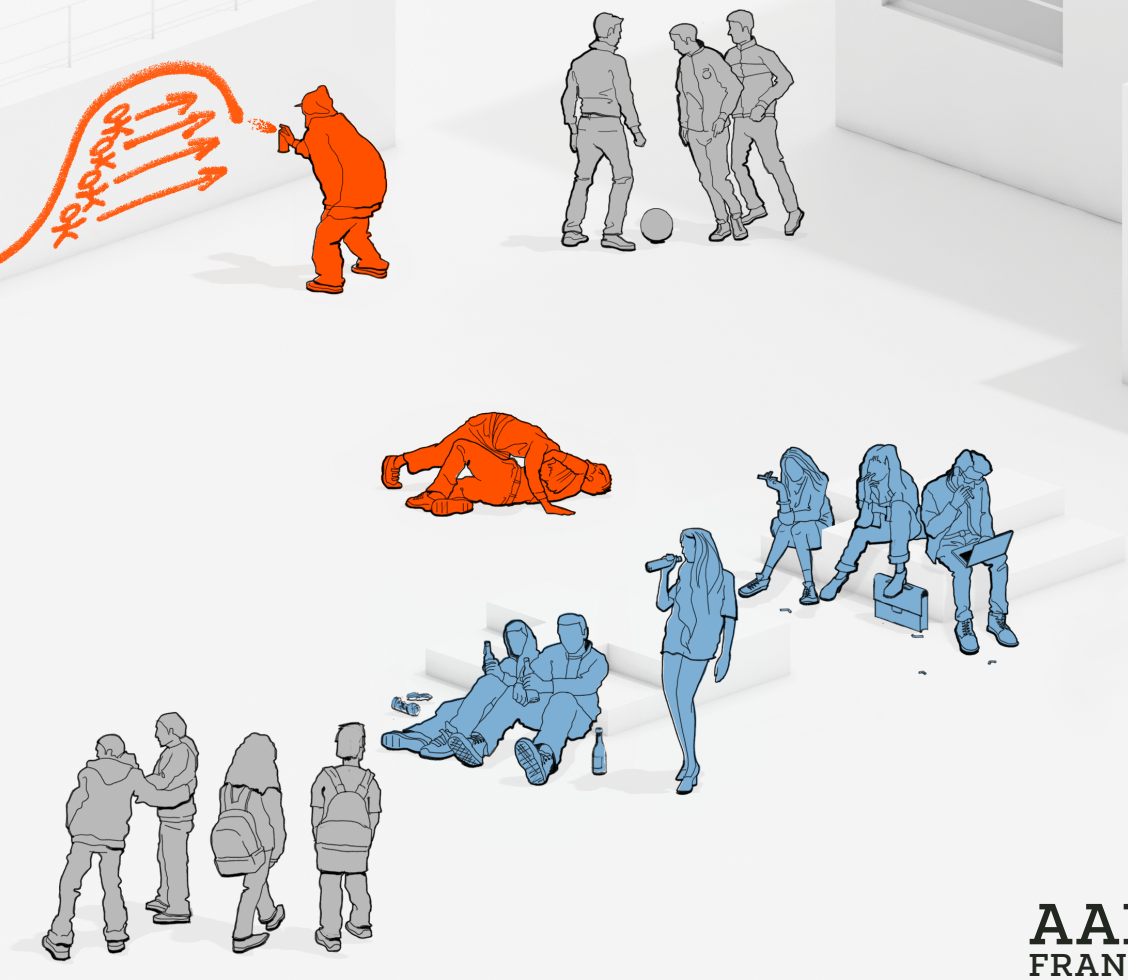
First steps to misbehaving

The co-development of early adolescent friendship and externalizing behavior.



AART FRANKEN

First steps to misbehaving:

The co-development of early adolescent friendship and externalizing behavior

De ontwikkeling van vriendschap en externaliserend gedrag tijdens het begin van de adolescentie (met een samenvatting in het Nederlands)

Proefschrift

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Promotor:
Prof. dr. W. A. M. Vollebergh

Copromotoren:
Dr. Z. Harakeh
Dr. J. K. Dijkstra

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CHAPTER 1

INTRODUCTION

During adolescence there is an increase in externalizing behaviors such as alcohol use, tobacco use, and delinquency (e.g., Currie et al., 2012; Jennings & Reingle, 2012). Peers and friends play a vital role in this increase of externalizing behavior. This ubiquitous engagement in externalizing behavior during adolescence and the role of peers in this has been explained by a stressful experience, called the 'maturity gap' (Moffitt, 1993). Adolescents experience the maturity gap when they feel biologically mature, but have not yet obtained a socially mature status in society. One way to overcome this experience is to engage in perceived adult-like behaviors such as externalizing behavior, instead of; by copying this behavior from more experienced peers.

The dual-taxonomy model (Moffitt, 1993) identifies two distinct groups. The first is a relatively small group, around 5 – 10% of the population, characterized by an early onset of externalizing behavior. They already start with externalizing behavior during childhood, and are expected to continue with this behavior throughout their lives. This group showing early onset externalizing behavior is thus already experienced with these perceived adult-like behaviors at the start of adolescence. The second group is characterized by an adolescent onset of externalizing behavior. They become interested in engaging in externalizing behavior during early adolescence to bridge the maturity gap. Therefore, they are expected to copy the perceived adult-like externalizing behaviors from their more experienced peers with an early onset of externalizing behavior. Especially during adolescence, the peer group becomes the major social context in which respect and recognition of social maturity – that is still denied in adult society – may be granted. During early adolescence the relationship between adolescents with an early and an adolescent onset of externalizing behavior is thus expected to change (Moffitt, 1993).

Although the dual-taxonomy model (Moffitt, 1993) has obtained substantial support, the link between adolescents with an early onset and adolescent onset of externalizing behavior remains understudied (see Moffitt, 2007). As adolescents gain interest in externalizing behavior to overcome the maturity gap, they become interested in their more experienced peers. The first understudied assumption of the dual-taxonomy model (Moffitt, 1993) is that the adolescents who had an early onset of externalizing behavior move from a marginalized position in childhood to a more central role in the peer group during adolescence. Thus they are expected to become popular role models during early adolescence. A second understudied hypothesis is that

adolescents are expected to copy the adult-like externalizing behaviors from their more experienced peers; to overcome the maturity gap. Thus, adolescents with an early onset of externalizing behavior are expected to influence their friends to engage in this behavior. Third, individual differences in the spread of externalizing behavior merit investigation. Several individual characteristics are known to impact both adolescents' friendships and their externalizing behavior, and might therefore impact the co-development of adolescents' friendship and externalizing behavior.

The social status of adolescents with an early onset of externalizing behavior

A first step in understanding the social position of adolescents with an early onset of externalizing behavior is to examine their social status in the peer group. Moffitt (1993) expects them to become popular role models to their peers, as their peers become interested in externalizing behavior to bridge the maturity gap. However, she does not expect adolescents with an early onset of externalizing behavior to become especially accepted in the peer group, as no mutual befriending or liking is needed for adolescents to copy externalizing behavior. In line with this differentiation between popularity and acceptance (i.e., liking, befriending), studies investigating social status have also demonstrated the importance of differentiating between (perceived) popularity (asking adolescents who they believe is popular) and acceptance (asking adolescents who their friends are or who they like) (e.g., Cillessen & Rose, 2005; Gifford-Smith & Brownell, 2003).

There are two types of studies linking adolescent externalizing behavior to social status. The first type of study identifies adolescents with a profile of life-course persistent, indicative of early onset, externalizing behaviors (i.e., aggression by Young, 2013, delinquency by Rulison, Kreager, & Osgood, 2014). These two studies show that adolescents characterized by a profile of life-course persistent externalizing behavior have fewer friends than their peers. The second type of study assesses the association between popularity and externalizing behavior as a global construct (Agan et al., 2014) or as specific types of externalizing behavior such as aggression, alcohol use, tobacco use, and norm breaking behaviors (e.g., Cillessen & Mayeux, 2004; Dijkstra, Lindenberg, Verhulst, Ormel, & Veenstra, 2009; Hawke & Rieger, 2013; Mayeux, Sandstrom, & Cillessen, 2008). These studies show that externalizing behaviors are positively associated with peer popularity rather

than acceptance during adolescence. Thus, the first type of studies focus on friendship as an indicator for social status, and the second type of studies take several forms of social status into consideration. Furthermore, while the first type of studies differentiate between early and adolescent onset externalizing behavior, the second type do not.

Therefore, this thesis investigated the social status of adolescents with an early onset of externalizing behavior in two studies. Firstly, using cross sectional data it was investigated if having an early onset of several externalizing behaviors is indicative of popularity, and acceptance, during early adolescence. Secondly, using longitudinal data it was investigated if early, elementary school, engagement in antisocial behavior (a part of externalizing behavior) is predictive of later, adolescent, popularity. Additionally, as studies have shown that peer-valued characteristics might increase the association between antisocial behavior and popularity (e.g., Dijkstra et al., 2009; Rosen & Underwood, 2010; Vaillancourt & Hymel, 2006) such characteristics were taken into consideration.

The social influence of adolescents with an early onset of externalizing behavior

A second step in understanding the social position of adolescents with an early onset of externalizing behavior is to examine if and how they influence their friends to engage in externalizing behavior. To properly investigate the spread of externalizing behavior among friends, it is important to take several methodological issues into consideration. The development of stochastic actor-based modeling (SABM; Snijders, Steglich, & Schweinberger, 2007; Steglich, Snijders, & Pearson, 2010) allows studying friendship connections among peers not only as dyadic friendship relations (relations between two individuals), but in the context of social networks where friends are embedded in a network of friendship relations. Furthermore, SABM allows disentangling friendship similarity selection and influence processes. It is important to disentangle these processes as they may lead to the same outcome: Friends are similar to each other. Friendship similarity selection takes place when adolescents become friends based on similarity in behavior. For example, adolescents who engage in externalizing behavior to a similar extent become friends. Thus, in friendship similarity selection the behavior stays the same but the friendship connections change. Friendship influence takes place between friends, when adolescents adapt their behavior to become more

similar to their friends. For example, adolescents start engaging in externalizing behavior to become more similar to friends who engage in such behavior. Thus, in friendship influence processes the behavior changes and the friendship remains the same. Therefore, SABM is needed to investigate friendship similarity selection and influence processes between friends, in the context of other friendship relations.

Recent studies using SABM, with some exceptions (e.g., Burk, Van der Vorst, Kerr, & Stattin, 2011; Knecht, Snijders, Baerveldt, Steglich, & Raub, 2010; Mercken, Snijders, Steglich, & De Vries, 2009), show that adolescents are influenced by the externalizing behavior of their friends (for an overview see Veenstra, Dijkstra, Steglich, & Van Zalk, 2013). Although these studies show that adolescents influence one another in externalizing behavior, with one exception (Light, Greenan, Rusby, Nies, & Snijders, 2013), they focused on (dis) continuation rather than on the onset of this behavior. Light and colleagues (2013) showed that adolescents were influenced by their friends in the onset of alcohol use.

For several reasons, it is important to further our understanding of friendship processes related to the onset of externalizing behavior. The onset of substance use during adolescence predicts substance abuse or dependence five years later; equally well as already having experienced substance abuse or dependence during adolescence (Palmer et al., 2009). Moreover, it may change attitudes towards this behavior (De Leeuw, Engels, Vermulst, & Scholte, 2008), and might have different determinants from further continuation of externalizing behavior (e.g., Van der Vorst, Engels, Meeus, & Dekovic, 2006). Therefore, studying how adolescents influence the onset of their friends' externalizing behavior is important. Moreover, it is unknown how influence processes associated with the onset of externalizing behavior relate to influence processes associated with further (dis)continuation of externalizing behavior. Therefore, influence processes related to both the onset and (dis)continuation of externalizing behavior were investigated and compared.

Individual characteristics moderating the co-development of friendship and externalizing behavior

A third step in understanding the spread of externalizing behavior in early adolescence is to investigate which personal characteristics are associated

with the co-development of friendship and externalizing behavior. As not all adolescents may be equally susceptible to their peers' influences (see Brechwald & Prinstein, 2011), individual characteristics might moderate the co-development of friendship and externalizing behavior. Three key characteristics known to affect early adolescent development of externalizing behavior and friendship processes will be investigated: Social status, pubertal development, and self-control. Additionally, music preference will be investigated as music preference might signal belonging to a specific peer crowd, which might impact the development of externalizing behavior.

Social status potentially affects adolescents' influence among peers, according to longitudinal (e.g., Bot, Engels, Knibbe, & Meeus, 2005; Laursen, Hafen, Kerr, & Stattin, 2012) and experimental (e.g., Cohen & Prinstein, 2011; Sandstrom and Romano, 2007, as cited in Sandstrom, 2011) studies. Thus far, to our knowledge, only one study investigated popularity as a potential moderator of the spread of externalizing behavior using stochastic actor-based modeling (Mathys, Burk, & Cillessen, 2013). This study showed that, during late adolescence, peer influence processes did not depend on popularity. However, the importance of popularity might peak during early adolescence (LaFontana & Cillessen, 2010). Therefore, it was investigated whether popularity and likeability act as moderators of influence processes in the spread of externalizing behavior among early adolescents.

Pubertal development as an indicator of biological maturity precipitates the experience of the maturity gap; since the maturity gap has been defined as a gap between adolescents' biological maturity and the lack of social recognition of this maturity by society (Moffitt, 1993). Thus, adolescents who are biologically more mature might be more likely to feel trapped in the maturity gap. This maturity gap likely increases adolescents' interest for externalizing behavior. Moreover, pubertal development has been associated with an increased susceptibility to social rewards (e.g., Blakemore & Mills, 2014; Crohne & Dahl, 2012; Somerville, 2013). Preliminary results suggest that among boys with more advanced levels of pubertal development, friends' externalizing behavior is associated with boys' own externalizing behavior, while this is not the case for boys with a less advanced level of pubertal development (Felson & Haynie, 2002). The potential role of pubertal development as a moderator in the co-development of friendship and externalizing behavior was investigated, as, to our knowledge, this is unstudied.

Self-control is an important variable in explaining the development of externalizing behavior according to the General Theory of Crime (Gottfredson and Hirshi, 1990). This theory expects adolescents with low self-control to select one another as friends as they have difficulty obtaining other friends. Moreover, adolescents are expected to engage in delinquent acts because of their low self-control, rather than their delinquent friends (Gottfredson and Hirshi, 1990). Indeed, low self-control has been associated with an abundance of negative life experiences, such as substance use and criminal offending (Moffitt et al., 2011). Therefore, it can be expected that adolescents with a low self-control are more likely to engage in externalizing behavior during adolescence. However, it remains unexplored if this direct effect of low self-control holds when taking a potentially increased susceptibility to friends' influence into account. On the one hand, adolescents with lower self-control might be less influenced by their friends who already engage in externalizing behavior, as they don't need such friends to engage in externalizing behavior (Meldrum et al., 2009). This would imply that adolescents with low self-control are more likely to develop externalizing behavior, but are not more likely to be influenced by their friends' externalizing behavior. On the other hand, adolescents with a lower self-control might be more susceptible to peer influence (Gardner., Dishion, & Connell, 2008; Wright, Caspi, Moffitt, & Silva, 2001). This would imply that adolescents do not necessarily develop externalizing behavior without friends who engage in externalizing behavior. As both expectations are potentially valid, they were simultaneously explored in the current thesis.

Music preference is expected to be a key factor for adolescents to be drawn to specific crowds, according to the Music Marker Theory (MMT; Ter Bogt, Keijsers, & Meeus, 2013). Especially for adolescents who prefer non-mainstream music types, these crowds in turn might impact the further development of adolescent externalizing behavior. Indeed, early adolescent non-mainstream music preferences strongly predicted later externalizing behavior (Selfhout, Delsing, Ter Bogt, & Meeus, 2008; Ter Bogt et al., 2013). Following a study of Steglich and colleagues (Steglich, Snijders, & West, 2006) it was investigated whether, above and beyond the effects of (friends') externalizing behavior, music preference impacts friendship selection and whether adolescents with a preference for non-mainstream music were more likely to develop externalizing behavior.

Participants and procedures

To study these hypotheses, the SNARE (Social Network Analysis of Risk behavior in Early adolescence) study was set up and conducted (see also Dijkstra et al., 2015, Franken et al., 2015). With an exception of Chapter 3, all data analyzed were part of the SNARE study. Chapter 3 uses data from the TRAILS study, for more detail of this project see Chapter 3 (or De Winter et al., 2005; Huisman et al., 2008).

The SNARE study is a prospective cohort study that focuses on the interplay between social networks and the development of externalizing behavior. The participants were recruited from two secondary schools, one in the middle and one in the North of the Netherlands. Ethical approval for the study was granted by one of the participating universities. From these schools, all first and second year students were approached to participate in the first year of the study; these students are referred to as the first cohort of participants. The next year a second cohort of students entered the first year of the schools, and also was approached to take part in the study; these latter students are referred to as the second cohort of participants. All eligible students and their parents received an information letter about the research, in which they were asked to participate. Students or their parents were asked to send a reply card or email within two weeks, if they wished to refrain from participation. In total, 1826 students were approached for this study, of which 40 students (2.2%) refused to participate. A total of 1786 students participated in SNARE (*M* Time 1 = 12.9 years, *SD* = 0.70, 50.1% male, 83.9% Dutch).

For this thesis only SNARE data from participants in the first year of secondary education were used. This assured that adolescents just entered secondary school. This transition is important in the Netherlands (see Poorthuis, 2012), and it is associated with changes in friendships (Güroglu, Cillessen, Haselager, & Van Lieshout, 2012). Therefore, friendship selection and influence processes were investigated among a mostly unacquainted social network, thus largely isolated from preexisting friendships. Moreover, this assured that the participants were mostly between the ages of 11 and 13, an important period for the development of externalizing behavior (Moffitt, 1990; 1993). Participants included 1144 students (50% boys), aged 11.1 to 15.6 (Mean 12.7, *SD* = 0.47); 97% were born in the Netherlands (as were 87% of their fathers and 88% of their mothers). Of the participants, 43.9% followed lower level education (including preparatory secondary school for technical and

vocational training) and 54.1% followed higher level education (including preparatory secondary school for higher professional education and university).

The pre-assessment was during the first weeks of secondary school (September). The first assessment took place in October (Time 1), the second in December (Time 2), and the third in April (Time 3) of the same academic year. During these assessments, a teacher and research assistants were present. A research assistant gave a brief introduction and explained that participants' answers would remain confidential and anonymous. During the assessment, students filled in a questionnaire on the computer during one classroom period, around 45 minutes. After the pre-assessment, this questionnaire contained, next to self-reports, peer nominations using CS socio software (www.sociometric-study.com). Peer reported variables were assessed by asking participants questions about their classmates. Participants were presented with all names of their classmates on their computer screen in alphabetical order, starting with a random name. For some peer nomination questions it was optional to select peers outside the classroom (but within the SNARE sample), using a search function. Unlimited, both same and cross sex, nominations were allowed. As there were two cohorts of students from two schools, four friendship networks were independently investigated. The students who were absent at the day of assessment were, if possible, assessed within a month.

Outline of the thesis

This thesis set out to further examine how early adolescent externalizing behavior is perceived by peers, how it spreads among friends, and whether individual characteristics impact the co-development of friendship and externalizing behavior.

In Chapter 2, the social status (popularity and acceptance) of adolescents with an early onset of one, two or three externalizing behaviors (i.e., antisocial behavior, alcohol use, and tobacco use) was examined. In Chapter 3, it was assessed if childhood antisocial behavior has a predictive association with early adolescent popularity. Chapter 4 focused on the influence of adolescents with an early onset of externalizing behavior, and compared influence processes in the onset and further (dis)continuation of externalizing behavior.

The final chapters focus on individual characteristics which might be

important for the co-development of friendship and externalizing behavior. In Chapter 5 social status (popularity and likeability) was investigated as a potential moderator of influence processes in the spread of externalizing behavior. In Chapter 6, it was assessed if pubertal development impacts friendship similarity selection based on externalizing behavior. In Chapter 7 the role of low self-control was studied. Specifically it was studied if low self-control affects early adolescents' development of externalizing behavior (1) regardless of their friends' behavior, or (2) through an increased susceptibility to their friends' externalizing behavior. In Chapter 8 music preference was investigated as an alternative explanation for early adolescents' similarity selection and influence processes next to (friends') externalizing behavior. It was studied if early adolescents would select each other as friends based on their music preference, and if non-mainstream music preference would predict further engagement in externalizing behavior; above and beyond effects of externalizing behavior.

Finally, Chapter 9 provides a general discussion of this dissertation.

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CHAPTER 2

SOCIAL STATUS OF ADOLESCENTS WITH AN EARLY ONSET OF EXTERNALIZING BEHAVIOR: THE SNARE STUDY.

AART FRANKEN [1, 2, 3, 4, 5]
ZEENA HARAKEH [1, 2, 3, 4, 5]
JAN KORNELIS DIJKSTRA [1, 2, 3, 4, 5]
RENÉ VEENSTRA [1, 3, 4, 5]
WILMA A.M. VOLLEBERGH [1, 3, 4, 5]

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1 Conceived and/or designed the study
2 Participated in data acquisition
3 Participated in data analysis and interpretation
4 Involved in drafting / revising the manuscript
5 Given final approval

ABSTRACT

According to the dual-taxonomy model (Moffitt, 1993) adolescents with an early onset of antisocial behavior become popular adolescent role models, but are not necessarily liked or befriended. Previous studies investigating this assumption did not examine popularity but focused on friendship as an indicator of social status. This study investigated the social status (i.e., popularity, likeability, and the number of friendships) of adolescents with an early onset of externalizing behavior (i.e., alcohol use, tobacco use, and antisocial behavior). It was hypothesized that early onset adolescents were more popular, but not more liked and had fewer friends. Hypotheses were tested using data from the SNARE study (N = 1,100, 50% boys, M_{age} = 12.7, SD = 0.47). Findings indicate that adolescents with an early onset of one or more externalizing behaviors are more popular, less liked, and have as many friends as their peers. These findings imply that early onset adolescents have a highly popular status among peers, potentially functioning as role models.

Keywords: Alcohol use, antisocial behavior, tobacco use,
perceived popularity, early adolescence

During adolescence, there is an increase in externalizing behaviors, such as alcohol use, tobacco use, and antisocial behavior (e.g., Currie et al., 2012; Jennings & Reingle, 2012). According to the dual-taxonomy model (Moffitt, 1993) the "maturity gap" is important for understanding this adolescent onset of externalizing behavior. Adolescents experience this gap when they feel biologically mature, while they do not yet have the same mature rights and responsibilities in society as adults. In this regard, externalizing behavior gives them an opportunity to be seen as mature, autonomous, and adult-like in their peer group. Consequently, those adolescents who have an early onset of externalizing behavior are expected to become popular to their peers, evoking the imitation and mimicry of externalizing behaviors (Moffitt, 1993, 2007; Moffitt & Caspi, 2001). Hence, this idea is a crucial part of the dual-taxonomy model of Moffitt (1993) as it explains the spread of externalizing behaviors from those with an early onset to their peers.

Surprisingly, only a few studies explicitly tested this hypothesis. Two studies investigated the relation between externalizing behaviors such as delinquency (Rulison, Kreager, & Osgood, 2014) or aggression (Young, 2013), and the number of friendships as an indicator for social status. Both studies (Rulison et al., 2014; Young, 2013) showed that adolescents with a stable delinquency or aggression level, which is associated with having an early onset of externalizing behavior (Moffitt, 1993), have fewer friends than their peers. Although these findings are not in line with Moffitt's (1993) expectations on popularity, they do support her ideas on affection and liking; neither is expected to be necessary to be able to imitate or mimic externalizing behavior from peers with an early onset of externalizing behavior.

Whereas these two previous studies focus on number of friends as indicator of social status, since 1998 (see LaFontana & Cillessen, 1998; Parkhurst & Hopmeyer, 1998) research differentiates between being accepted by peers and having a popular status in the peer group (Cillessen & Rose, 2005; Gifford-Smith & Brownell, 2003; Mayeux, Houser, & Dyches, 2011). The first construct of being accepted by peers (i.e., well liked or having many friends) is mainly associated with prosocial characteristics such as being kind and trustworthy (Parkhurst & Hopmeyer, 1998) but also with being less socially visible (Lease, Kennedy, & Axelrod, 2000). The latter construct is captured by the concept of popularity, sometimes referred to as perceived popularity, which has also been linked to being attractive for affiliation (Dijkstra, Cillessen, & Borch, 2013) but also with being dominant, powerful and influential (Lease, Kennedy, &

Axelrod, 2000), and aggression (LaFontana & Cillessen, 1998; Parkhurst & Hopmeyer, 1998; Prinstein & Cillessen, 2003). Thus, although popularity is generally associated with both positive and negative characteristics during adolescence, acceptance is not (see also Mayeux et al., 2011).

Some studies indeed showed that perceived popularity rather than social acceptance is positively associated with externalizing behavior (Agan et al., 2014), and with specific externalizing behaviors such as aggression, alcohol use, tobacco use, and norm breaking behavior (e.g., Dijkstra, Lindenberg, Verhulst, Ormel & Veenstra, 2009; Hawke & Rieger, 2013; Mayeux, Sandstrom, & Cillessen, 2008). However, these studies investigated social status and externalizing behavior during middle adolescence without differentiating between adolescents with an early onset of externalizing behaviors and their peers with an adolescent onset of externalizing behaviors. Cillessen and Mayeux (2004) however, did examine popularity during late childhood and early adolescence, but only focused on relational and physical aggression, revealing that popularity was indeed linked with aggression. Although aggression reflects externalizing behavior, it only represents a small part of adolescents' externalizing behaviors. Hence, examining a more broad range of externalizing behaviors might provide a more detailed picture of its link with popularity.

Moffitt (1993) did not explicitly differentiate between being liked, having many friends, and being popular; as before 1998 researchers did not yet differentiate between acceptance and popularity (LaFontana & Cillessen, 1998; Parkhurst & Hopmeyer, 1998). However, her description of the early onset adolescents as models seems to reflect popularity rather than having friends or being well liked. Indeed, in her 2007 review on the dual-taxonomy model, Moffitt calls for studies to address the fact that early onset adolescents would become popular with peers during adolescence. Moreover, Moffitt, (1993) explicitly mentions that liking is not needed to successfully copy behavior: "What is contended is that adolescents-limited youths should regard life-course persistent youths as models, and life-course persistent teens should regard themselves as magnets for other teens. Neither perception need involve reciprocal liking between individuals" (p. 688). Last, she (1993) claims that adolescents with an early onset of externalizing behavior will obtain more influential positions in the peers system; which again seems to reflect popularity rather than having many friends or being well liked.

Identifying early onset or even life-course persistent externalizing behavior ideally requires following children till adulthood. The two studies investigating a profile of life-course persistent externalizing behavior used consistent adolescent engagement in externalizing behavior to identify life-course persistent externalizing (i.e., aggression, delinquency) behavior (Rulison et al., 2014; Young, 2013). Alternatively, it might be possible to identify those children who are already experienced in externalizing behavior before they are likely to experience the maturity gap; thus before they likely have an adolescent onset of externalizing behavior. Moffitt (1993) states that especially the entrance to secondary school and the years between 11 and 13 are important for the increase, thus adolescent-onset, of externalizing behavior. The change to secondary school increases the awareness of the maturity gap; as adolescents experience less supervision and are surrounded by older peers who already experience the maturity gap. Therefore, identifying externalizing behaviors at the very start of secondary school allows identifying those adolescents who are most likely to have an early onset of externalizing behavior. There might be few peers who already have an early adolescent onset of externalizing behavior, but those early adolescents who are already experienced in multiple externalizing behaviors will most likely have had an early onset of externalizing behavior. This study focused on early adolescents who are characterized by being experienced in externalizing behavior just after leaving elementary school. Therefore, this study focused on the question if adolescents perceive their peers who are more experienced in externalizing behavior as popular; presumably as such peers had an early onset of externalizing behavior and can be role models to overcome the experience of the maturity gap (Moffitt, 1993).

This study aimed to investigate the hypothesis of Moffitt (1993) that adolescents with an early onset of externalizing behavior become popular in early adolescence, and builds on previous research in three ways. First, we focused on three types of social status: Popularity, likeability, and friendships. This allowed comparing current findings with aforementioned studies. Second, we identified early onset, although not a profile of early onset or even life-course persistent, externalizing behavior among adolescents who just left elementary school and are therefore unlikely to have an adolescent onset of externalizing behavior. Additionally, several externalizing behaviors have been assessed, thus allowing differentiating between adolescents who are experienced in one externalizing behavior and those experienced in multiple

externalizing behaviors. Especially those adolescents experienced in multiple externalizing behaviors were expected to be characterized by having an early onset of externalizing behavior. Participants were recruited when they entered a new and larger social network at secondary school in the Netherlands (when they are around 12.5 years old). Third, to obtain a more complete picture of externalizing behavior, different types of externalizing behavior were taken into consideration, that is, alcohol use, tobacco use, and antisocial behavior. These behaviors are known to cluster together during early adolescence (e.g., Monshouwer et al., 2012). Furthermore, as it can be expected that having an onset of multiple behaviors increases the likelihood that peers perceive adolescents as role models in externalizing behavior, we analyzed the additive effect of having an onset of multiple externalizing behaviors. Specifically, the following hypotheses were tested: Adolescents with an early onset of externalizing behavior will be 1) more popular, 2) but not more liked, and 3) have fewer friends. This will be 4) especially likely for adolescents who have an early onset of several externalizing behaviors. Additionally, we investigated possible gender differences to assess if, in line with the expectations of Moffitt and Caspi (2001), findings will be similar for boys and girls.

METHODS

Participants and Procedure

Data were derived from the SNARE (Social Network Analysis of Risk behaviors in Early adolescence) study. SNARE is an ongoing prospective cohort study involving two schools in two regions of the Netherlands (see also Dijkstra et al., 2015; Franken et al., 2015). Participants were recruited in their first or second grade of secondary school (i.e., similar to 7th-8th grades in the US) in Year 1. In Year 2, a second cohort was added, including students in first grade at the same schools. A passive consent procedure was used; students or their parents were asked to send a reply card or email within two weeks, if they wished to refrain from participation. In total, 1826 students were approached for this study, of which 40 students (2.2%) refused to participate. A total of 1786 students participated in SNARE (*M* age time 1 = 12.9 years, *SD* = 0.70, 50.1% male, 83.9% Dutch). The study was approved by the Internal Review Board (IRB) of one of the participating universities.

For the current study only participants form the first grade were included in

order to assess a valid indication of early onset externalizing behavior at the beginning of secondary school. Participants who attended the pre-assessment and the first wave of data collection were included, resulting in a sample of 1124 first grade students in secondary school (50% boys), aged 11.1 till 15.6 years (M_{age} = 12.7, *SD* = 0.47). A total of 97% of participants were born in the Netherlands (as were 87% of their fathers and 88% of their mothers). The pre-assessment took place in the first weeks of the school year (September) and the first assessment took place in October (Time 1). During the pre-assessment and the first assessment participants completed self-reported study questionnaires on the computer while a teacher and research assistant were present. During the first assessment peer nominations were also completed by participants, using CS socio software (www.sociometric-study.com). Participants were presented with a roster including all the names of their classmates, in alphabetical order but starting with a random name, and were allowed unlimited same and cross gender nominations.

MEASURES

Self-reported externalizing behaviors (pre-assessment, Time 1). At the pre-assessment and Time 1 participants reported their engagement in three forms of externalizing behavior: Alcohol use, tobacco use, and antisocial behavior. At pre-assessment participants were asked if they ever engaged in these behaviors, at Time 1 participants were asked if they engaged in these behaviors since the pre-assessment. For alcohol use, participants used a 13 point scale (ranging from 0 to over 40 times) to report on how many occasions they consumed at least a glass of alcohol (Wallace et al., 2002). For tobacco use, participants used a 7 point scale (ranging from never to more than 20) to indicate how many cigarettes they smoked (e.g., Monshouwer et al., 2011). Antisocial behavior was measured with 17 items by asking participants how often (between 0 to 12 or more times) they had been involved in 17 types of antisocial behavior; including stealing, vandalism, burglary, violence, weapon carrying, threatening to use a weapon, truancy, contact with the police, and fare evasion in public transport (e.g., Nijhof, Scholte, Overbeek, & Engels, 2010; Van der Laan, Veenstra, Bogaerts, Verhulst, & Ormel, 2010).

To obtain an 'onset score' at Time 1, the scores of the pre-assessment and Time 1 were combined per behavior. Furthermore, based on recommendations of Farrington and Loeber (2000) and because data using

continuous measures of externalizing behavior frequency were highly skewed (see Table 1), all externalizing behavior data were recoded as binary, indicating no onset at all (0) or any onset (1) of alcohol use, tobacco use, or antisocial behavior. As externalizing behaviors are known to cluster together during early adolescence (e.g., Monshouwer et al., 2012), an exploratory factor analysis (using maximum likelihood estimations and oblique rotation) tested if the externalizing behaviors loaded on a single factor. The variables loaded on one factor, explaining 55.3% of the variance, with an Eigen Value greater than 1. Therefore (see Tabachnick & Fidell, 2007), a composite variable, representing the number of different externalizing behaviors participants engaged in (i.e., alcohol use, tobacco use, antisocial behavior) was computed; resulting in scores between zero (no onset of externalizing behavior) and three (an onset of all externalizing behaviors). The binary variables on antisocial behavior, alcohol use, and tobacco use, were added and participants could thus have a score between zero (no onset of externalizing behavior) and three (an onset of all externalizing behaviors).

TABLE 1 **Frequency Onset of Externalizing Behavior**

NUMBER OF PARTICIPANTS	NO ONSET	ONSET
Antisocial behavior	459	630
Alcohol use	803	271
Tobacco use	950	117
At least 1 externalizing behavior	431	693
At least 2 externalizing behaviors	846	278
Three externalizing behaviors	1037	87

Social Status (Time 1). At Time 1 popularity was assessed by asking "who are most popular", likeability was assessed by asking "who do you like most", and number of friends by asking "which of your classmates are your best friends". Received scores were summed and divided by the total number of possible nominators (i.e., classmates), to obtain a proportional score which allowed comparing social status between classrooms of different sizes. Therefore, participants could obtain a score between 0 (no nominations) and 1 (nominated by all classmates). Afterwards, these scores were z-standardized.

Analysis Strategy

Externalizing behavior was entered as a dummy-coded contrast in order to assess if there is an additional impact of having an onset of multiple externalizing behaviors compared to having an onset of less of these behaviors. The first dummy-coded variable was coded zero (0) when participants had no onset of externalizing behavior and one (1) if they had an onset of at least one externalizing behavior. The second variable was coded zero (0) if participants had an onset of at most one type of externalizing behavior, an one (1) if participants had an onset of at least two externalizing behaviors. The last variable was coded zero (0) if participants had an onset of maximum two externalizing behaviors and one (1) if they had an onset of all three externalizing behaviors. Using this method, each group is compared with the previous group. Hence, regression coefficients are additive. For example, the last effect of having an onset of three externalizing behaviors can be calculated by combining this effect with the effects of having at an onset of at least one and at least two externalizing behaviors (see also Dijkstra, Cillessen, Lindenberg, & Veenstra, 2010; Kalmijn, 1999).

To get an overview of the variables, descriptive statistics were calculated. First, the mean, standard deviation, and the bivariate correlations between the main study variables were calculated. Second, to test current hypotheses, multiple Linear Regression Analyses were run to analyze the association between the onset of externalizing behaviors (alcohol use, tobacco use, and antisocial behavior) and social status (popularity, likeability, friendships); while controlling for gender and the other status types. Therefore it was possible to disentangle the different status types. For example, controlling for likeability and friendship in the prediction of popularity assured that the possible association between externalizing behavior and popularity is not explained by an association between externalizing behaviors and being liked or having friends. Thus, rather than identifying a select group of participants based on a profile of externalizing behavior, participants were identified who had an onset of in one, two, or even three types of externalizing behavior.

Three analyses were run, one per item of social status (popularity, likeability, and friendships) as the dependent variable. Analyses were run in two steps. First the main effects of the externalizing behaviors were assessed, while controlling for gender and other types of social status. In the second step, interaction effects between an early onset of externalizing behavior and gender were added.

RESULTS

Descriptive statistics

First, the mean scores and bivariate correlations between the main study variables were calculated (Table 2). The different social status types correlated positively and moderately (between .32 and .53). Furthermore, whereas popularity and the number of friends were positively correlated with externalizing behaviors, likeability was negatively correlated with these behaviors.

Externalizing Behavior and Social Status

The association between externalizing behavior and social status was examined for each of the three social status types: Popularity, likeability, and the number of friends (see Table 3). In the first step of the analyses the social status was predicted by the amount of externalizing behavior (engagement in more than one, more than two, or more than three externalizing behaviors), while controlling for gender and the other types of social status. Having an early onset of at least one externalizing behavior was significantly and

TABLE 2

Means (*SD*) of, and Correlations between, the Main Study Variables

		MEAN (*SD*)	CORRELATIONS							
			1.	2.	3.	4.	5.	6.	7.	8.
1.	Popularity	0.00 (1.00)	1.00							
2.	Likeability	0.00 (1.00)	0.32**	1.00						
3.	Friendships	0.00 (1.00)	0.48**	0.53**	1.00					
4.	Antisocial behavior	0.58 (0.49)	0.19**	-0.10**	0.08**	1.00				
5.	Alcohol use	0.25 (0.43)	0.20**	-0.06*	0.09**	0.33**	1.00			
6.	Tobacco use	0.11 (0.31)	0.17**	-0.02	0.05	0.26**	0.39**	1.00		
7.	At least 1 externalizing behavior	0.62 (0.49)	0.18**	-0.10**	0.09**	0.93**	0.46**	0.28**	1.00	
8.	At least 2 externalizing behaviors	0.25 (0.43)	0.21**	-0.06*	0.09**	0.47**	0.85**	0.59**	0.45**	1.00
9.	Three externalizing behaviors	0.08 (0.27)	0.21**	0.01	0.07*	0.25**	0.49**	0.82**	0.23**	0.51**

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

TABLE 3

Results from Multilevel Linear Regressions Predicting Popularity from Externalizing Behaviors

	POPULARITY			
	BETA	*t*	BETA	*t*
Adjusted R-square (*S.E.*)	0.29 (0.13)		0.29 (0.13)	
Popularity	–	–	–	–
Likeability	0.15**	4.64	0.15**	4.55
Friendships	0.38**	12.08	0.38**	12.08
Sex (0 = girls, 1 = boys)	0.06*	2.18	0.02	0.54
At least 1 externalizing behavior	0.09**	2.97	0.07	1.68
At least 2 externalizing behaviors	0.07*	2.25	0.09	1.68
Three externalizing behaviors	0.12**	3.90	0.07	1.36
At least 1 externalizing behavior x gender	–	–	0.05	0.83
At least 2 externalizing behaviors x gender	–	–	-0.02	-0.37
Three externalizing behaviors x gender	–	–	0.06	1.21

Note. * $p < .05$, ** $p < .01$. Effects of having an early onset of multiple behaviors are additive.

TABLE 3

Results from Multilevel Linear Regressions Predicting Likeability from Externalizing Behaviors

	LIKEABILITY			
	BETA	*t*	BETA	*t*
Adjusted R-square (*S.E.*)	0.38 (0.12)		0.38 (0.12)	
Popularity	0.13**	4.64	0.13**	4.55
Likeability	–	–	–	–
Friendships	0.49**	17.91	0.49**	17.94
Sex (0 = girls, 1 = boys)	-0.26**	-10.66	-0.32**	-7.76
At least 1 externalizing behavior	-0.07*	-2.42	-0.12**	-3.14
At least 2 externalizing behaviors	-0.08*	-2.50	-0.03	-0.59
Three externalizing behaviors	0.02	0.70	0.01	0.03
At least 1 externalizing behavior x gender	–	–	0.11*	1.98
At least 2 externalizing behaviors x gender	–	–	-0.07	-1.27
Three externalizing behaviors x gender	–	–	0.02	0.51

Note. * $p < .05$, ** $p < .01$. Effects of having an early onset of multiple behaviors are additive.

TABLE 3

Results from Multilevel Linear Regressions Predicting Friendship from Externalizing Behaviors

	FRIENDSHIPS			
	BETA	*t*	Beta	*t*
Adjusted R-square (*S.E.*)	(0.41) (0.10)		(0.41) (0.10)	
Popularity	0.32**	12.08	0.32**	12.08
Likeability	0.47**	17.91	0.47**	17.94
Friendships	–	–	–	–
Sex (0 = girls, 1 = boys)	0.12**	4.75	0.14**	3.30
At least 1 externalizing behavior	0.03	1.27	0.06	1.69
At least 2 externalizing behaviors	0.04	1.34	-0.02	-0.46
Three externalizing behaviors	-0.04	-1.32	0.00	0.02
At least 1 externalizing behavior x gender	–	–	-0.05	-1.00
At least 2 externalizing behaviors x gender	–	–	0.09	1.64
Three externalizing behaviors x gender	–	–	-0.05	-1.02

Note. * $p < .05$, ** $p < .01$. Effects of having an early onset of multiple behaviors are additive.

positively associated with popularity (Beta = 0.09, $t = 2.97$ $p < .01$), negatively associated with likeability (Beta = -0.07, $t = -10.66$, $p = .02$), and not associated with friendships (Beta = 0.03, $t = 1.27$, $p = .20$). Furthermore, there was an additive effect of having an onset of multiple externalizing behaviors for popularity and likeability. Participants who had an onset of at least two externalizing behaviors were more popular (Beta = 0.07, $t = 2.25$, $p = .03$) than their peers with an onset of less externalizing behaviors, and those with an onset of three externalizing behaviors were in turn even more popular (Beta = 0.12, $t = 3.90$, $p < .01$). Furthermore, participants who had an onset at least two externalizing behaviors were less liked than their peers with an onset of at least one or no externalizing behaviors (Beta = -0.08, $t = 2.50$, $p = .01$).

The analyses investigating possible gender differences showed that the only differences between boys and girls were in the association between likeability and externalizing behavior. The interaction between externalizing behavior and gender ($B = 0.037$, $SE = 0.017$, $p = 0.048$) indicated that the negative association between having an onset of at least one externalizing behavior and likeability was stronger for girls than for boys (see Figure 1). Simple slope analyses indicated that for girls the level of engagement in externalizing

behavior was negatively associated with being liked (Beta = -0.24; $p = <.01$), while for boys this was not the case (Beta = -0.02; $p = 0.49$). Specifically, girls who were experienced with externalizing behavior were less liked than girls who had no experience in externalizing behavior.

FIGURE 1

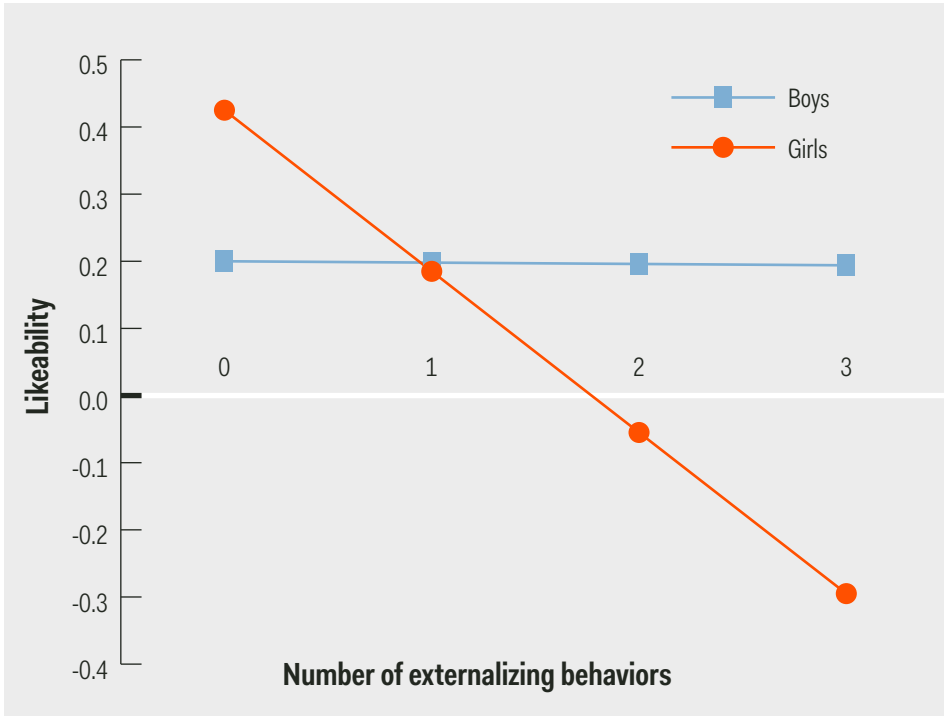

FIGURE 1. The interaction between gender and externalizing behavior, indicating the association between externalizing behavior and onset of externalizing behavior for girls and boys.

DISCUSSION

The main aim of this study was to investigate the social status of adolescents with an early onset of externalizing behavior. In contrast to earlier studies focusing on the adolescents' number of friends (Rulison et al., 2014; Young, 2013), this study study focused on different status types. The findings showed that, compared to their peers, adolescents with an early onset of externalizing behavior are 1) more popular, 2) less liked, 3) have a similar number of friends,

and that 4) these findings are stronger for adolescents with an early onset of multiple externalizing behaviors for popularity and likeability. Therefore, we found strong support that adolescents with an early onset of externalizing behavior are perceived as being popular by their peers. Although interactions with gender were tested, only one interaction reached significance. While in general the association between externalizing behavior and status seems to be similar for boys and girls, girls who engage in at least one externalizing behavior were less liked compared to their friends who do not engage in this behavior, whereas for boys such difference did not exist.

Current findings show the importance of assessing multiple social status types when looking at the social status of adolescents with an early onset of externalizing behavior. Although Moffitt (1993) focused on antisocial behavior, it can be expected that those adolescents who engage in multiple adult-like behaviors will be more likely perceived as adult-like and as popular. Furthermore, these more experienced adolescents might also be more likely characterized by a profile of early onset externalizing behavior. As those adolescents who engaged in multiple externalizing behaviors were less liked compared to their peers, they might lack some social skills; in line with predictions of Moffitt (1993) for adolescents with an early onset of externalizing behavior.

We found no differences in the number of friends between adolescents with an early onset of externalizing behavior and their peers. This finding is also in contrast to earlier studies which showed that adolescents with a stable engagement in aggression or delinquency, which might be seen as indicative for an early onset of externalizing behavior, had fewer friends than their peers (Rulison et al., 2014; Young, 2013). This might be because we assessed their status in a new social network when entering secondary school and friendships might not yet be very stable in this new network. Both previous studies (Rulison et al., 2014; Young, 2013) investigated friendships in networks where participants already knew one another for a longer period of time. Alternatively it might be that especially delinquency and aggression are associated with having fewer friends, rather than smoking and alcohol use.

Looking at gender differences, the association between social status and externalizing behavior only differed between boys and girls for likeability. While for girls the level of externalizing behavior negatively affected their likeability, for boys externalizing behavior did not alter their likeability.

Possibly externalizing behaviors are perceived to be more normative for boys rather than girls, especially substance use may be appreciated more among male rather than female peers (Mayeux, 2011). Results showed that both boys and girls were likely to be popular when they had an early onset of externalizing behavior, and for neither boys nor girls this onset made a difference in their number of friends. This lack of gender differences is in line with the expectations of Moffitt and Caspi (2001) who expected that, although there are more boys than girls with an early onset of externalizing behavior, the mechanisms behind the spread of externalizing behavior are similar for boys and girls.

Strengths and Limitations

The current study has several strengths. The main strength is that we used peer nominations of age-mates in the same classes at school, which allowed showing how adolescents with an early onset of externalizing behavior are perceived by their peers. Furthermore, popularity, likeability, and friendships were assessed; thus comparing these three types of social status was possible. Moreover, assessing an early onset of externalizing behavior among participants who just left elementary education allowed identifying them before their peers experienced an adolescent onset of such behaviors. Also, we investigated three types of externalizing behavior (alcohol use, tobacco use, and antisocial behavior) rather than focusing on one type of externalizing behavior. Moreover, we investigated additive effects of having an onset of multiple externalizing behaviors using dummy-coded contrast variables; which allowed assessing the additional effect of having an onset of several externalizing behaviors. Last, we used self-reported indicators for externalizing behavior and peer reported indicators for social status, therefore rater bias, which occurs when participants identify both their friends and the externalizing behavior of those friends (see Meldrum, Young, & Weerman, 2009), was prevented.

This study also has some limitations. First, the study design did not allow participants to be followed from childhood until adulthood. This would be ideal to identify those adolescents with an early onset, or even life-course persistent profile, of externalizing behavior. However, we asked participants about their lifetime engagement in externalizing behavior just after leaving primary school. Thus, we feel fairly confident that the analysis in this study can be seen as an adequate test of the hypothesis of Moffitt (1993) about the

social status of adolescents with an early onset of externalizing behavior. Second, as the design was cross-sectional we could not investigate changes over time. Therefore, we do not know to what extent the image of adolescents with an early onset of externalizing behavior is specific for the age studied or will change over time; in particular whether the popular image of this group will decline after adolescence; as suggested by Moffitt (1993). Moreover, we do not know how early externalizing behavior becomes associated with popularity. Moffitt (1993) would expect adolescents to become interested in externalizing behavior and thus those adolescents who are experienced in externalizing behavior to become popular. However, popular adolescents might also befriend their peers with an early onset of externalizing behavior which in turn might increase the popularity of adolescents with an early onset of externalizing behavior through contagion processes (see Marks, Cillessen, & Crick, 2012). In addition, future studies should investigate if these adolescents with an early onset of externalizing behavior become influential in the spread of externalizing behavior. Last, longitudinal studies would allow for making the distinction between the adolescent onset group and non-involved adolescents (i.e., abstainers). This would allow testing whether it is the adolescent onset group that is most sensitive to the early onset adolescents and is most likely to assign them with a popular status. Future longitudinal studies should fill this gap.

CONCLUSION

Current findings indicate that adolescents with an early onset of externalizing behavior are perceived as popular by their peers, while they are less liked. Thus, these findings support the claim of Moffitt (1993) that adolescents with an early onset of externalizing behavior may become popular to their peers. Furthermore, findings expand on recent studies which investigated friendship as an indicator of social status (Rulison et al., 2014; Young, 2013) by comparing friendships to popularity and likeability, and showing it is important to compare these types of social status. Future research should investigate whether adolescents with an early onset of externalizing behavior do indeed influence the development of externalizing behavior among their peers, and thus could be seen as key agents in the spread of such behavior at this age. Especially peer-led interventions such as the ASSIST program (Starkey, Audrey, Holliday, Moore, & Campbell, 2009) where the most

influential adolescents are trained in verbal communication skills and selected to spread smoke-free and health-promoting messages among their peers, should consider that some of the selected adolescent role models might have an early onset of other types of externalizing behavior such as alcohol use or antisocial behavior, and might currently engage in several externalizing behaviors. Teaching such adolescents verbal communication skills, without helping them change their externalizing behavior, might actually make them more influential in the spread of their externalizing behavior among their peers. Also for these intervention programs, it could be beneficial to investigate both the externalizing behavior, and the popularity, likeability, and number of friends adolescents have – to find the most influential adolescents to spread their message to prevent adolescent externalizing behavior.

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CHAPTER 3

THE ASSOCIATION BETWEEN EARLY ONSET ANTISOCIAL BEHAVIOR AND EARLY ADOLESCENT POPULARITY: THE TRAILS STUDY.

AART FRANKEN [1, 3, 4, 5]
ZEENA HARAKEH [1, 3, 4, 5]
JAN KORNELIS DIJKSTRA [1, 3, 4, 5]
RENÉ VEENSTRA [1, 2, 3, 4, 5]
WILMA A.M. VOLLEBERGH [1, 2, 3, 4, 5]

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1 Conceived and/or designed the study
2 Participated in data acquisition
3 Participated in data analysis and interpretation
4 Involved in drafting / revising the manuscript
5 Given final approval

ABSTRACT

This study examined whether there is a predictive association between childhood antisocial behavior and adolescent popularity. Individual characteristics that have been associated with popularity (i.e., physical attractiveness, athletic abilities, socio-economic status), and gender, were taken into account as moderators. Data from the longitudinal TRAILS (Tracking Adolescents' Individual Lives Survey) study were used. Participants were 11 years old at Time 1, and assessed again 2.5 years later (49% female, 89% of Dutch origin). Antisocial behavior was assessed with parent, teacher, and self-reports, and popularity was assessed with peer nomination. Structural Equation Modeling was conducted among 828 children. Findings showed that early onset antisocial behavior was associated with adolescent popularity, especially for adolescents with peer-valued characteristics (i.e., are physically attractive or good in sports); socio-economic status and gender did not moderate the association. Thus, an early onset of antisocial behavior was associated with adolescent popularity; interventions should keep this in mind.

Keywords: Adolescence, aggression, delinquency, peer nominations, peer-valued characteristics, popularity

Young people become more engaged in antisocial behavior (e.g., delinquency, aggression) during early adolescence (Statistics Netherlands, 2014). In Western societies, adolescence can be seen as a separate life phase characterized by a combination of biological maturation and postponement of opportunities for social maturity. This "maturity gap" has been identified as a core issue in the field of adolescent development (Moffitt, 1993). According to Moffitt (1993, 2007), adolescents attempt to narrow the maturity gap by adopting presumed "mature" behaviors, such as antisocial behavior, that lead to social status within adolescent peer groups. Through antisocial behaviors, adolescents are expected to obtain powers and privileges normally reserved for adults. In particular adolescents experiencing the maturity gap are expected to view antisocial behaviors to represent mature behaviors. Especially the period between the ages 11 and 13 is an important period for the onset of antisocial behavior (Moffitt, 1990, 1993). During this period there is the transition from primary school to secondary school, where students enter a new and larger peer context. Moreover, older students who have already found their way of coping with the maturity gap through antisocial behaviors will be the new school mates of adolescents who just enter secondary school (Moffitt, 1993). As a result, the adolescents who have an early onset of antisocial behavior, those who are already involved in antisocial behaviors in childhood, may become popular role models to their peers who experience the maturity gap.

Moffitt (1993) differentiated between people showing life-course-persistent (early onset) and adolescent-limited (adolescent onset) antisocial behavior in her dual-taxonomy model. According to this model the life-course-persistent adolescents can be characterized by an early onset of antisocial behavior; during childhood. During childhood they are expected to be rejected by their peers, as their antisocial behavior is not yet attractive to their peers. However, during adolescence they are expected to become role models and experience a popular status among their peers, because at this time antisocial behavior is seen to decrease the experience of the maturity gap. Other adolescents who do not yet engage in antisocial behavior are expected to desire contact with adolescents already experienced in antisocial behavior in order to mimic such behavior. The popularity of adolescents with an early onset of antisocial behavior is therefore based on the desire of their peers to affiliate with them and imitate their antisocial behavior (Moffitt, 1993). Crucial to this idea is that early onset antisocial behaviors (in elementary school) should predict

popularity in early adolescence (in secondary school). The aim of this study is to assess whether an early onset of antisocial behavior is associated with adolescent popularity.

Previous cross-sectional studies have shown that, during early adolescence, there is a positive association between different types of antisocial behavior (e.g., physical aggression, norm breaking behavior, destructive behavior, and bullying) and popularity (Dijkstra, Lindenberg, Verhulst, Ormel, & Veenstra, 2009; Luthar & McMahon, 1996). The few existing longitudinal studies have shown similar findings, particularly with regard to aggression (i.e., Cillessen & Mayeux, 2004; Puckett, Aikins, & Cillessen, 2008; Rose, Swedson, & Waller, 2004). Puckett and colleagues (2008) showed that aggression and popularity were positively associated over time, in a sample of adolescents aged between 13 and 15. Cillessen and Mayeux (2004) found that aggression became increasingly associated with popularity between the ages 10 and 14 by looking at yearly transitions. Last, the study by Rose et al. (2004) showed that the predictive association of aggression on popularity was positive after the age of 12 (seventh grade), but not before. In sum: previous findings show that there is a positive association of antisocial behavior and other externalizing behaviors with popularity, particularly in adolescence, but did not investigate a longer longitudinal transition from childhood to adolescence.

To investigate if early, childhood, onset antisocial behavior is predictive of adolescent popularity, several methodological aspects should be taken into account. First, to describe the typical behavior of children with early onset antisocial behavior, both aggression and delinquency seem to be important (Moffitt, 1993; 2007). Therefore, both delinquency and aggression were included in a global construct of antisocial behavior; to test if there is an association between antisocial behavior and popularity. Second, it was important to identify behaviors which happen across situations (Moffitt, Caspi, Dickson, Silva, & Stanton, 1996), which provide a more complete image of antisocial behavior (Veenstra, Lindenberg, Verhust, & Ormel, 2009). Therefore, a multiple informant approach (e.g., teacher, parent and self-reports) was used. Third, it is important to investigate the transition from elementary school to secondary school. Thus it is necessary to study a period longer than one year to test the hypothesis of Moffitt (1993). Follow up has been limited in other studies, investigating relatively short-term effects with a maximum of half a year (Rose et al., 2004), one year (Puckett et al., 2008), or looking at yearly transitions (Cillessen & Mayeux, 2004). In conclusion, the above

mentioned aspects were taken into account to test the hypotheses in this study.

Moreover, it is important to investigate whether the assumed associations might only be valid for adolescents with peer-valued characteristics. Moffitt (1993) does not discuss this possibility, but former studies showed that the cross-sectional association between antisocial behavior and popularity was moderated by individual characteristics that are valued by peers such as physical attractiveness and athletic abilities (Dijkstra et al., 2009; Rosen & Underwood, 2010; Vaillancourt & Hymel, 2006). This association was stronger for adolescents scoring higher, rather than lower, on peer valued characteristics. From an evolutionary point of view characteristics that signal health and a higher chance of reproducing might be valued by peers (Berry, 2000). Therefore, physical attractiveness and athletic abilities might be seen as such characteristics. Peer valued characteristics might help antisocial behaviors to be seen in a more positive light (Dijkstra et al., 2009). Investigating this hypothesis would show if an early onset of antisocial behavior is enough to be a popular adolescent, or if peer-valued characteristics are needed as well. Another possible moderator that appears to be relevant is socioeconomic status (SES); SES seems to be valued by peers. Previous studies have implied that adolescents with a higher SES, compared to adolescents with a lower SES, are more likely to have a popular status during adolescence (Eder, 1985; Xie, Li, Boucher, Hutchins, & Cairns, 2006). Therefore, just like the other mentioned peer-valued characteristics (physical attractiveness and athletic abilities), SES is associated with popularity. The moderating effect of SES on the association between antisocial behavior and popularity is, however, unknown. Based on the positive association between SES and popularity, it was expected that SES will also be seen as a peer-valued characteristic and will also act as a moderator in the association between antisocial behavior and popularity. It was expected that SES will moderate this association in a similar manner as peer-valued characteristics; the association was expected to be stronger for adolescents from high SES backgrounds.

Furthermore, gender is a more general individual characteristic that potentially moderates the association between antisocial behavior and popularity. Investigating gender differences to learn how early onset antisocial behavior connects to adolescent onset antisocial behavior is difficult. Few girls engage in early onset antisocial behavior and therefore a

large sample is needed. Moreover, they need to be followed over time to be able to compare early onset antisocial behavior with adolescent outcomes (Moffitt & Caspi, 2001). So far, to our knowledge, no study investigated whether an early onset of antisocial behavior would be associated with adolescent popularity more strongly for boys or girls. Although more boys than girls engage in antisocial behavior, the reasons behind this are expected to be similar (Moffit & Caspi, 2001; Moffitt, Caspi, Rutter, & Silva, 2001; Odgers et al., 2008). Thus, although fewer girls engage in early onset antisocial behavior, the mechanisms during adolescence are expected to be similar for both sexes. However, the association between antisocial behavior and popularity seems to be stronger for boys than girls (e.g., De Bruyn & Cillessen, 2006; Farmer & Rodkin, 1996), as both boys and girls view deviant behaviors to be higher associated with boys' rather than girls' popularity (Xie et al., 2006). Therefore, it was expected that both sexes with an early onset of antisocial behavior will be popular during adolescence, but that this association was stronger for boys than girls.

In this longitudinal study we examined whether there is an association between antisocial behavior in late childhood and being popular in early adolescence. We aimed to add to existing studies by investigating a latent construct of antisocial behavior, based on multiple informants, during the transition from late childhood 2.5 years later to early adolescence, while investigating several variables as potential moderators. Based on the theory of Moffitt (1993), it was hypothesized that an early, childhood, onset of antisocial behavior was associated with popularity in early adolescence. Furthermore, we tested individual characteristics that have been associated with gaining popularity (i.e., physical attractiveness, athletic abilities, SES) and gender, as moderators of the association between antisocial behavior and popularity. It was hypothesized that being attractive, good in sports, and having a high SES strengthened the positive association between antisocial behavior and popularity. The association between an early onset of antisocial behavior and adolescent popularity was also expected to be stronger for boys and girls.

METHODS

Participants

Data were derived from TRAILS (TRacking Adolescents' Individual Lives Survey), a prospective cohort study conducted among Dutch (pre-) adolescents, who started participating in 2001. The participants were recruited from five municipalities, from rural and urban areas, in the North of the Netherlands (De Winter et al, 2005; Huisman et al, 2008). The municipalities in this area were requested to provide names and addresses of all inhabitants born between 10 January 1989 and 30 September 1990 (first two municipalities) or between 10 January 1990 and 30 September 1991 (last three municipalities). This produced 3483 names. At the same time, primary schools within these municipalities were requested to participate. Of the 135 schools, 122 (90.4 percent) agreed to participate, accommodating 90.3 percent of the potential participants. Of all the participants who were approached (N = 3145), 6.7 percent were excluded because of a severe mental or physical handicap or language problems. Of the remaining 2,935 participants, 76.0 percent of the participants and their parents agreed to participate and were all enrolled in the study at Time 1 (N = 2,230, mean age 11.1 years, SD = 0.6, 50.8 percent female). After two and a half years, at Time 2, there was still a high response rate (96 percent) (N = 2,149, mean age 13.6 years, SD = 0.5, 51.2 percent female).

For the current study, we used data from participants with information on all predictor variables at Time 1 (late childhood) and on popularity at Time 2 (early adolescence). At Time 1, the participants were 11 years old. The age of 11, when students are still in elementary school, has previously been used to indicate early onset antisocial behavior (e.g., Aguilar, Soufre, Engeland, & Carlson, 2000; Moffitt & Caspi, 2001). We used self-reported, parent reported, and teacher reported data. Participants filled in questionnaires at school, in the class, under the supervision of one or more experienced TRAILS assistants. Parents were visited at home by interviewers; they were interviewed about a wide range of topics and they were asked to fill out a questionnaire. Teacher reported data was collected by asking teachers to fill out a brief questionnaire for all TRAILS participants in their classes. At Time 2, after 2.5 years, participants had made the transition to secondary school. In The Netherlands this is an important transition where students leave smaller primary schools, with one teacher per year, and enter larger secondary schools

with different teachers for different courses and a new peer group (see Poorthuis, 2012). At Time 2, classrooms were asked to take part in the peer nominations if there were at least three TRAILS participants in the classroom (cf. Dijkstra et al., 2009; Dijkstra, Lindenberg, & Veenstra, 2008). Classroom nominations were used because students spend the majority of their time with the same classroom peers in the first two years of secondary school. The names of the classmates of TRAILS participants were provided by the schools, and all eligible students and their parents received a letter describing the study. Participants or parents used a mail-in reply card if they did not wish to participate. In total, 98 students, including three TRAILS participants, refused to participate. Roughly two weeks after the information letter, a TRAILS staff member visited the classroom to collect peer nominations data. Peer nominations were collected in 72 first-year and 100 second-year classrooms of 34 secondary schools using pencil-and-paper questionnaires. The participants were presented with a roster containing the names of all participating classmates. The average number of students per classroom was 18.4 (SD = 6.0). This yielded a sample of 3,312 students (1,675 boys, 1,637 girls), including 1007 TRAILS participants (M_{age} = 13.60; SD = 0.66). Of these 1,007 TRAILS participants, 828 had information available on all predictor variables and popularity. These 828 TRAILS participants (who received popularity nominations from all other students in their class) were used for the current study. They were in classes ranging from 8 to 31 students; on average there were five TRAILS participants with complete data per class. The subsample was predominantly of Dutch origin (89.4 percent), and 49.4 percent of the sample were female.

The subsample included in our analyses was compared to the total sample within TRAILS, by comparing the mean scores. Independent sample t-tests indicated that the subsample of 828 students did not differ from the total TRAILS sample on gender (p = .08, 47 percent boys in the subsample, compared to 51 percent in the total sample), age (p = .05, M = 11.1 years for both subsample and total sample), self-reported aggression (p = .07, M = 0.30 for the subsample, compared to 0.32 for the total sample) and delinquency (p = .23, M = 0.22 for the subsample, compared to 0.23 for the total sample). However, the 828 students scored significantly lower (p < .01) than the total TRAILS sample on parent reported aggression (M = 0.32 compared to M = 0.37) and delinquency (M = 0.11 compared to M = 0.14), on teacher

reported aggression (M = 0.25 compared to M = 0.35) and delinquency (M = 0.09 compared to M = 0.17), and slightly higher on SES (M = 0.10 compared to M = - 0.14). These were small differences (effect sizes < .15).

MEASURES

Peer reported Popularity. Peer reported popularity was assessed at Time 2 and derived from peer nominations. It was based on the number of nominations received on the question "Who do others want to be associated with?". The concept of popularity covers aspects of influence, dominance, having social power, attractiveness, and resource control (cf. LaFontana & Cillessen, 2002; Lease, Kennedy, & Axelrod, 2002; Parkhurst & Hopmeyer, 1998). In most studies of popularity, respondents are asked to nominate the most (and least) popular peers. We explicitly disentangled personal preferences for being associated with a person from reputation-based preferences by asking respondents to nominate people with whom others want to be associated with, instead of who they themselves want to be associated with. Therefore, this question assessed who others want to be associated with, to ''bask in reflected glory'' (Cialdini & Richardson, 1980). We believe that this yielded a reputation-based measure for popularity. This question has been used in previous research (e.g., Dijkstra, et al., 2008). Respondents could name an unlimited number of peers, same as well as cross-gender, for this question. All received scores were divided by the number of nominating classmates, to account for differences in numbers of nominators between classes. These scores were then standardized in the total sample with a mean of 0 and a standard deviation of 1 in order to facilitate the calculation of interaction effects.

Peer-valued Characteristics. At Time 2, physical attractiveness and athletic abilities were assessed using the following peer nominations: "Who is good looking?" and "Who is good at sports?". For these questions unlimited, same-gender and cross-gender, nominations were allowed. For both questions, all received scores were divided by the number of nominating classmates, to account for differences in numbers of nominators between classes. Afterwards these scores were standardized in the full sample with a mean of 0 and a standard deviation of 1.

SES. SES was reported by parents at Time 1 and based on the educational level of both parents, the occupational level of both father and mother using

the International Standard Classification for Occupations (Ganzeboom & Treiman, 1996; 2003), and income level. After standardization, the average of these five items (alpha = .84) was used to measure SES. This assessment of SES has been successfully used in other research (for example see Veenstra et al., 2008).

Antisocial Behavior. Antisocial behavior was assessed at Time 1 by self, parent, and teacher reports. The Youth Self Report (YSR; Achenbach, 1991b), was filled in by the students. For the current study the scales of aggression (e.g., "I get in many fights", 17 items, alpha = .79) and delinquency (e.g., "I break rules at home, school, or elsewhere", 15 items, alpha = .63) were used. Of the parent reported Child Behavior Checklist (CBCL; Achenbach, 1991a), the scales of aggression (e.g., "Gets in many fights", 18 items, alpha = .89) and delinquency (e.g., "Breaks rules at home, school, or elsewhere", 17 items, alpha = .65) were also included. The items from the YSR and the CBCL contained delinquent and aggressive behaviors, which were rated as "not", "sometimes", or "very often" present. All scales were based on the mean scores of the items in the scale. Teachers completed the Teacher Checklist of Psychopathology (TCP; Achenbach, 1991c; De Winter et al., 2005). Two vignettes of the TCP assessing aggression and delinquency, related to the scales of the YSR and CBCL, were used for the current study. Teachers rated all participants on these vignettes using a five-point scale, from 0 = *not applicable* to 4 = *very clearly or frequently applicable.*

Analysis Strategy

Structural Equation Modeling (Muthen & Muthen, 2010) was used to test our hypotheses. Because there were on average few TRAILS participants per classroom, no multilevel analyses have been conducted. Per reporter (self, parent, and teacher) one latent construct of antisocial behavior was created, based on delinquency and aggression. These self, parent, and teacher reported constructs of antisocial behavior in turn were the basis of the global latent construct of antisocial behavior, with significant ($p < .001$) standardized loadings of .59 for the self-report, .66 for the parent report, and .57 for the teacher report. The latent construct of antisocial behavior was afterwards entered as a predictor of popularity. For the analyses, the significance criterion was set at $p < .01$ to prevent a type I error because of the rather large sample size. In the basic model being attractive, being good at sports, SES, gender, and age were entered as covariates. To determine model fit, criteria by Kline

Correlations among Main Study Measures by gender TABLE 1

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. YSR - delinquency (Time 1)		.66**	.31**	.24**	.18**	.22**	-.08	.06	-.02	.03
2. YSR - aggression (Time 1)	.63**		.29**	.31**	.15**	.26**	-.06	-.04	-.05	.04
3. CBCL - delinquency (Time 1)	.26**	.26**		.72**	.24**	.26**	-.21**	.03	-.04	.10
4. CBCL - aggression (Time 1)	.20**	.27**	.70**		.24**	.30**	-.21**	-.06	-.10*	.01
5. TCP - delinquency (Time 1)	.11*	.17**	.13**	.20**		.61**	-.21**	-.04	-.04	.02
6. TCP - aggression (Time 1)	.15**	.22**	.19**	.24**	.62**		-.27**	-.05	-.06	.03
7. SES (Time 1)	-.09	-.05	-.06	-.09	-.17**	-.22**		.01	.08	.01
8. Athletic Abilities (Time 2)	.06	.07	-.01	.03	.04	.12*	.01		.52**	.37**
9. Attractiveness (Time 2)	.10*	.12**	-.07	-.04	.08	.04	-.01	.43**		.49**
10. Popularity (Time 2)	.08	.09*	.00	.02	.15**	.20**	-.06	.32**	.55**	

Note. Correlations for girls are below the diagonal, correlations for boys above the diagonal. CBCL = Child Behavior Checklist; TCP = Teacher Checklist of Psychopathology; YSR = Youth Self Report. ** $p < .01$; * $p < .05$.

(1998) were used, a model with RMSEA <.08 and CFI >.90 would have an adequate fit. In a second step the interaction effects were added separately. For each moderator (i.e., physical attractiveness, athletic abilities, SES, and gender) an interaction term with antisocial behavior was created to test the effect on popularity.

RESULTS

The correlations between the variables are depicted in Table 1. All predictor variables of antisocial behavior were significantly associated with each other; providing a good basis to create a latent construct. For boys, some measures of antisocial behaviors (self and teacher reported aggression) were correlated with popularity, others were not. For girls, there were no correlations between the measures of antisocial behavior and popularity.

First, the basic model was tested (see Figure 1). This full model explained 30 percent of the variance of popularity, with an adequate model fit ($\chi^2(41)$ = 188.4, CFI = .93, RMSEA = .07). Because the model fit was adequate, no further model constraints were made. Results of the basic model showed that antisocial behavior in childhood was a significant and positive predictor of perceived popularity in early adolescence, while controlling for SES at Time 1, athletic abilities and physical attractiveness at Time 2, and age and gender. Of the main effects of the other variables, only physical attractiveness and athletic abilities were significantly and positively associated with popularity. Adolescents who were more attractive and adolescents who were better at sports were more popular. SES, age, and gender were not associated with popularity at Time 2.

Furthermore, we separately tested moderation effects of physical attractiveness, athletic ability, SES, and gender at Time 2. The interaction between physical attractiveness and antisocial behavior was significant (B = 6.5, SE = 1.1, p < .01). Physical attractiveness moderated the association between antisocial behavior in childhood and popularity in early adolescence. To interpret the moderation by physical attractiveness, we compared three scores of this continuous predictor. Scores were used of adolescents who scored low (-1 *SD*), average (Mean score), or high (+1 *SD*) on physical attractiveness (see Figure 2). The positive association between antisocial behavior and popularity was stronger for adolescents who were more attractive.

FIGURE 1

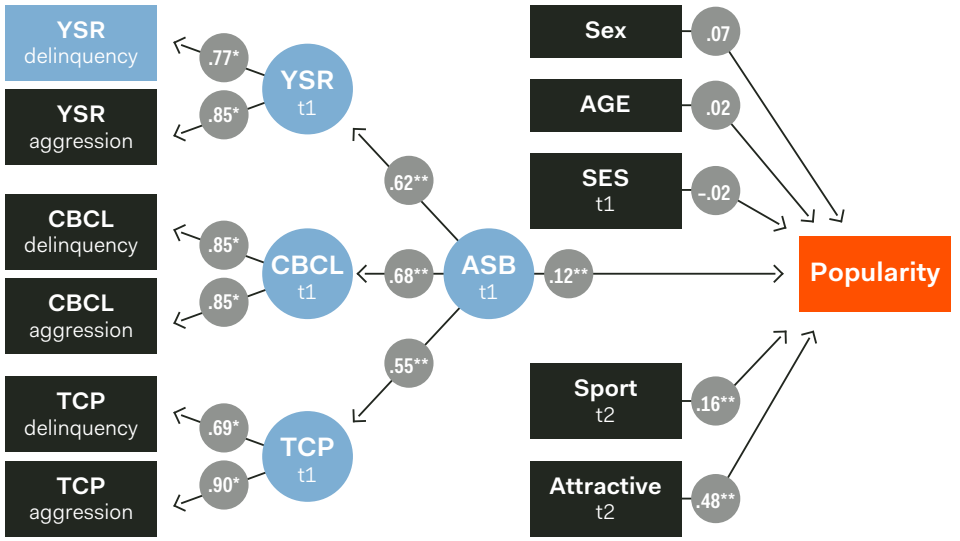

FIGURE 1. Structural Equation Model for the Prediction of Popularity. Standardized coefficients are presented. ** p = <.001. Model fit is $\chi^2(41)$ = 188.4, CFI = .93, RMSEA = .07, AIC = 76.7, BIC = 213.6. ASB = Antisocial behavior; CBCL = Child Behavior Checklist; TCP = Teacher Checklist of Psychopathology; YSR = Youth Self Report. To improve model fit, the error terms of teacher YRS delinquency and CBCL delinquency were allowed to covary. Correlated error terms were modeled but are not depicted, to make this figure more comprehensible[1]

[1] These analyses were also conducted looking separately at aggression and delinquency as predictors of popularity. Self, parent, and teacher reported aggression loaded on a single latent construct of aggression. The same method was used for delinquency. Although all outcomes remained similar and significant at p < .05, the model fit decreased (model fit for the aggression model is $\chi^2(17)$ = 128.6, CFI = .81, RMSEA = .09, AIC = 3049.6, BIC = 3129.9, model fit for the delinquency model is $\chi^2(17)$ = 115.6, CFI = .81, RMSEA = .08, AIC = 523.7, BIC = 604.0)

FIGURE 2

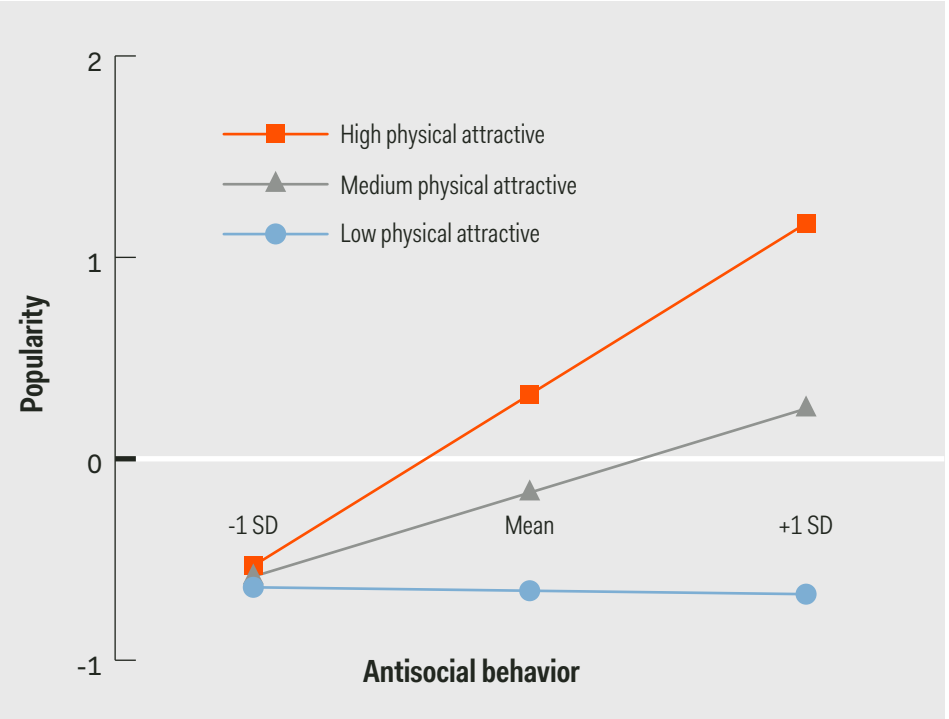

FIGURE 2. The Association between Antisocial Behavior and Popularity, for Adolescents scoring High (+1 *SD*), Medium (Mean), or Low (-1 *SD*) on Physical Attractiveness.

The interaction between athletic abilities and antisocial behavior was also significant ($B = 2.2$, $SE = 0.7$, $p < .01$). Being good in sports also moderated the association between antisocial behavior and popularity ($p < .01$). The interaction was interpreted in a similar manner (see Figure 3). The positive association between childhood antisocial behavior and popularity was stronger for adolescents who were better at sports. The other two moderators, SES and gender, did not moderate the association between antisocial behavior and popularity ($p > .05$).

FIGURE 3

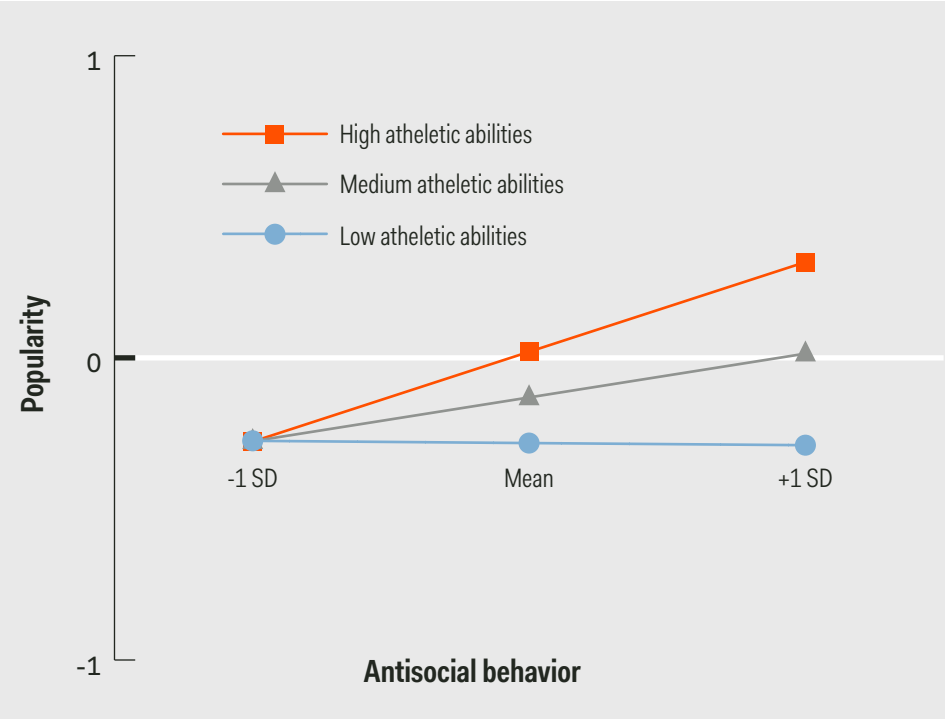

FIGURE 3. The Association between Antisocial Behavior and Popularity, for Adolescents scoring High (+1 *SD*), Medium (Mean), or Low (-1 *SD*) on Athletic Abilities.

DISCUSSION

This study examined whether an early onset of antisocial behavior during elementary school was associated with being popular 2.5 years later, i.e., in early adolescence and at secondary school. Moreover, we investigated if this association would be different depending on physical attractiveness, athletic abilities, SES, and gender. Although we could not test causality, our findings showed a significant positive association between early onset antisocial behavior and adolescent popularity. Our findings add to the knowledge base by showing that early, childhood, onset antisocial behavior was associated with adolescent popularity.

In addition, our findings showed that the original hypothesis of Moffitt (1993) might benefit from some refinements. Adolescents' individual characteristics

valued by peers (i.e., being attractive and being good at sports) moderated the association between early onset antisocial behavior and popularity. For adolescents who scored higher on these peer-valued characteristics, the positive association between early onset antisocial behavior and adolescent popularity became stronger. Our findings, in line with Dijkstra and colleagues (2009), indicate that engagement in early onset antisocial behavior needs to be accompanied by adolescent peer valued characteristics to increase the likelihood of popularity in early adolescence. Thus, this implies adolescents with early onset of antisocial behavior only in combination with adolescent peer valued characteristics are likely to become role models for their peers. Social mimicry of these specific adolescent peer models (who have peer-valued characteristics) might explain why the group showing adolescent onset antisocial behavior group starts engaging in antisocial behavior during adolescence (Moffitt, 1993).

Contrary to our expectations, SES did not moderate the association between early onset antisocial behavior and popularity. Our findings also showed that there was no direct association between SES and popularity. The lack of an association between SES and popularity is in contrast with previous research (Eder, 1985; Xie et al., 2006). Possibly because previous research was conducted in the USA where the SES distribution may differ from that of The Netherlands. For example, the Health Behaviour in School-Aged Children (HBSC) international report from the 2009/2010 survey shows that the prevalence of students with low SES is higher in the USA (11 percent) compared to the Netherlands (4 percent) (Currie et al., 2012).

Gender also did not moderate the association between early onset antisocial behavior and popularity. Thus, children who engaged in antisocial behavior were more likely to be popular adolescents regardless of their gender. Our research extends previous finding (Mazerolle, Brame, Paternoster, Piquero, & Dean, 2000; Moffitt & Caspi, 2001) by showing that the association between early onset antisocial behavior and adolescent popularity is similar for boys and girls. Therefore it seems that both boys and girls who have an early onset of antisocial behavior are likely to be popular adolescents.

Strengths and Limitations

This study has the following strengths: including multiple reports of antisocial behavior (adolescent, parent, and teacher), assessing a latent

construct of antisocial behavior, focusing on an important transition period from late childhood to early adolescence and from elementary school to secondary school, using a large sample of participants with a low drop-out rate, testing individual characteristics as moderators (i.e., physical attractiveness, athletic abilities, SES, and gender); allowing us to refine the theory of Moffitt (1993). Moreover, our findings were also tested for aggression and delinquency separately. The results were replicated, although with a worse model fit, which shows the robustness of our findings. There are also some limitations. First, popularity was only assessed during adolescence. It would have been more adequate to use elementary school peer nominations as well, but this measure was not available. Therefore, we cannot prove that the popular adolescents were not already popular children. Thus, we were unable to investigate if antisocial behavior leads to changes in popularity. Not taking popularity in childhood into account may have led to a stronger association between childhood antisocial behavior and adolescent popularity. However, on theoretical basis childhood popularity would not be expected to be associated with childhood antisocial behavior. For example, whereas at grade 3 and 5 aggression was not, or even negatively, associated with popularity, only at grades 7 and 9 this association became positive (Rose et al., 2004). Moreover, this is in line with the hypothesis of Moffitt (1993) that children who engage in antisocial behavior are likely to become popular only during adolescence; when their peers start experiencing the maturity gap. Furthermore, beliefs about delinquency only influenced changed in friendship (among boys) after the transition to secondary school (Pardini, Loeber, & Stouthamer-Loeber, 2005). Second, we only assessed childhood antisocial behavior. As our interest is how adolescents with an early, childhood, onset of antisocial behavior are perceived by their peers, we believe that assessing antisocial behavior during childhood was sufficient. Moreover, Veenstra and colleagues (2009) showed that childhood antisocial behavior was highly stable over time; 75% of children with a high score on antisocial behavior also scored high or moderately on antisocial behavior in early adolescence. Third, the participants included in this study were slightly less antisocial compared to those excluded from analyses. This might decrease the generalizability of our findings. However, this might also have weakened our findings as some of the more antisocial youth were excluded. Fourth, the moderators were only assessed at Time 2 as the TRAILS data does not assess peer nominations on attractiveness and athletic abilities at the first wave. However, as we were interested in the perceptions of adolescents,

investigating peer-valued characteristics at Time 2 was needed to assess if current peer-valued characteristics help to perceive peers with an earlier onset of antisocial behavior in a more positive light. Future studies should investigate the co-development of popularity and peer valued characteristics from childhood to adolescence to further understand how peer valued characteristics influence the association between early onset antisocial behavior and popularity. Last, our sample was predominantly of Dutch origin. Although other aspects of the theory of Moffitt (1993) have been tested and supported in many studies, including samples from more diverse backgrounds (see Moffitt, 2007), the generalization of our findings to samples with more ethnic minorities should be tested. Future research which directly assesses the maturity gap would allow for further understanding of the underlying mechanisms through which adolescents who engage in antisocial behavior become popular.

CONCLUSIONS

This study provides support for an important element of the influential theory posed by Moffitt (1993) that children who engage in antisocial behavior are popular adolescents. This research puts this hypothesis to a longitudinal test looking at a time difference of 2.5 years, including the transition from elementary to secondary school. Furthermore, the theory of Moffit (1993) seems to benefit from some refinements. Especially the children with an early onset of antisocial behavior who have some other highly valued characteristics during adolescence were likely to be popular adolescents. This finding, linking early onset antisocial behavior to adolescent popularity, provides further support for Moffitt's (1993) prediction that children showing early onset antisocial behavior are likely to be popular adolescent role models. Future research should control for childhood popularity, and investigate if these adolescents influence their peers regarding antisocial behavior. Especially the ages between 11 and 13 seem to be an appropriate age for targeted interventions, since antisocial behavior at age 11 is predictive of popularity at age 13. Interventions should consider that early experience in antisocial behavior, although it is associated with many negative outcomes (Moffitt, 1993), can be rewarding during adolescence, as it has been associated with to popularity. Thus, our results underline the importance of redirecting intervention efforts to take the potentially rewarding outcomes of

early development of antisocial behavior in the peer group into account. Since adolescents adapt their externalizing behaviors, for example alcohol use (Teunissen et al., 2012) to the norms of popular adolescents, especially the adolescents with an early onset of antisocial behavior might serve as popular role models and they might therefore be influential peer educators. Peer-led interventions that focus on peer education, such as the ASSIST program (Starkey, Audrey, Holiday, Moore, & Campbell, 2009), where influential adolescents become peer educators for smoking prevention, should keep in mind that influential adolescents might engage in several externalizing behaviors. Therefore, adolescents who prevent peers from engaging in one behavior, for example smoking, might be negative role models in other behaviors such as drinking alcohol or delinquency. Such interventions might benefit from focusing on several externalizing behaviors instead of just one in isolation.

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CHAPTER 4

ADOLESCENT FRIENDSHIPS AND THE ONSET AND CONTINUATION OF EXTERNALIZING BEHAVIOR: THE SNARE STUDY.

AART FRANKEN [1, 2, 3, 4, 5]
JAN KORNELIS DIJKSTRA [1, 2, 3, 4, 5]
CHRISTIAN E. G. STEGLICH [3, 4, 5]
ZEENA HARAKEH [1, 2, 3, 4, 5]
WILMA A.M. VOLLEBERGH [1, 3, 4, 5]

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1 Conceived and/or designed the study
2 Participated in data acquisition
3 Participated in data analysis and interpretation
4 Involved in drafting / revising the manuscript
5 Given final approval

ABSTRACT

Objectives: This study investigated friendship influence processes in both the onset and the further (dis)continuation of externalizing behaviors such as antisocial behavior, alcohol use, and tobacco use. Whereas the majority of studies showed that adolescents mimic friends in their (dis)continuation of externalizing behavior, only one study focused on the onset of externalizing behavior (alcohol use). The dual-taxonomy model (Moffitt, 1993) expects adolescents to copy 'adult-like' externalizing behaviors from their peers to overcome the 'maturity gap' (i.e., gap between biological and social maturity), however it is unknown if this hold for both the onset and further (dis) continuation of externalizing behavior. Methods: Hypotheses were tested using data from the SNARE (Social Network Analysis of Risk behavior in Early adolescence) study (N = 1144, M_{age} = 12.7, SD = 0.47). Participants were assessed three times during their first year of secondary education. Data was analyzed using Stochastic Actor-Based Modelling (RSIENA). Results: We showed that adolescents were influenced by their peers in (dis)continuation, but not in the onset of externalizing behavior. Conclusions: Peer focused interventions should differentiate between the onset and further (dis) continuation of externalizing behavior, as friendship influence processes might be less important for the onset than the (dis)continuation of such behavior.

Keywords: Alcohol use, antisocial behavior, onset, social network analysis, SIENA, tobacco use

Early adolescence is an important period for the onset and continuation of externalizing behaviors, such as antisocial behavior, alcohol use, and tobacco use (e.g., Currie et al., 2012; Jennings & Reingle, 2012). According to Moffitt (1993), one of the reasons for early adolescents to start with and continue to engage in externalizing behavior is to overcome the stressful experience of the "maturity gap"; a discrepancy between feeling biologically mature without social recognition of this maturity (see also Dijkstra et al., 2015). Early adolescents expect to obtain a mature status among their peers through externalizing behavior, as this behavior is associated with adult-like privileges and social status among peers (Moffitt, 1993, 2007; Moffitt & Caspi, 2001). Early adolescents are hereby expected to mimic externalizing behavior from peers, who already engage in these types of behavior (Moffitt, 1993). Hence, peers play a vital role in the onset and further continuation of externalizing behavior. This study aims to investigate the influence of peers, specifically friends, in the onset and (dis)continuation of externalizing behavior at the start of adolescence.

Previous research convincingly revealed positive associations between externalizing behavior of adolescents and their friends' externalizing behavior (e.g., Van Lier, Wanner, & Vitaro, 2007). Two fundamental processes may account for this similarity among friends: Selection and influence processes. Selection takes place when adolescents change their friendship choices to befriend others who are similar to themselves. Influence takes place when adolescents adapt their behavior to become more similar to their friends. The introduction of stochastic actor-based models (SABM) for network dynamics made it possible to study both friendship processes, while controlling for each other, through simultaneously studying the co-development of friendships and behaviors (Snijders, Steglich, & Schweinberger, 2007). This allows assessing the unique contribution of each process to similarity in behavior among adolescents who are affiliated with each other (Steglich, Snijders, & Pearson, 2010).

Several studies using SABM examined selection and influence processes for externalizing behaviors (for an overview see Veenstra, Dijkstra, Steglich, & Van Zalk, 2013). With some exceptions (Burk, Van der Vorst, Kerr, & Stattin, 2011; Knecht, Snijders, Baerveldt, Steglich, & Raub, 2010; Mercken, Snijders, Steglich, & De Vries, 2009), most studies found that, while controlling for friendship selection effects, early adolescents do influence their friends (dis)

continuation in delinquency (e.g., Burk, Kerr, & Stattin, 2008; Burk, Steglich, & Snijders, 2007; Kerr, Van Zalk, & Stattin, 2012; Weerman, 2011), alcohol use (e.g., Giletta et al., 2012; Mercken, Steglich, Knibbe, & De Vries, 2012), and tobacco use (e.g., Huisman, Bruggeman, 2012; Mercken, Steglich, Sinclair, Holliday, & Moore, 2012). Thus, in general, evidence points in the direction that adolescents are influenced by their friends. That is, they are likely to change their externalizing behavior to become more similar to their friends.

Interestingly, all these studies focused on (dis)continuation in externalizing behavior, that is, the level or amount of externalizing behavior adolescents engage in. However, one particular aspect has been understudied so far, that is the onset of externalizing behavior. The step from no experience with externalizing behavior to any experience (i.e., an onset) is important for several reasons. Firstly, the onset of substance use during adolescence predicts substance abuse or dependence five years later; equally well as already having experienced substance abuse or dependence during adolescence (Palmer et al., 2009). Secondly, an onset of externalizing behavior might create changes in attitudes towards these behaviors; which in turn could influence further continuation or escalation of these behaviors. This might occur through processes like cognitive dissonance reduction with people changing their thoughts to match their behaviors (Festinger, 1957). In line with this idea, the onset of smoking is predictive of positive attitudes towards smoking rather than vice versa (De Leeuw, Engels, Vermulst, & Scholte, 2008). These changes in attitudes and intentions in turn can be predictive of future externalizing behavior, for example, substance use (Neppl, Dhalewadikar, & Lohman, 2015). Finally, there is some tentative evidence that the underlying processes of onset may differ from continuation. For example, parental factors such as parental rules regarding alcohol use may prevent the onset but not the further continuation of alcohol use (e.g., Van der Vorst, Engels, Meeus, & Deković, 2006).

To our knowledge thus far there is only one study that focused on the effect of friends on the onset of externalizing behavior, that is, alcohol use (Light, Greenaan, Rusby, Nies, & Snijders, 2013). Using stochastic actor-based modelling, Light and colleagues (2013) showed that early adolescents were influenced by their friends to start with alcohol use.

The current study set out to investigate and compare the influence of

friendship in the onset and (dis)continuation of early adolescent externalizing behaviors including antisocial behavior, alcohol use, and tobacco use. This study builds on previous studies in several ways. First, we compared friendship influence processes in the onset and (dis)continuation of externalizing behavior. Second, early adolescents who have just entered a new network of peers at secondary school were investigated. In the Netherlands, where this study took place, the transition from primary to secondary school is important and happens around the age of 12. This transition is also associated with changes in friendships (Güroglu, Cillessen, Haselager, & Van Lieshout, 2012). Investigating a new network of peers allowed controlling more stringently for friendship selection effects as adolescents entered a new school with new peers. Furthermore, by studying the start of secondary school, it was possible to capture the beginning of adolescent onset externalizing behavior. Third, as externalizing behaviors co-develop and co-occur (e.g., Monshouwer et al., 2012), this study focused on a composite score for multiple externalizing behaviors such as antisocial behavior, alcohol use, and tobacco use (see also Franken et al., 2015).

METHODS

Participants and Procedure

Participants included 1,144 students (50% boys), aged 11.1 to 15.6 (M_{age} = 12.7, *SD* = 0.47), 97% were born in the Netherlands (as were 87% of their fathers and 88% of their mothers). Of the participants, 43.9% followed lower level education (including preparatory secondary school for technical and vocational training) and 54.1% followed higher level education (including preparatory secondary school for higher professional education and university).

Data stem from the SNARE (Social Network Analysis of Risk behavior in Early adolescence) project; a longitudinal study on the social development of early adolescents with a specific focus on adolescents' involvement in risk behavior (see also Dijkstra et al., 2015; Franken et al., 2015). Two secondary schools were asked and willing to participate: One in the middle and one in the north of the Netherlands. Subsequently, all first- and second-year secondary school students (i.e., similar to 7th-8th grades in the US) from these schools were

approached for enrollment in SNARE (2011-2012). All eligible students received an information letter for themselves and their parents, in which they were asked to participate. If students wished to refrain from participation, or if their parents disagreed with their children's participation, they were requested to send a reply card or email within ten days. One year later (2012-2013) all new first year students were again approached for participation in the study. In total, 1826 students were approached for this study, of which 40 students (2.2%) refused to participate for several reasons. A total of 1786 students participated in SNARE (M_{age} Time 1 = 12.91 years, *SD* = 0.70, 50.1% male, 83.9% Dutch). Therefore the study consisted of four samples; two schools and two cohorts (participants who started in 2011, and in 2012).

In September 2011, just when participants entered the first or second year of secondary school we started with a pre-assessment. Subsequently, in 2012, all new first-year students also completed a pre-assessment. After the pre-assessment there were follow-up regular measurement waves in October, December, and April. After two years (2011-2013), data collection was continued for another two years among the participating students.

We used data from the pre-assessment and the first three waves for this study. The pre-assessment was during the first weeks of secondary school (September). The first assessment took place in October (Time 1), the second in December (Time 2), and the third in April (Time 3) of the same academic year. During these assessments, a teacher and one or more research assistants were present. The research assistant gave a brief introduction and explained that participants' answers would remain confidential and anonymous. During the assessment, students filled in a questionnaire on the computer during one classroom period, around 45 minutes. After the pre-assessment, this questionnaire contained, next to self-reports, peer nominations using CS socio software (www.sociometric-study.com). Peer reported variables were assessed by asking participants questions about their classmates. Participants were presented with all names of their classmates on their computer screen in alphabetical order, starting with a random name. For some peer nomination questions it was optional to select peers outside the classroom (but within the SNARE sample), using a search function. Unlimited, both same and cross sex, nominations were allowed. The students who were absent at the day of assessment were, if possible, assessed within a month. The anonymity and privacy of the students were warranted. The study was approved by the

Internal Review Board (IRB) of one of the participating universities.

MEASURES

Self-reported externalizing behaviors (Pre-assessment, Time 1, Time 2, Time 3). At the pre-assessment and all three time points, participants reported their engagement in three forms of externalizing behavior: Antisocial behavior, alcohol use, and tobacco use. Antisocial behavior was measured with 17 items by asking participants how often (between 0 to 12 or more times) they had been involved in 17 types of delinquent behavior; including stealing, vandalism, burglary, violence, weapon carrying, threatening to use a weapon, truancy, contact with the police, and fare evasion in public transport (see also, Nijhof, Scholte, Overbeek, & Engels, 2010; Van der Laan, Veenstra, Bogaerts, Verhulst, & Ormel, 2010). Alcohol use was measured on a 13 point scale (ranging from 0 to over 40 times) indicating on how many occasions participants consumed alcohol (Wallace et al., 2002). Tobacco use, was measured on a 7 point scale (ranging from never to more than 20) indicating how many cigarettes they smoked daily (e.g., Monshouwer et al., 2011). Based on recommendations of Farrington and Loeber (2000), all externalizing behaviors were recoded as binary, indicating no engagement at all (0) or any engagement (1). As externalizing behaviors are known to cluster together during early adolescence was conducted (e.g., Monshouwer et al., 2012), an exploratory factor analysis (using maximum likelihood estimations and oblique rotation) which revealed that the externalizing behaviors loaded on a single factor; explaining 55.3% of the variance. Therefore, a composite variable, representing the number of different externalizing behaviors participants engaged in (i.e., antisocial behavior, alcohol, tobacco use), was computed; resulting in scores between zero (no externalizing behaviors) and three (all externalizing behaviors).

The onset of externalizing behavior was assessed by identifying the moment participants first engaged in externalizing behavior. At the pre-assessment participants were asked if they ever engaged in these behaviors. Afterwards, at Time 1 and onwards, participants were asked if they engaged in the externalizing behaviors between the assessments. When participants had an onset of any of the externalizing behaviors, externalizing behavior was coded as 1, and participants kept this score at following assessments. Participants

could therefore have a score between 0 (no onset of externalizing behavior) and 1 (an onset of any externalizing behavior).

The (dis)continuation of externalizing behavior was based on participants' engagement in externalizing behavior during the month prior to assessments Time 1, Time 2, and Time 3. Therefore, this score was based on current engagement in externalizing behavior and participants could thus increase and decrease their current externalizing behavior over time. Participants could therefore have a score between 0 (no engagement in externalizing behavior) and 3 (an engagement in all three externalizing behaviors).

Friendship nominations (Time 1, Time 2, Time 3). Participants were asked to name their best friends. Participants could nominate friends within their class and, afterwards, friends from their grade. Grade networks were used for the current analyses. These four networks (i.e., two schools and two cohorts per school) were summarized in adjacency matrices, indicating the presence (1) or absence (0) of a friendship relationship. Unlimited same and cross gender nominations were allowed.

Analysis Strategy

Descriptive statistics for each of the four friendship networks (i.e., two cohorts in 2 schools) were calculated, including the average age, percentage of boys, average onset of externalizing behavior level, frequency of current externalizing behavior per assessment, and the percentage of absent participants of the networks. Furthermore, the Jaccard index, showing the relative stability of the friendship network over time, was calculated.

All network analyses were conducted using SIENA (Simulation Investigation for Empirical Network Analyses), version 4, in R. SIENA is an actor based model for the longitudinal co-evolution of social networks and individual behavior (Ripley, Snijders, Boda, Vörös, & Preciado, 2014). SIENA estimates changes between two points in time; in this study, changes were calculated for Period 1 (between Time 1 and Time 2), and for Period 2 (between Time 2 and Time 3). While controlling for structural network effects (i.e., the structure of friendships in the network), SIENA estimates both network dynamics and behavior dynamics longitudinally. The outcomes of SIENA analyses are based on an iterative Markov Chain Monte Carlo approach (Snijders, Van de Bunt, & Steglich, 2010; Ripley et al., 2014). For the analyses the dependent

variables are the network ties (friendships) and the number of externalizing behaviors participants engaged in (antisocial behavior, alcohol use, and tobacco use). For the onset model, effects were modeled based on the onset of externalizing behavior, or no onset of externalizing behavior; thus ranging from 0 (no onset) to 1 (an onset of any externalizing behavior). For the (dis) continuation model, effects were modeled based on the number of externalizing behaviors participants engaged in during the month prior to assessments; thus ranging between 0 (no current engagement) and 3 (current engagement in all three behaviors).

Commonly used structural network effects and additional network effects were added to the model to optimally capture the friendship structure in the current networks (Ripley et al., 2014; Veenstra et al., 2013). The effects which are generally included in SIENA analyses are density, reciprocity, transitive triplets (likelihood to befriend friends of friends), three-cycles (indicates hierarchies within triads), indegree popularity (square root version; likelihood for participants who receive many friendship nominations to receive extra friendship nominations over time), indegree activity (square root version; likelihood for participants who receive many friendship nominations to send extra friendship nominations over time), and outdegree activity (square root version; likelihood for participants who send out many friendship nominations to send out extra friendship nominations over time); for more details see Ripley et al. (2014). To improve the model fit, density and indegree popularity were allowed to vary between assessment periods. Furthermore, transitive reciprocated triplets were modeled to estimate the likelihood to reciprocate friendships in triads (groups of three friends).

Several factors potentially affecting the social network (i.e., network dynamic effects) were estimated as covariates (see Veenstra et al., 2013). The effects of same-gender friendship selection (i.e., girls nominate girls; boys nominate boys; girls were coded as 0, boys as 1) were estimated as well as the effects of proximity by using adolescents' classroom and school locations as covariates (School 1 consisted of four locations). The effects of gender on giving (ego) and receiving (alter) friendship nominations also was controlled for. The likelihood of giving (ego) or receiving (alter) friendship nominations, and selecting similar friends, was modeled based on externalizing behavior.

Several behavior dynamic effects were estimated (see Veenstra et al., 2013).

Behavior dynamic effects model changes in externalizing behavior. They model the rate of change, and whether behavior change conforms to linear trend (i.e., increases or decreases over time). For the (dis)continuation model, quadratic trends were also estimated. A positive effect indicates that externalizing behavior is more likely to occur at the extremes of the scale; that participants are likely to either engage in no externalizing behavior or to engage in multiple behaviors. For the onset model this was not possible, since the only scores were zero or one. Similar to Light et al (2013), we the used the average exposure effect for the onset model. This effect estimates if the average number of friends who have had an onset of externalizing behavior influences adolescents' onset of this behavior. To assess the effect of (dis) continuation of externalizing behavior, an influence effect was estimated expressing the likelihood that participants change their externalizing behavior in accordance with the average externalizing behavior of their friends.

Meta-analyses of the parameters were conducted on the four networks; one for the onset and one for the (dis)continuation model. These meta-analyses were conducted using the SIENA likelihood based method for meta-analyses (for more information see Ripley et al., 2014). The meals and variances were normal, which indicates trustworthy outcomes of such analyses.

RESULTS

Descriptive Statistics of the Networks, and Externalizing Behaviors within Networks

Table 1 lists descriptive statistics for each of the four networks examined in this study. Results at Time 1 suggested that all four networks did not differ in age, and that there were only some small differences in gender distribution and externalizing behaviors. Table 1 also includes network characteristics for each cohort. There were between 1% and 5% participants absent during the assessments. The Jaccard index indicates the relative stability of each network over time. The Jaccard indices were between .44 and .48, which is well within the desired range for longitudinal social network analysis (Veenstra et al., 2013).

TABLE 1

Descriptive Statistics of Friendship Networks for School 1 (cohort 1 *N* = 432, cohort 2 *N* = 390) and School 2 (cohort 1 *N* = 186, cohort 2 *N* = 136), Time 1-Time 3

VARIABLE		SCHOOL 1				SCHOOL 2			
		Cohort 1 Mean (*SD*)		Cohort 2 Mean (*SD*)		Cohort 1 Mean (*SD*)		Cohort 2 Mean (*SD*)	
Age	Time 1	12.65	(0.43)	12.65	(0.43)	12.66	(0.48)	12.70	(0.68)
% boys	Time 1	0.50[a]	(0.50)	0.48[ab]	(0.50)	0.47[ab]	(0.50)	0.61[b]	(0.49)
Onset externalizing behavior	Time 1	0.61	(0.49)	0.61	(0.49)	0.57	(0.50)	0.70	(0.46)
	Time 2*	0.64[ab]	(0.48)	0.63[ab]	(0.48)	0.61[a]	(0.49)	0.75[b]	(0.43)
	Time 3*	0.69[ab]	(0.46)	0.67[a]	(0.47)	0.66[ab]	(0.48)	0.79[b]	(0.41)
Current externalizing behavior	Time 1*	0.36[a]	(0.69)	0.47[b]	(0.82)	0.29[a]	(0.60)	0.34[ab]	(0.56)
	Time 2	0.39	(0.68)	0.42	(0.75)	0.31	(0.66)	0.41	(0.69)
	Time 3	0.44	(0.78)	0.51	(0.81)	0.42	(0.71)	0.47	(0.76)
Missing fraction	Time 1	0.01		0.03		0.05		0.01	
	Time 2	0.01		0.04		0.03		0.01	
	Time 3	0.03		0.03		0.02		0.02	
Jaccard index	Time 1 – Time 2	0.46		0.47		0.44		0.45	
	Time 2 – Time 3	0.46		0.48		0.44		0.45	

Note. One-way ANOVA between group differences at $p < .05$. Within each time point (i.e., row), Mean scores with different superscripts differ significantly from each other at $p < .05$; calculated with a post-hoc Tukey Honestly Significant Difference test.

SIENA Estimates of Friends' Influence: Onset and (Dis)Continuation

The outcomes of the SIENA analyses of the onset model and of the (dis) continuation model are shown in Table 2. First, the structural network effects model the network structure and optimize the goodness of fit of the networks. These effects were similar for both the onset and the (dis)continuation model and they will be described for both models. There was a negative density effect during Period 1, indicating that participants were likely to be selective in their friendship nominations. There was a positive reciprocity effect, indicating that participants were likely to reciprocate friendship nominations. There was a positive transitive triplet effect, which shows that participants were likely to be friends with the friends of their friends. Moreover, there was a negative three-cycle effect. In combination with the positive transitive triplet effect, this indicates that there was hierarchy in the networks (within triads few participants received many nominations, while many participants

TABLE 2 **Meta Estimates of Selection and Influence Effects for the Onset and (Dis)Continuation of Externalizing Behavior in Friendship Networks Time 1, 2, and 3**

NETWORK DYNAMICS		ONSET		(DIS)CONTINUATION	
[1]Outdegree (density)	Period 1	-2.30*	(0.14)	-2.33*	(0.14)
	Period 2	0.09	(0.12)	0.08	(0.12)
Reciprocity		2.58*	(0.12)	2.59*	(0.12)
Transitive triplets		0.51*	(0.02)	0.52*	(0.02)
Transitive reciprocated triplets		-0.43*	(0.04)	-0.43*	(0.03)
3-cycles		-0.07*	(0.02)	-0.06*	(0.02)
Indegree - popularity (sqrt)	Period 1	0.05	(0.06)	0.05	(0.06)
	Period 2	-0.13	(0.04)	-0.13*	(0.04)
Indegree – activity (sqrt)		-0.93*	(0.10)	-1.00*	(0.13)
Outdegree – activity (sqrt)		0.15*	(0.02)	0.15*	(0.02)
[2]Sex received [2A]		-0.08	(0.05)	-0.08	(0.06)
Sex sent [2B]		-0.12	(0.09)	-0.06	(0.06)
Sex similarity selection [2C]		0.72*	(0.05)	0.71*	(0.05)
Class similarity selection [2C]		0.75*	(0.07)	0.76*	(0.06)
Location similarity selection [2C]		0.39	(0.03)	0.38	(0.03)
Externalizing behavior received [2A]		-0.03	(0.03)	0.10	(0.05)
Externalizing behavior sent [2B]		0.06	(0.03)	0.22*	(0.05)
Externalizing behavior similarity selection [2C]		0.14	(0.05)	0.68*	(0.17)
BEHAVIOR DYNAMICS		**ONSET**		**(DIS)CONTINUATION**	
[3]Externalizing behavior change period 1[3A]		0.04	(0.03)	1.40*	(0.11)
Externalizing behavior change period 2 [3A]		0.03	(0.03)	1.51*	(0.14)
Externalizing behavior change linear shape [3A]				-1.26*	(0.07)
Externalizing behavior change quadratic shape [3A]				0.26*	(0.05)
Externalizing behavior exposure [3B]		0.13	(1.04)		
Externalizing behavior influence average alter [3C]				1.05*	(0.18)

Note. * $p < .05$. [1] effects estimating the structure of the friendship network, for descriptions of single effects see the main text. [2] effects estimating friendship selection. [2A] received effects estimate the number of received friendship ties for participants with this characteristic. [2B] sent effects estimate the number of sent out friendship ties for participants with this characteristic. [2C] similarity effects estimate if participants base friendship selection on similarity of this characteristic. [3] effects estimating the change of externalizing behavior. [3A] estimating the development of externalizing behavior, and if this has a linear or quadratic shape. [3B] estimating the effect friends' onset of externalizing behavior on the onset of externalizing behavior. [3C] estimating the effect of the average externalizing behavior of friends on the development of participants' externalizing behavior.

received fewer nominations). Furthermore, as shown by a negative transitive reciprocated triplet effect, triads were less likely to have reciprocated ties than dyads, which is another indication of hierarchy in the network. Particularly in Period 2, there was a negative indegree – popularity effect (although this effect was marginally significant at $p = 0.05$ for the onset model). This indicated that those with many friends were less likely to increase their number of friends. The negative effects of indegree – activity indicates that those participants who received many friendship nominations were less likely to send out nominations themselves. Last, the outdegree – activity was positive indicating that those with a higher outdegree – activity were more likely to increase the number of friends they select.

Second, the main effects of the control variables were generally consistent with prior research: Participants were more likely to select friends who were similar in gender and class (gender and class similarity selection effects). The effect of similarity in location was marginally significant ($p = 0.05$), possibly as this effect was only based on the two networks (cohorts) of School 1 while the other effects were based on four networks. The onset of externalizing behavior was not associated with receiving or sending more or less friendship nominations (externalizing behavior received or sent). Nor was it associated with similarity selection based on the onset of externalizing behavior (externalizing behavior similarity selection). The (dis)continuation in externalizing behavior was not associated with receiving more friendship nominations (externalizing behavior received), but was associated with sending more friendship nominations (externalizing behavior sent). Moreover, for the (dis)continuation model participants were likely to select friends based on a similarity in externalizing behavior (externalizing behavior similarity selection).

Third, behavior dynamics were estimated, modelling the onset of and (dis) continuation in externalizing behavior (Table 2). For the onset model, externalizing behavior did not significantly increase (change Period 1 and Period 2) over time. Influence (externalizing behavior exposure) was not significant, indicating participants were not influenced by their friends in the onset of externalizing behavior. For the (dis)continuation model, externalizing behavior significantly increased in Period 1 and Period 2 (externalizing behavior change). Furthermore, the (dis)continuation model showed a negative linear effect in all networks and a positive quadratic effect for externalizing behavior. This indicates that participants were likely to either

engage in no externalizing behaviors, or to engage in multiple externalizing behaviors. Moreover, there was a positive effect of friendship influences on externalizing behavior (externalizing behavior average alter), indicating that in most friendship networks participants changed their externalizing behavior in accordance with their friends.

To summarize, for the onset model similarity selection was not based on an onset of externalizing behavior nor were participants influenced by their friends' onset of externalizing behavior. Whereas in the (dis)continuation model participants selected their friends based on similarity in externalizing behavior, and participants were influenced by their friends in externalizing behavior.

DISCUSSION

This study investigated friendship influences in the onset and (dis) continuation of early adolescent externalizing behaviors such as antisocial behavior, alcohol use, and tobacco use. Findings indicated that early adolescents influenced their friends' (dis)continuation of externalizing behavior rather than the onset of this behavior. Therefore, although same-grade friends were unlikely to cause the onset of externalizing behavior, they were important in continuation in such behaviors during early adolescence.

Our findings are in contrast with those of Light and colleagues (2013), who showed that adolescents influenced each other in the onset of alcohol use. Possibly there are sociocultural differences between our Dutch sample and their sample from the U.S. Alternatively, the study of Light et al. (2013) focused on early adolescents in middle school who were mostly already acquainted with one another while this study focused on early adolescents who had just entered a new peer network. Possibly, friendship influence processes for the onset of externalizing behavior is more likely to occur among friends who are more familiar with one another.

The dual-taxonomy model (Moffitt, 1993) expects early adolescents to rely on their same-age peers as role models for externalizing behavior. This implies that adolescents copy their first externalizing behavior (i.e., onset) from their more experienced peers. However, friendship might not be necessary for adolescents to copy externalizing behavior from these peers; adolescents just need to be close enough to learn through observation (Moffitt, 1993). Indeed,

an onset or current engagement in externalizing behavior was not associated with receiving more friendship nominations; which would be expected if adolescents become friends with their more experienced peers to copy their externalizing behavior. As this study only examined whether friends are likely to influence the onset of externalizing behavior, other type of peers who are not necessarily friends, such as popular peers, classmates, or out-of-school friends might still be role models for the onset of externalizing behavior.

Besides the possibility that other peers rather than friends influence adolescents in the onset of externalizing behavior, parents might play an important role for the onset of externalizing behavior. A positive relationship with parents (Dekovic, Buist, & Reitz, 2004) and parental rules regarding alcohol use (Koning, Engels, Verdurmen, & Vollebergh, 2010; Van der Vorst et al., 2006) are negatively associated with the onset but not with the increase of externalizing behavior. Therefore, family rather than peers might influence whether adolescents have an onset of externalizing behavior.

When looking at (dis)continuation of current externalizing behavior, however, early adolescents were influenced by their friends. This is in line with most previous findings (see Veenstra et al., 2013); indicating that our data are comparable with other studies on the co-development of friendship and externalizing behavior. Furthermore, the finding that adolescents copy the presumably 'mature' externalizing behavior from their more experienced friends is in line with expectations of the dual-taxonomy model of Moffitt (1993) that adolescents mimic their externalizing behavior from their more experienced peers; possibly to overcome the stressful experience of the maturity gap (Dijkstra et al., 2015). However, this friends' influence only seems to occur after adolescents made the transition from abstinence to engagement in externalizing behavior.

Strengths and Limitations

This study has several strong points. First, this is the first study to compare the onset and (dis)continuation of externalizing behavior. Thus this is the first study to show the differences in friends' influences in both processes. Second, recent developments of stochastic-actor based modeling were used to assess friendship influence processes in the onset of externalizing behavior (see Light et al., 2013). Third, friendship was identified when participants just entered a new and larger peer context at secondary education. This allowed us to

identify friendship selection in a new network of friends, and to study the early start of adolescent externalizing behavior. Moreover, by assessing participants in a new network of friends, friendship selection was based on current experience and behavior rather than on pre-existing friendship bonds. Last, by assessing friendships over the entire grade and assessing changes in friendships three times in one year we managed to obtain a highly complete picture of the friendship networks and the changes in these networks.

Future studies can build on, and overcome limitations of, this study in several ways. First, this study focused only on friendship processes as SIENA models friendship connections. Future studies should investigate other peers or related factors such as family factors (e.g., Dekovic et al., 2004; Koning et al., 2010), personal characteristics (e.g., Malmberg et al., 2010), classroom norms regarding externalizing behavior (Rambaran et al., 2013), or outside of school friendships (Dishion et al., 1995). Second, this study only focused on a short, though important, period in adolescence; the first year of secondary education. Future studies should follow participants before and after, to compare processes before and in later stages of adolescence; especially as influence in the onset of externalizing behavior might occur among friends who know one another longer. Last, although the maturity gap is an important part of the dual-taxonomy model we did not directly assess the maturity gap. As Moffitt (1993) expects the maturity gap to play a vital part in the association between the onset of externalizing behavior and mimicking such behavior from friends, future studies should investigate the role of the maturity gap in friendship influences in the onset and (dis)continuation of externalizing behavior (see also Dijkstra et al., 2015).

CONCLUSION

This study investigated the influence of adolescents with an early onset of externalizing behavior on the externalizing behavior of their peers. Our findings are important in light of the dual-taxonomy model of Moffitt (1993) as we investigated the influence of those adolescents who had an early, pre-adolescent, onset of externalizing behavior. Taken together, our findings suggest that early adolescents have their first experiences with externalizing behavior, that is, their onset of such behavior, without being influenced by their same-grade friends. However, friends are important in further (dis) continuation of their engagement in externalizing behavior. Thus, different

friendship processes seem to be important for the onset and (dis)continuation of externalizing behavior. Therefore, prevention programs should differentiate between the onset and continuation of externalizing behavior. Prevention programs aimed at reducing externalizing behaviors such as smoking in secondary school, for example the peer-led ASSIST program (see Starkey, Audrey, Holliday, Moore, & Campbell, 2009), should pay special attention to those adolescents who have already experimented with externalizing behaviors as these adolescents are most susceptible to be influenced by their friends' externalizing behaviors. Other factors, perhaps the family context, are potential intervention targets to prevent early adolescent onset of externalizing behavior.

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CHAPTER 5

POPULARITY AND LIKEABILITY AS MODERATORS OF PEER INFLUENCE OF EARLY ADOLESCENT EXTERNALIZING BEHAVIOR: THE SNARE STUDY.

AART FRANKEN [1, 2, 3, 4, 5]
JAN KORNELIS DIJKSTRA [1, 2, 3, 4, 5]
ZEENA HARAKEH [1, 2, 3, 4, 5]
WILMA A.M. VOLLEBERGH [1, 3, 4, 5]

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1 Conceived and/or designed the study
2 Participated in data acquisition
3 Participated in data analysis and interpretation
4 Involved in drafting / revising the manuscript
5 Given final approval

ABSTRACT

This study examined the moderating role of popularity and likeability in peer influence processes regarding externalizing behavior (i.e., antisocial behavior, alcohol use, and tobacco use) among early adolescents. It was expected that both popularity and likeability would positively affect early adolescents' influence in the spread of externalizing behavior among friends. Data were used from the SNARE study (N = 1,444; 50% boys, M_{age} = 12.7; SD = 0.47). Hypotheses were tested using Stochastic Actor-Based Modeling (RSIENA). While controlling for the friendship network structure and similarity selection effects, results indicated that popularity but not likeability moderated friendship influence processes for externalizing behavior. Therefore, popular rather than well-liked peers influence their friends in externalizing behavior during early adolescence.

Keywords: Likeability, popularity, SIENA, social network analysis, social status

During early adolescence externalizing behaviors, such as antisocial behavior, alcohol use, and tobacco use, increase (e.g., Currie et al., 2012; Jennings & Reingle, 2012). These behaviors often develop within the peer context in which adolescents are influenced by their friends in externalizing behavior (Moffitt, 1993; Warr, 2002). The introduction of stochastic actor-based modelling (SABM; Snijders, Van de Bunt, & Steglich, 2010; Steglich, Snijders, & Pearson, 2010) allows investigating influence processes, when adolescents adapt their behavior to become more similar to their friends, while controlling for selection processes, when adolescents befriend peers who are similar in behaviors. Studies show that adolescents are indeed influenced by their friends in externalizing behaviors (see Veenstra, Dijkstra, Steglich, & Van Zalk, 2013). However, adolescents might differ in how influential they are (Allen, Porter, McFarland, 2006; Brechwald & Prinstein, 2011). Adolescents may be especially susceptible to behavior of their high status peers (Brechwald & Prinstein, 2011), as obtaining social status is an important social goal during early adolescence (LaFontana & Cillessen, 2010). Using an experimental design, Cohen & Prinstein (2006) showed that adolescents were indeed more likely to conform to high status than low status peers. However, currently only few studies have investigated the role of social status as a moderator of peer influence processes. To our knowledge, there is only one study investigating whether popularity moderates friendship influence processes of externalizing behaviors, while taking friendship selection effects into account (Mathys, Burk, & Cillessen, 2013). The study did not find any moderation effects during late adolescence. However, the importance of popularity for influence processes possibly peaks in early adolescence rather than pre- or late-, adolescence (LaFontana & Cillessen, 2010). Hence, although popularity might not moderate influence processes during late adolescence, it possibly moderates such processes during early adolescence. Therefore, this study set out to investigate whether adolescents are especially likely to be influenced in their externalizing behavior by friends with a high social status.

Two distinct types of social status are (perceived) popularity and likeability (see LaFontana & Cillessen, 1998; Mayeux, Houser & Dyches, 2011; Parkhurst & Hopmeyer, 1998). Popularity is generally assessed by asking adolescents who is popular, and associated both with prosocial and antisocial characteristics. Likeability is generally assessed by asking adolescents who they like, and associated with prosocial rather than antisocial characteristics (e.g., Mayeux, Sandstrom, & Cillessen, 2008, for a review see Mayeux et al., 2011).

It has been argued that popular adolescents are more influential compared to their peers (cf. Cillessen, 2011). First, they have characteristics suggesting social influence, such as dominance and power (LaFontana & Cillessen, 2002), being cool and admired, and having social control (Lease, Musgrove, & Axelrod, 2002). Second, adolescents might want to imitate popular peers' behavior to be 'basking in reflected glory', as being affiliated with popular peers has been associated with increased popularity (Dijkstra, Cillessen, & Borch, 2013; Dijkstra, Cillessen, Lindenberg, & Veenstra, 2010; Marks, Cillessen, & Crick, 2012). In line with this, a study by Rambaran and colleagues (2013) showed that popular classmates affected to what extent peers were influenced in their attitudes towards externalizing behaviors via norms in the classroom. Third, longitudinal research on friendship dyads has also shown that adolescents are especially likely to copy externalizing behavior, specifically alcohol use, from their more rather than less popular friends (e.g., Bot et al., 2005).

For likeability, there is some evidence that adolescents who are liked might also be more influential than their peers. As mentioned, Cohen and Prinstein (2006) showed that adolescents with a high status, those who were more popular or more liked, were more likely to influence their peers. Also using an experimental design, Sandstrom and Romano (2007; as cited in Sandstrom, 2011) indicated that adolescents were more likely to conform to their more liked peers rather than more popular peers. Indeed, adolescents seem more likely to confirm to their stable friends' externalizing behavior if this friend is more liked than themselves (Laursen, Hafen, Kerr, & Stattin, 2012).

This study investigated if popular and liked early adolescents are more influential in the spread of externalizing behaviors among their friends using stochastic-actor based modeling. In so doing, we controlled for selection effects, that is, becoming friends because of similarity in externalizing behavior. This study focused on early adolescents, who have just made the transition from elementary to secondary school. Studying this transition allowed investigating a new network of friends, thus capturing new friendships rather than continuation of old friendship networks. As externalizing behavior in early adolescence is likely to co-develop and co-occur (e.g., Monshouwer et al., 2012), we investigated an aggregate of several externalizing behaviors: Antisocial behavior, alcohol use, and tobacco use. Based on current literature we tested the hypotheses that early adolescents are more likely influenced by their friends who are more (1) popular, or (2) liked.

METHODS

Participants and Procedure

Participants included 1,144 students (50% boys), aged 11.1 to 15.6 (Mean 12.7, *SD* = 0.47), 97% were born in the Netherlands (as were 87% of their fathers and 88% of their mothers). Of the participants, 43.9% followed lower level education (including preparatory secondary school for technical and vocational training) and 54.1% followed higher level education (including preparatory secondary school for higher professional education and university).

Data stem from the SNARE (Social Network Analysis of Risk behavior in Early adolescence) project; a longitudinal study on the social development of early adolescents with a specific focus on adolescents' involvement in externalizing behavior (see also Dijkstra et al., 2015; Franken et al., 2015). Two secondary schools were asked and willing to participate: One in the middle and one in the North of the Netherlands. Subsequently, all first- and second-year secondary school students (i.e., similar to 7th-8th grades in the US) from these schools were approached for enrollment in SNARE (2011-2012). All eligible students received an information letter for themselves and their parents, in which they were asked to participate. If students wished to refrain from participation, or if their parents disagreed with their children's participation, they were requested to send a reply card or email within ten days. One year later (2012-2013) all new first year students were again approached for participation in the study. In total, 1,826 students were approached for this study, of which 40 students (2.2%) refused to participate for several reasons. A total of 1,786 students participated in SNARE (M_{age} time 1 = 12.91 years, *SD* = 0.70, 50.1% male, 83.9% Dutch). Therefore the study consisted of four samples; two schools and two cohorts (participants who started in 2011, and in 2012).

In September 2011, just when participants entered the first or second year of secondary school we started with a pre-assessment. Subsequently, in 2012, all new first-year students also completed a pre-assessment. After the pre-assessment there were follow-up regular measurement waves in October, December, and April. After two years (2011-2013), data collection was continued for another two years among the participating students.

We used data from the pre-assessment and the first three waves for this study.

The pre-assessment was during the first weeks of secondary school (September). The first assessment took place in October (Time 1), the second in December (Time 2), and the third in April (Time 3) of the same academic year. During these assessments, a teacher and one or more research assistants were present. The research assistant gave a brief introduction and explained that participants' answers would remain confidential and anonymous. During the assessment, students filled in a questionnaire on the computer during one classroom period, around 45 minutes. After the pre-assessment, this questionnaire contained, next to self-reports, peer nominations using CS socio software (www.sociometric-study.com). Peer reported variables were assessed by asking participants questions about their classmates. Participants were presented with all names of their classmates on their computer screen in alphabetical order, starting with a random name. For some peer nomination questions it was optional to select peers outside the classroom (but within the SNARE sample), using a search function. Unlimited, both same and cross sex, nominations were allowed. The students who were absent at the day of assessment were, if possible, assessed within a month.

MEASURES

Self-reported externalizing behaviors (Time 1 – Time 3). At all three time points, participants reported their engagement in three forms of externalizing behavior, including antisocial behavior, alcohol use, and tobacco use. Antisocial behavior was measured by asking participants how often (using a five point scale, ranging between 0 to 12 or more times) they had been involved in 17 types of antisocial behavior during the last month; including stealing, vandalism, burglary, violence, weapon carrying, threatening to use a weapon, truancy, contact with the police, and fare evasion in public transport (Nijhof, Scholte, Overbeek, & Engels, 2010; Van der Laan, Veenstra, Bogaerts, Verhulst, & Ormel, 2010). For alcohol use, participants used a 13 point scale (ranging from 0 to over 40 times) to report on how many occasions they consumed alcohol in the last month (Wallace et al., 2002). For tobacco use, participants used a 7 point scale (ranging from never to more than 20) to indicate how many cigarettes they smoked daily over the past month (e.g., Monshouwer et al., 2011). Based on recommendations of Farrington and Loeber (2000) and because data using continuous measures of externalizing behavior frequency were highly skewed, all externalizing behavior data were

recoded as binary, indicating no engagement at all (0) or any engagement (1) in any of the three behaviors: Antisocial behavior, alcohol use, and tobacco use. This recoding allowed for an examination of externalizing behavior engagement rather than the frequency of externalizing behavior engagement. An exploratory factor analysis (using maximum likelihood estimations and oblique rotation) tested if the externalizing behaviors loaded on a single factor; they loaded on one factor, explaining 55.3% of the variance. Therefore, a composite variable, representing the number of different externalizing behaviors participants engaged in (i.e., antisocial behavior, alcohol, or tobacco use), was computed; resulting in scores between zero (no externalizing behaviors) and three (all externalizing behaviors).

Social Status (Time 1 -Time 2). Popularity was assessed by asking "who are most popular" and "who are least popular", and likeability was assessed by asking "who do you like most". Received nominations were summed and divided by the total number of possible nominators (i.e., classmates) to obtain a proportion score which accounts for differences in classroom size. Hence, participants could obtain a score between 0 (no nominations) and 1 (nominated by all classmates). For popularity a continuous score was created by subtracting the "least popular" scores from the "most popular" scores, as is common practice in studies investigating popularity (see also Cillessen & Marks, 2011). Both scores were z-standardized before analyses.

Friendship nominations (Time 1 – Time 3). Participants were asked to name their best friends. Participants could nominate unlimited friends within their class and, afterwards, friends from their grade. Grade networks were used for the current analyses.

Analysis Strategy

All network analyses were conducted using SIENA (Simulation Investigation for Empirical Network Analyses), version 4, in R. SIENA is actor based, and models the longitudinal co-evolution of social networks and individual characteristics (Ripley, Snijders, Boda, Vörös, & Preciado, 2014). SIENA estimates the changes in networks and behavior over time. While controlling for structural network effects (i.e., the structure of friendships in the network), SIENA estimates both network dynamics and behavior dynamics longitudinally. The changes in individual behavior were modeled as an increase or decrease in the number of externalizing behaviors participants

engaged in (ranging from zero to three externalizing behaviors). SIENA estimates changes between two points in time. For the current analyses the dependent variables are the network ties (friendships) and the number of externalizing behaviors participants engaged in (antisocial behavior, alcohol use, and tobacco use). For these analyses, SIENA disentangles selection (network dynamics) from influence (behavior dynamics) processes. The outcomes of SIENA analyses are based on an iterative Markov chain Monte Carlo approach (Snijders et al., 2010; Ripley et al., 2014). Two models were ran, one estimating effects of perceived popularity and one estimating effects of likeability. As both models are the same except for the effects of popularity and likeability, they will be described once.

Commonly used structural network effects were added, and as suggested by the SIENA manual (for more details see Franken et al., 2015; Ripley et al., 2014, Veenstra et al., 2013). To improve model fit, density and indegree popularity were allowed to vary between assessment periods. Furthermore, transitive reciprocated triplets were modeled to estimate the likelihood for triads (a group of three friends) to reciprocate friendships.

Before examining study hypotheses, several factors potentially affecting the social network (i.e., network dynamic effects) were estimated as covariates (see Veenstra et al., 2013). The effects of same-gender friendship selection (i.e., girls nominate girls; boys nominate boys; girls were coded as 0, boys as 1) were estimated as well as the effects of proximity by using adolescents' similarity in classroom and school locations as covariates (school 1 consisted of four locations). The effects of gender on sending (ego) and receiving of (alter) friendship nominations also was controlled. To investigate possible selection effects, the likelihood of sending (ego) or receiving (alter) friendship nominations, and selecting similar friends, was modeled based on externalizing behavior.

To test our main hypotheses, several behavior dynamic effects (including influence effects) were estimated (see Veenstra et al., 2013). Behavior dynamic effects model changes in externalizing behavior. They model the rate of change, and whether behavior change conforms to linear or quadratic trends. A main effect of influence is estimated as the likelihood that participants adapt their externalizing behavior to become more similar to the average externalizing behavior of their friends ("average influence alter"). Main effects of popularity and likeability were also modeled ("effect from"), estimating if

adolescent with a higher popularity or likeability are more likely to increase their externalizing behavior. Furthermore, to test our hypotheses, interaction effects between popularity (externalizing behavior average alter * popularity alter) or likeability (externalizing behavior average alter * likeability alter) and externalizing behavior were estimated. These effects modeled if popularity or likeability of participants' friends changes the likelihood of participants to adapt their friends' externalizing behavior.

In a final step, after having estimated these effects for the four networks separately, a meta-analysis of the parameters was conducted on the four networks. This meta-analysis was conducted using the SIENA likelihood based method for meta-analyses (for more information see Ripley et al., 2014).

RESULTS

Descriptive Statistics of the Networks, and Externalizing Behaviors within Networks

Results at Time 1 suggest that there were some small differences in gender distribution (ranging from 48% to 61% boys), and overall externalizing behavior at Time 1 (ranging from an average score of 0.29 and 0.47) between the four networks. As popularity and likeability were standardized before analyses, they were equal in all networks (with Mean = 0, *SD* = 1). There were between 1% and 5% absent participants during the assessments. The Jaccard index indicates the relative stability of each network over time. The Jaccard indices were between .44 and .48, well within the desired range for longitudinal social network analyses (Veenstra et al., 2013).

SIENA Estimates of Friends' Influence for Perceived Popularity and Likeability

The outcomes of the SIENA analyses are shown in Table 1. First, the structural network effects model the network structure, and optimize the goodness of fit of the networks (for more details see also Franken et al., 2015). Second, the effects of externalizing behavior, and control variables were estimated. They estimate the effects of externalizing behavior, and control variables on friendship selection effects.

TABLE 1

Estimates of Selection and Influence Effects for Externalizing Behavior and Popularity and Likeability in Friendship Networks for Time 1, 2, and 3

NETWORK DYNAMICS		POPULARITY		LIKEABILITY	
Outdegree (density)	Period 1	-2.29*	(0.13)	-2.28*	(0.13)
	Period 2	0.08	(0.10)	0.08	(0.12)
Reciprocity		2.61*	(0.12)	2.64*	(0.12)
Transitive triplets		0.52*	(0.02)	0.53*	(0.02)
Transitive reciprocated triplets		-0.44*	(0.04)	-0.45*	(0.04)
3-cycles		-0.06	(0.02)	-0.06	(0.02)
Indegree - popularity (sqrt)	Period 1	0.06	(0.06)	0.06	(0.06)
	Period 2	-0.13*	(0.04)	-0.13*	(0.04)
Indegree – activity (sqrt)		-1.01*	(0.12)	-1.02*	(0.12)
Outdegree – activity (sqrt)		0.16*	(0.04)	0.15*	(0.02)
Sex sent		-0.08	(0.06)	-0.08	(0.06)
Sex received		-0.08	(0.07)	-0.04	(0.05)
Sex similarity selection		0.72*	(0.05)	0.72*	(0.05)
Class similarity selection		0.76*	(0.07)	0.76*	(0.07)
Location similarity selection		0.38	(0.03)	0.38	(0.03)
Externalizing behavior sent		0.11	(0.05)	0.10	(0.05)
Externalizing behavior received		0.21*	(0.05)	0.22*	(0.05)
Externalizing behavior similarity selection		0.72*	(0.16)	0.68*	(0.17)
BEHAVIOR DYNAMICS		**POPULARITY**		**LIKEABILITY**	
Externalizing behavior change period 1		1.38	(0.12)	1.39*	(0.11)
Externalizing behavior change period 2		1.53*	(0.13)	1.51*	(0.14)
Externalizing behavior change linear shape		-1.35*	(0.08)	-1.24*	(0.07)
Externalizing behavior change quadratic shape		0.22*	(0.05)	0.25*	(0.03)
Externalizing behavior average influence from alter		0.87*	(0.17)	1.03*	(0.18)
Effect from status [1]		0.09	(0.06)	-0.06	(0.09)
Externalizing behavior average alter x status alter [1]		0.46*	(0.08)	-0.13	(0.14)

Note. * $p < .05$.[1] effects based on popularity or likeability.

The main effects of the control variables were generally consistent with prior research. Participants' selection of friends was significantly associated with similarity in gender and class. The effect of location was marginally significant ($p = 0.055$) – possibly as it was only based on two rather than four networks as only School 1 consisted of several locations. The number of friendship nominations send out was associated with externalizing behavior

(positive externalizing behavior sent), but not with the nominations received (non-significant externalizing behavior received). Moreover, participants based their friendship on similarity in externalizing behavior.

Third, the change in externalizing behavior dynamics was estimated. These behavior dynamics model the change in externalizing behavior. Results revealed a significant negative linear effect, and a positive quadratic effect for externalizing behavior. Thus, externalizing behavior had a tendency to escalate once it develops: Participants were likely to either engage in multiple externalizing behaviors or engage in none. Participants were influenced by their friends in externalizing behavior (positive average influence alter). There were no direct effects from popularity or likeability on externalizing behavior. Thus, the development of externalizing behavior was independent on social status. To test our hypotheses, the interaction between popularity/likeability and the average alter influence effects were calculated. There was a significant interaction effect between the popularity of peers and their influence on participants' behavior (see Figure 1). Participants were more likely to be influenced by their peers if these peers were more popular. For likeability, the interaction effect was not significant. Thus, participants were influenced by their peers but this influence was regardless of their friends' likeability.

DISCUSSION

This study aimed to investigate the moderating role of popularity and likeability of friends in influence processes regarding early adolescent externalizing behavior. In line with our hypothesis, adolescents were more likely to be influenced by their more rather than less popular friends. However, friends' likeability did not affect their influence in the development of externalizing behavior.

FIGURE 1

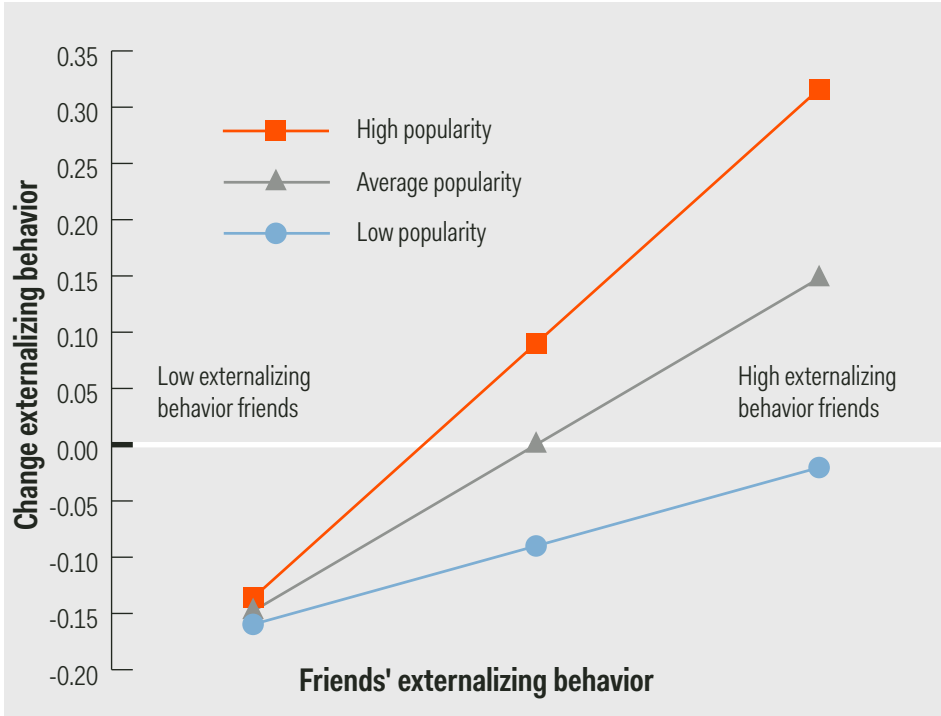

FIGURE 1. The interaction between popularity (low popularity = -1 *SD*, average popularity = Mean score, high popularity = +1 *SD*) and friends' externalizing behavior (low externalizing behavior = -1 *SD*, high externalizing behavior = +1 *SD*) predicting the likelihood of an increase in externalizing behavior.

In line with expectations of Cillessen (2011), findings of longitudinal studies (e.g., Bot et al., 2005), and the experimental study by Cohen and Prinstein (2006) – which focused both on popular and liked adolescents, adolescents were more likely influenced by their more, rather than less, popular friends. This significant finding, however, is in contrast with another study using SABM (Mathys et al., 2013) among late adolescents; which did not find any differences between late adolescents based on popularity. Possibly because popularity is more important during early rather than late adolescence (see LaFontana & Cillessen, 2010). Indeed, the study by Bot and colleagues (2005) also focused on early adolescents.

Surprisingly, likeability did not moderate friendship influence processes in externalizing behavior. Based on experimental studies (e.g., Cohen &

Prinstein, 2006; Sandstrom & Romano, 2007, as cited in Sandstrom, 2011) and longitudinal studies (e.g., Laursen, et al., 2012) it was expected that adolescents would be more likely to copy externalizing behavior from their friends who were more liked. Possibly our findings differed from the experimental studies as those (Cohen and Prinstein 2006; Sandstrom & Romano, 2007, as cited in Sandstrom, 2011) did not assess influence between friends, but focused on high status peers in general. Moreover, our study differed from Laursen (2012) as they assessed the relative likeability within a friendship pair, where the more liked friends was more likely to influence the less liked friend than vice versa.

Indeed, during early adolescence popular adolescents seem to be more influential than their well liked peers (see also Cillessen, 2011). This is also in line with the social dominance theory (see for example Hawley, 2011), which states that the most influential adolescents are those with a high status, which is, just like popularity (e.g., LaFontana & Cillessen, 1998; Mayeux, Houser & Dyches, 2011; Parkhurst & Hopmeyer, 1998), based on both prosocial and antisocial behaviors.

There are several strengths to this study. First, stochastic actor-based modeling was used to overcome limitations of several previous studies; to control for friendship selection effects and for the fact that friendships embedded in networks of friends rather than dyadic relationships. Second, we tested the role of two forms of social status; popularity and likeability, which allows comparing both concepts. Third, this study investigated adolescent friendships when they just entered secondary school. Therefore, the friendship selection was based on current behavior rather than on previous behavior. Moreover, we focused on early adolescence when externalizing behavior steadily increases (e.g., Currie et al., 2012; Jennings & Reingle, 2012) and at the same time social status becomes more salient (LaFontana & Cillessen, 2010).

There are also some limitations. The main limitation of the current study is that we focused on the influence of friends in the same grade. Early adolescents might also be influenced by friends outside of their classroom, peers in general, or norms within peer groups (e.g., Rambaran, Dijkstra, & Stark, 2013).

In conclusion, this study showed that adolescents are especially influenced by their popular friends' externalizing behavior. This study is important as it

indicates that popular rather than well liked friends are influential in the spread of early adolescent externalizing behavior. As some prevention programs use adolescents with a high social standing to educate their peers (e.g., Starkey, Audrey, Holliday, Moore, & Campbell, 2009), these studies might focus especially on popular rather than well liked adolescents.

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CHAPTER 6

EARLY ADOLESCENT FRIENDSHIP SELECTION BASED ON EXTERNALIZING BEHAVIOR: THE MODERATING ROLE OF PUBERTAL DEVELOPMENT. THE SNARE STUDY.

AART FRANKEN [1, 2, 3, 4, 5]
MITCHELL J. PRINSTEIN [1, 3, 4, 5]
JAN KORNELIS DIJKSTRA [1, 2, 3, 4, 5]
CHRISTIAN E. G. STEGLICH [3, 4, 5]
ZEENA HARAKEH [1, 2, 3, 4, 5]
WILMA A.M. VOLLEBERGH [1, 3, 4, 5]

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1 Conceived and/or designed the study
2 Participated in data acquisition
3 Participated in data analysis and interpretation
4 Involved in drafting / revising the manuscript
5 Given final approval

ABSTRACT

This study examined friendship (de-)selection processes in early adolescence. Pubertal development was examined as a potential moderator. It was expected that pubertal development was associated with an increased tendency for adolescents to select their friends based on their similarities in externalizing behavior engagement (i.e., delinquency, alcohol use, and tobacco use). Data were used from the first three waves of the SNARE (Social Network Analysis of Risk behavior in Early adolescence) study (N = 1144; 50% boys; M_{age} = 12.7; SD = 0.47), including students who entered the first-year of secondary school. The hypothesis was tested using Stochastic Actor-Based Modeling in SIENA. While taking the network structure into account, and controlling for peer influence effects, the results supported this hypothesis. Early adolescents with higher pubertal development were as likely as their peers to select friends based on similarity in externalizing behavior and especially likely to remain friends with peers who had a similar level of externalizing behavior, and thus break friendship ties with dissimilar friends in this respect. As early adolescents are actively engaged in reorganizing their social context, adolescents with a higher pubertal development are especially likely to lose friendships with peers who do not engage in externalizing behavior, thus losing an important source of adaptive social control (i.e., friends who do not engage in externalizing behavior).

Keywords: Alcohol use, delinquency, pubertal development, social network analysis, SIENA, tobacco use

It has been well-established that the dramatic increase in youths' externalizing behaviors (e.g., delinquency, alcohol use, tobacco use) over the adolescent transition period is strongly associated with social peer processes (e.g., Brechwald & Prinstein, 2011; Dishion & Tipsord, 2011; Moffitt, 2007; Veenstra, Dijkstra, Steglich, & van Zalk, 2013). Social network theories suggest that early adolescents and their friends' engagement in similar behaviors are due to two simultaneous peer socialization processes. First, *selection effects* suggest that youth tend to befriend peers who engage in similar levels of behaviors. Second, *influence effects* suggest that adolescents tend to adapt their behavior to become more similar to their friends (for more details see Steglich, Snijders, & Pearson, 2010). Interestingly, although there has been an increasing focus on factors that may mediate or moderate influence effects, still little is known regarding the factors that may make youth more (or less) likely to select friends with similar behavioral proclivities (Veenstra et al., 2013).

Selection effects have substantial potential implications for understanding adolescent social and behavioral development. In particular, selection effects may establish a pattern of person-environment transactions that have implications for both social relationships and for longer-term adjustment. By engaging in specific behaviors (e.g., externalizing behaviors) some adolescents are afforded new social opportunities (i.e., formation of new relationships), or are able to maintain existing relationships with peers (e.g., Moffitt, 1993, 2007). Conversely, deselection effects can lead to dissolution of friendships. In other words, adolescents may break friendship ties with peers who are dissimilar to themselves (e.g., DeLay, Laursen, Kiuru, Salmela-Aro, & Nurmi, 2013; Van Zalk, Kerr, Branje, Stattin, & Meeus, 2010). Less is known about the process of deselection. Findings of studies investigating deselection indicate that deselection of friends who are dissimilar in tobacco use tends to happen among late adolescents who use tobacco (Delay et al., 2013), and that among 14 year olds selection rather than deselection is important to explain similarity in delinquency and alcohol use (Van Zalk et al., 2010). Hence, it is important to take both selection and deselection effects into account. This might be especially important for externalizing behavior, as retention of friendships with peers who do not engage in externalizing behavior may confer a variety of adjustment benefits (Richmond, Mermelstein, & Metzger, 2012), while more stable friendships with externalizing peers might increase

the spread of externalizing behavior (Laursen, Hafen, Kerr, & Stattin, 2012). Thus, selection is a dynamic process between adolescents' behaviors and the navigation of their social relationships; by choosing to drink alcohol, smoke cigarettes, or engage in delinquent acts, adolescents are actively engaged in reorganizing their social context (Dishion, 2013). An initial step for understanding these processes is to more thoroughly examine factors that impact (de-)selection effects.

Selection effects based on externalizing behaviors may be critical to examine in the early adolescent period for at least two reasons. First, externalizing behavior becomes especially appealing to early adolescents as it might allow them to bridge the 'maturity gap' (Moffitt, 1993; 2007). Adolescents experience this maturity gap when they feel biologically mature, but society does not grant them adult rights and responsibilities. Adolescents experiencing the maturity gap may be likely to engage in perceived 'adult-like' behaviors, such as in externalizing behavior (Moffitt, 1993; 2007). Second, brain maturation during early adolescence is associated with increased susceptibility to social rewards before cognitive control is fully developed (e.g., Blakemore & Mills, 2014; Crone & Dahl, 2012; Prinstein & Giletta, in press; Somerville, 2013). The desire to attract such rewarding friends may be especially powerful in early adolescence. For these reasons, early adolescence may be an important period for understanding selection effects based on externalizing behaviors.

Substantial prior research indicates that early adolescents select friends based on similarity in externalizing behaviors, such as delinquent activities, alcohol use, and tobacco use (Burk, van der Vorst, Kerr, & Stattin, 2012; Huisman & Bruggeman, 2012; Kerr, van Zalk, & Stattin, 2012; Light, Greenan, Rusby, Nies, & Snijders, 2013; Mercken, Snijders, Steglich, & De Vries, 2009; Mercken, Steglich, Sinclair, Holliday, & Moore, 2012; Osgood et al., 2013; Steglich, Sinclair, Holliday, & Moore, 2012). However, not all adolescents are equally likely to do so. Moreover, findings regarding friendship selection on externalizing behavior have been inconsistent (e.g., Weerman, 2011). Weerman (2011) provides several explanations for the lack of selection effects in some past work. For instance, studies using two measurement waves may not be sufficient to detect effects. Moreover, Weerman (2011) notes that selection effects might take place in smaller rather than in larger multiple grade-level friendship networks. Alternatively, there might have been other factors that moderate friendship selection effects (see also Veenstra et al., 2013). The current study uses three waves of gradewide nomination data to

assess pubertal development as a potential moderator.

Pubertal development might be relevant to selection and deselection effects, yet it has been understudied and has not been studied as a moderating variable in studies using stochastic actor-based models. Pubertal development precipitates the experience of the maturity gap (Moffitt, 1993), as well as an increased susceptibility to social rewards, such as those that come from friendship (e.g., Blakemore & Mills, 2014; Crone & Dahl, 2012; Somerville, 2013). Moreover, early pubertal development is generally considered a risk factor for the development of externalizing behavior among both boys and girls (for a review, see Negriff & Susman, 2011). Preliminary results suggest that among boys with more advanced levels of pubertal development, friends' externalizing behavior is associated with boys' own externalizing behavior, while this is not the case for boys with a less advanced pubertal development (Felson & Haynie, 2002). Westling and colleagues (Westling, Andrews, Hampson, & Peterson, 2008) found that the association between pubertal development and externalizing behavior (including alcohol and tobacco use) was moderated by affiliation with deviant peers for girls and not for boys. Furthermore, among early developing girls, older friends might be important for the development of externalizing behaviors such as delinquency (see Stattin, Kerr, & Skoog, 2011). Last, friends' delinquency affects the association between early pubertal development and externalizing behaviors (i.e., delinquency) for boys and girls in a similar way and it is therefore possible to study these effects for boys and girls simultaneously (Lynne, Graber, Nichols, Brooks-Gunn, & Botvin, 2007). It is hypothesized that early adolescents with more advanced pubertal development are especially interested in the social rewards associated with externalizing behavior for both boys and girls; thus they may be more likely to select friends based on similarity in externalizing behavior tendencies.

This study examined pubertal development as a moderator of (de-)selection effects while addressing several limitations of prior work (see Veenstra et al., 2013). To stringently examine the associations between early adolescents' externalizing behavior and friendship selection, it is important to ensure that 1) associations are not inflated due to shared method variance; 2) selection and effects are parsed from overall network effects (i.e., controlling for cohort-wide changes in friendship selection); 3) both selection and deselection effects are modeled separately. Each of these issues is addressed using Stochastic Actor-Based Modeling (SABM).

It was hypothesized that higher levels of adolescents' pubertal development would be associated with a stronger tendency to select friends based on similar levels of externalizing behavior, and to deselection friends based on different levels of externalizing behavior. Data from the SNARE (Social Network Analysis of Risk behavior in Early adolescence) study were used to examine these hypotheses. A unique strength of this dataset is the opportunity to examine friendship networks of two cohorts in the first year of secondary school, starting at age 12, in each of two schools in the Netherlands, thus enabling the examination of selection of friends in an largely unacquainted network. The study of the same hypothesis across all four social networks allows for an examination of internal replication of findings.

METHODS

Procedure and Participants

Participants included 1,144 from the first year of secondary school students (50% boys), aged 11.1 till 15.6 (M = 12.7, SD = 0.47). A total of 97% of participants were born in the Netherlands (as were 87% of their fathers and 88% of their mothers).

The SNARE study is an ongoing prospective cohort study involving schools in two regions of the Netherlands; ethical approval for the study was granted by the first authors' university. Participants were recruited in their first or second grade of school (i.e., similar to 7th-8th grades in the US) in Year 1. In Year 2, a second cohort was added, including students in first grade at the same schools. A passive consent procedure was used; students or their parents were asked to send a reply card or email within two weeks, it they wished to refrain from participation. In total 1,826 students participated in the SNARE study, and 40 students (2.2%) refused to participate.

Data from the first three waves of data collection were available for analysis. As the focus was on the development of externalizing behavior during early adolescence, only data from first grade students were used. The first assessment took place in October (Time 1), the second in December (Time 2), and the third in April (Time 3). During each assessment, participants completed study questionnaires on the computer while a teacher and research assistant were present. Peer nominations were completed using CS socio

software (www.sociometric-study.com). Friendship nominations were conducted by asking participants to select an unlimited number of their closest same- or cross-gender friends from a roster of all classmates, presented in alphabetical order, starting with a random name. Participants were permitted to list peers outside their classroom, using a search function.

MEASURES

Self-reported externalizing behaviors (Time 1 – Time 3). At all three time points, participants reported their engagement in three forms of externalizing behavior, including delinquent behavior, alcohol use, and tobacco use. Delinquent behavior was measured with 17 items by asking participants how often (between 0 to 12 or more times) they had been involved in 17 types of delinquent behavior during the last month; including stealing, vandalism, burglary, and violence, weapon carrying, threatening to use a weapon, truancy, contact with the police, and fare evasion in public transport (e.g., Nijhof, Scholte, Overbeek, & Engels, 2010; Van der Laan, Veenstra, Bogaerts, Verhulst, & Ormel, 2010). For alcohol use, participants used a 13 point scale (ranging from 0 to over 40 times) to report on how many occasions they consumed alcohol in the last month (Wallace et al., 2002). For tobacco use, participants used a 7 point scale (ranging from never to more than 20) to indicate how many cigarettes they smoked daily over the past month (e.g., Monshouwer et al., 2011). Because data using continuous measures of externalizing behavior frequency were highly skewed (see Table 1), all externalizing behavior data were recoded as binary, indicating no engagement at all (0) or any engagement (1) in delinquent behavior, alcohol use, and tobacco use. This recoding allowed for an examination of selection effects based on externalizing behavior engagement rather than the frequency of externalizing behavior engagement. An exploratory factor analysis (using maximum likelihood estimations and oblique rotation) tested if the binary-coded externalizing behaviors loaded on a single factor; they loaded on one factor, explaining 55.3% of the variance (similar results were obtained with the continuous scores, explaining 61.4% of the variance). Therefore, a composite variable, representing the number of different externalizing behaviors participants engaged in (i.e., delinquency, alcohol, or tobacco use), was computed; resulting in scores between zero (no externalizing behaviors) and three (all externalizing behaviors).

TABLE 1

Overview of the number of participants scoring 0, 1, or higher than 1 on Delinquency, Alcohol use, and Tobacco use; at Time 1, Time 2, and Time 3

VARIABLE		SCHOOL 1				SCHOOL 2			
		Cohort 1 Participants		Cohort 2 Participants		Cohort 1 Participants		Cohort 2 Participants	
Delinquency Time 1	0	332	(78.3%)	273	(72.6%)	135	(78.6%)	95	(70.9%)
	1	47	(11.1%)	44	(11.7%)	14	(8.1%)	25	(18.7%)
	>1	45	(10.6%)	59	(15.7%)	23	(13.3%)	14	(10.4%)
Delinquency Time 2	0	316	(75.1%)	268	(72.6%)	139	(79.4%)	95	(71.4%)
	1	47	(11.2%)	49	(13.3%)	12	(6.9%)	22	(16.5%)
	>1	58	(13.8%)	52	(14.1%)	24	(13.7%)	16	(12.0%)
Delinquency Time 3	0	304	(75.1%)	273	(72.6%)	128	(73.1%)	94	(70.7%)
	1	46	(11.4%)	49	(13.0%)	24	(13.7%)	13	(9.8%)
	>1	55	(13.6%)	54	(14.4%)	23	(13.1%)	26	(19.5%)
Alcohol Time 1	0	376	(89.3%)	321	(86.3%)	161	(93.1%)	126	(94.7%)
	1	27	(6.4%)	28	(7.5%)	6	(3.5%)	6	(4.5%)
	>1	18	(4.3%)	23	(6.2%)	6	(3.5%)	1	(0.8%)
Alcohol Time 2	0	376	(89.3%)	328	(90.4%)	161	(92.5%)	119	(90.8%)
	1	24	(5.7%)	16	(4.4%)	8	(4.6%)	10	(7.6%)
	>1	21	(5.0%)	19	(5.2%)	5	(2.9%)	2	(1.5%)
Alcohol Time 3	0	355	(87.9%)	319	(89.4%)	154	(89.0%)	107	(86.3%)
	1	22	(5.4%)	27	(7.5%)	8	(4.6%)	8	(6.5%)
	>1	27	(6.7%)	15	(4.2%)	11	(6.4%)	9	(7.3%)
Tobacco Time 1	0	407	(96.2%)	349	(93.6%)	171	(98.8%)	134	(100%)
	1	7	(1.7%)	9	(2.4%)	1	(0.6%)	–	–
	>1	9	(2.1%)	15	(4.0%)	1	(0.6%)	–	–
Tobacco Time 2	0	405	(96.2%)	343	(93.5%)	168	(96.0%)	125	(94.7%)
	1	10	(2.4%)	9	(2.5%)	3	(1.7%)	3	(2.3%)
	>1	6	(1.4%)	15	(4.1%)	4	(2.3%)	4	(3.0%)
Tobacco Time 3	0	366	(90.6%)	332	(89.0%)	165	(94.8%)	115	(90.6%)
	1	22	(5.4%)	11	(2.9%)	5	(2.9%)	4	(3.1%)
	>1	16	(4.0%)	30	(8.0%)	4	(2.3%)	8	(6.3%)

Pubertal Development (Time 1, Time 2). The Pubertal Development Scale (PDS; Petersen, Crockett, Richards, & Boxer, 1998) was used to assess pubertal development. The PDS used a four-point scale, ranging from not yet started (0), recently started (1), started a while ago (2), and already completed (3) to measure various indicators of pubertal development. Girls were asked four questions regarding their body grow spurt, body hair (pubic hair), changes in skin (pimples), and breast growth. Girls were allowed to skip the question regarding menarche, as a result there were more missing scores and this question was not included in the current analyses. Boys were asked about their body growth, body hair (pubic hair), skin changes, voice changes, and beard growth. Mean scores were computed for girls and boys separately, resulting in a scale with an acceptable internal consistency at Time 1 (alpha = .70 for girls, and .79 for boys).

Friendship nominations (Time 1 – Time 3). Participants were asked to name their best friends. Participants could nominate friends within their class and, afterwards, friends from their grade. Grade networks were used for the current analyses resulting in four friendship networks (i.e., two schools, two cohorts).

Analysis Strategy

Preliminary analyses included descriptive statistics for each of the four social networks (i.e., two cohorts in two schools). For each network and each assessment, the average age, percentage of boys, average externalizing behavior level, the number of externalizing behaviors participants engaged in, pubertal development scores, the fraction of missing participants per assessment, and the average number of friends for participants were computed. A Jaccard index, indicating relative network stability over time, was also calculated.

All network analyses were conducted using SIENA (Simulation Investigation for Empirical Network Analyses), version 4, in R. SIENA is actor based, and models the longitudinal co-evolution of social networks and individual characteristics (Ripley, Snijders, Boda, Vörös, & Preciado, 2014). For the social networks, at each time point SIENA reads the presence (identified by the score 1) or absence (identified by the score 0) of friendship ties between participants (actors) in the network, and the number of externalizing behaviors participants engage in. As there were three time points, each network has three friendship network input files and each participant has three scores on

externalizing behavior. SIENA also reads two types of individual characteristics, constant or varying characteristics. Constant characteristics do not change over time (such as participants' gender). Varying characteristics can change over time (such as the pubertal development scale). SIENA uses information about a varying characteristic at Time 1 to estimate changes between Time 1 and Time 2, and information at Time 2 to estimate changes between Time 2 and Time 3.

While controlling for structural network effects (i.e., the structure of friendships in the network), SIENA estimates both selection effects (network dynamics) and influence effects (behavior dynamics) longitudinally. The changes in individual behavior were modeled as an increase or decrease in the number of externalizing behaviors participants engaged in (ranging from zero to three externalizing behaviors). SIENA estimates changes between two points in time. For the current analyses the dependent variables are the network ties (friendships) and the number of externalizing behaviors participants engaged in (delinquent behavior, alcohol use, and tobacco use). The outcomes of SIENA analyses are based on an iterative Markov chain Monte Carlo approach (Snijders, van de Bunt, & Steglich, 2010; Ripley et al., 2014). SIENA shows t-ratios as convergence statistics for the different effects in the model, with t-ratios below 0.10 signifying good convergence; models with good convergence were used for interpretation of the results. The pubertal development score at Time 1 was used for the analyses in the first period (between Time 1 and Time 2), and the score at Time 2 was used for the analyses in the second period (between Time 2 and Time 3). The effects which were modelled will be described below, for more detail and the equations behind these effects we refer to the SIENA manual (Ripley et al., 2014).

Structural network effects commonly used in comparable studies were added (see Ripley et al., 2014, Veenstra et al., 2013), afterwards, using goodness of fit indices, to optimally capture the friendship structure in the current networks. The effects which are generally included in SIENA analyses were network density (1A the number of present versus absent friendship ties in the network), reciprocity (1B the likelihood of reciprocated friendship ties), transitive triplets (1C likelihood to befriend friends of friends), three-cycles (1D indicates generalized reciprocity and negative hierarchies), indegree popularity (1E square root version; likelihood for participants who receive many friendship nominations to receive extra friendship nominations), indegree activity (1F square root version; likelihood for participants who

receive many friendship nominations to send extra friendship nominations), and outdegree activity (1G square root version; likelihood for participants who send out many friendship nominations to send out extra friendship nominations); for more details see Ripley et al. (2014). To improve model fit, density and indegree popularity were allowed to vary between assessment periods. Furthermore, transitive reciprocated triplets were modeled to estimate the likelihood for triads (a group of three friends) to reciprocate friendships.

Before examining study hypotheses, several factors potentially affecting the social network (i.e., network dynamic effects) were estimated as covariates (see Veenstra et al., 2013). The effects of same-gender friendship selection (2C i.e., girls nominate girls; boys nominate boys) (girls were coded as 0, boys as 1) were estimated as well as the effects of proximity by using adolescents' classroom and school locations as covariates (2C School 1 consisted of four locations). The effects of gender on provision (2B ego) and receipt of (2A alter) friendship nominations also was controlled.

To examine our main hypotheses, we included the effects of pubertal development and externalizing behavior on friendship nominations given (2B ego effects) and received (2A alter effects). Furthermore, we included the selection similarity effect (2C) modelling the likelihood of providing and selecting similar friends based on externalizing behavior and pubertal development. Of particular note, two interaction effects were added to examine if pubertal development had an impact on the likelihood for participants to select and deselect friends who were dissimilar in externalizing behavior (maintain (2D) and create (2E) pubertal development x externalizing behavior similarity selection).

Although not a focus of the current study, SIENA simultaneously examines influence, as well as selection effects. Thus, several behavior dynamic effects also were estimated (see Veenstra et al., 2013). Behavior dynamic effects model changes in externalizing behavior. They model the rate of change (externalizing behavior change period 1 & 2), and whether behavior change conforms to linear (externalizing behavior linear shape) or quadratic (externalizing behavior quadratic shape) trends. A main effect of influence is estimated as the likelihood that participants adapt their externalizing behavior to become more similar to the average externalizing behavior of their friends (externalizing behavior influence). The effects of pubertal development on behavior change was also modeled (effects from pubertal development). An

interaction effect between pubertal development and externalizing behavior also was examined (pubertal development x externalizing behavior influence) to determine whether susceptibility to peer influence depends on pubertal development. Overall, the inclusion of these effects was similar to prior research using SIENA (e.g., DeLay et al., 2013; van Zalk et al., 2010).

A meta-analysis of the parameters was conducted on the four networks. This meta-analysis was conducted using the SIENA likelihood based method for meta analyses (for more information see Ripley et al., 2014). Although this analysis is usually not viable for less than 10 networks (Ripley et al., 2014) it worked well with the current networks due to normality of distributions of estimates.

RESULTS

Descriptive Statistics of the Networks, and Externalizing Behaviors within Networks

Table 2 lists descriptive statistics for each of the four networks examined in this study. Results at Time 1 suggested that all four networks did not differ in age or delinquency level. There were some small differences in gender distribution, alcohol use, tobacco use, overall externalizing behavior, and or pubertal development. None of the students of the smallest network, cohort 2 of School 2 used tobacco at Time 1.

Table 2 also includes network characteristics for each cohort. There were between 1% and 5% absent participants during the assessments. On average, participants had between 6 and 9 friends in all networks and waves. The Jaccard index indicates the relative stability of each network over time. An index between .44 and .48, indicating the percentage of stable friendships, is well within the desired range for longitudinal social network analyses (Veenstra et al., 2013).

Effects of Pubertal Development on Friendship Selection of Externalizing Behavior

The outcomes of the SIENA analyses are shown in Table 3. The structural network effects model the network structure, and optimize the goodness of fit of the networks. Network dynamic effects indicate the effects of externalizing

TABLE 2

Overview of the number of participants scoring 0, 1, or higher than 1 on Delinquency, Alcohol use, and Tobacco use; at Time 1, Time 2, and Time 3

VARIABLE		SCHOOL 1				SCHOOL 2			
		Cohort 1 M (SD)		Cohort 2 M (SD)		Cohort 1 M (SD)		Cohort 2 M (SD)	
Age	Time 1	12.65	(0.43)	12.65	(0.43)	12.66	(0.48)	12.70	(0.68)
% boys	Time 1*	0.50[ab]	(0.50)	0.48[a]	(0.50)	0.47[ab]	(0.50)	0.61[b]	(0.49)
Delinquency	Time 1	0.22	(0.41)	0.27	(0.45)	0.21	(0.41)	0.29	(0.46)
	Time 2	0.25	(0.43)	0.27	(0.45)	0.21	(0.41)	0.29	(0.45)
	Time 3	0.25	(0.43)	0.27	(0.45)	0.27	(0.44)	0.29	(0.46)
Alcohol	Time 1*	0.11[ab]	(0.31)	0.14[a]	(0.34)	0.07[b]	(0.25)	0.05[b]	(0.22)
	Time 2	0.11	(0.31)	0.10	(0.30)	0.07	(0.26)	0.09	(0.29)
	Time 3	0.12	(0.33)	0.14	(0.35)	0.11	(0.31)	0.14	(0.35)
Smoking	Time 1*	0.06[ab]	(0.31)	0.10[a]	(0.42)	0.01[b]	(0.11)	0.00[b]	(0.00)
	Time 2	0.05	(0.28)	0.10	(0.42)	0.04	(0.20)	0.05	(0.22)
	Time 3*	0.13[ab]	(0.44)	0.19[a]	(0.56)	0.05[ab]	(0.22)	0.09[b]	(0.29)
Externalizing Behavior	Time 1*	0.38[ab]	(0.77)	0.51[a]	(0.94)	0.29[b]	(0.60)	0.34[ab]	(0.56)
	Time 2	0.41	(0.73)	0.45	(0.86)	0.31	(0.66)	0.41	(0.69)
	Time 3	0.47	(0.87)	0.59	(1.00)	0.42	(0.71)	0.47	(0.76)
Pubertal development	Time 1*	0.84[a]	(0.53)	0.93[ab]	(0.58)	0.99[b]	(0.56)	0.88[ab]	(0.55)
	Time 2*	0.85[a]	(0.53)	0.90[ab]	(0.59)	0.96[ab]	(0.63)	1.00[b]	(0.56)
Missing fraction	Time 1	0.01		0.03		0.05		0.01	
	Time 2	0.01		0.04		0.03		0.02	
	Time 3	0.03		0.03		0.02		0.02	
Average number of friendships connections	Time 1	7.05		7.65		7.64		6.44	
	Time 2	7.93		9.00		7.99		7.66	
	Time 3	7.41		8.09		8.05		6.08	
Jaccard index	Time 1 – Time 2	0.46		0.47		0.44		0.45	
	Time 2 – Time 3	0.46		0.48		0.44		0.45	

Note. * One-way ANOVA between group differences at $p < .05$. Within each time point (i.e., row), Mean scores with different superscripts differ significantly from each other at $p < .05$; calculated with a post-hoc Tukey Honestly Significant Difference test.

behavior, pubertal development, and control variables on selection effects. Main effects were generally consistent with prior research. Participants' selection of friends was significantly associated with similarity in gender and class. Location was marginally significant in the meta-analysis at $p = 0.05$, probably because the effect was only based on the two networks of school 1. Both of these effects were significant when examined in their respective network (see supplementary materials). Higher levels of participants' engagement in externalizing behaviors were associated with the provision of

TABLE 3

Meta-Analysis Estimates the Evaluation Functions and Standard Errors of Selection and Influence Effects for Externalizing Behavior and Pubertal Development in Friendship, Time 1, 2, and 3

NETWORK DYNAMICS		META-ANALYSIS	
[1]Outdegree (density) [1A]	Period 1	-2.31*	(0.14)
	Period 2	0.12	(0.12)
Reciprocity [1B]		2.57*	(0.12)
Transitive triplets [1C]		0.52*	(0.02)
Transitive reciprocated triplets [1D]		-0.43*	(0.03)
3-cycles [1E]		-0.06*	(0.02)
Indegree - popularity (sqrt) [1F]	Period 1	0.05	(0.06)
	Period 2	-0.14*	(0.04)
Indegree – activity (sqrt) [1G]		-0.98*	(0.11)
Outdegree – activity (sqrt) [1H]		0.15*	(0.04)
[2]Sex received [2A]		-0.08	(0.06)
Sex sent [2B]		-0.14	(0.12)
Sex similarity [2C]		0.71*	(0.05)
Location similarity [2C]		0.38	(0.03)
Class similarity [2C]		0.77*	(0.07)
Externalizing behavior received [2B]		0.09	(0.05)
Externalizing behavior sent [2A]		0.23*	(0.05)
Externalizing behavior similarity [2C]		0.59	(0.19)
Pubertal development received [2B]		-0.01	(0.02)
Pubertal development sent [2A]		-0.03	(0.02)
Pubertal development similarity [2C]		0.37*	(0.11)
Pubertal development sent x externalizing behavior similarity maintain [2D]		0.80*	(0.22)
Pubertal development sent x externalizing behavior similarity create		-0.45	(0.20)

BEHAVIOR DYNAMICS	META-ANALYSIS	
[3]Externalizing behavior change period 1 [3A]	1.36*	(0.12)
Externalizing behavior change period 2 [3A]	1.41*	(0.15)
Externalizing behavior change linear shape [3A]	-1.26	(0.07)
Externalizing behavior change quadratic shape [3A]	0.24*	(0.06)
Externalizing behavior influence [3B]	1.07*	(0.21)
Effect from pubertal development [3C]	0.11	(0.06)
Pubertal development x externalizing behavior influence [3D]	0.23	(0.29)

Note. $p < .10$ * $p < .05$. [1] effects estimating the structure of the friendship network, for descriptions of single effects see the main text. [2] effects estimating friendship selection. [2A] received effects estimate the number of received friendship ties for participants with this characteristic. [2B] sent effects estimate the number of sent out friendship ties for participants with this characteristic. [2C] similarity effects estimate if participants base friendship selection on similarity of this characteristic. [2D], [2E] interaction assessing the impact of pubertal development on likelihood of maintaining/creating friendships based on externalizing behavior. [3] effects estimating the change of behavior. [3A] estimating the development of externalizing behavior, and if this has a linear or quadratic shape. [3B] estimating the effect of this characteristic on the development of externalizing behavior. [3C] estimating the effect of the average externalizing behavior of friends on the development of participants' externalizing behavior. [3D] interaction assessing the impact of pubertal development on friends' influence on the development of participants' externalizing behavior.

more friendship nominations (see positive externalizing behavior sent effect). Participants were more likely to select friends who were similar in their engagement of externalizing behavior (see externalizing behavior similarity), although this effect was marginally significant ($p = 0.05$). Participants also were likely to select friends at similar levels of pubertal development (see pubertal development similarity effect). Behavior dynamics results also revealed a significant negative linear effect, and positive quadratic effect, for changes in externalizing behavior over time. Consistent with hypotheses interaction effects (between pubertal development and maintaining friends based on externalizing behavior) emerged, suggesting that over time pubertal development influenced the likelihood to maintain friends who are similar in externalizing behavior.

As can be seen in Figure 1, this effect indicates that among more pubertally-developed participants, maintenance of friendship ties over time was more strongly associated with similarity in externalizing behavior especially at higher engagement in externalizing behavior. In other words, adolescents with a higher pubertal development who engage in externalizing behavior were more likely to deselection friends with dissimilar levels of externalizing behavior; there was no difference for adolescents who do not engage in externalizing behavior. However, pubertal development did not influence the likelihood to create friendships based on similarity in externalizing behavior.

FIGURE 1

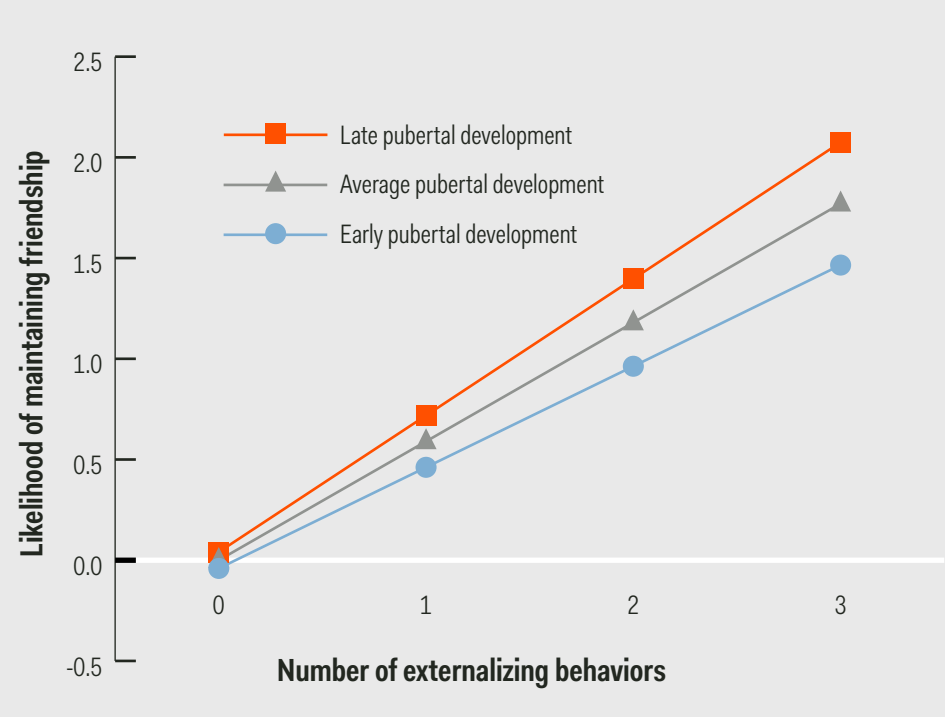

FIGURE 1. The interaction between pubertal development and maintaining friendships based on similarity in externalizing behavior based on the effects of the meta-analysis. The effect is shown in isolation (rather than in context of other effects) for illustrative purposes, the number of externalizing behaviors is shown and the levels of pubertal development are early (+1 *SD*), average (Mean score), and late (-1 *SD*).

Although not a focus of the current study, results also indicated a significant effect for peer influence in externalizing behavior, suggesting that participants' externalizing behavior became more similar to the average level of their friends' externalizing behavior over time. Specifically, results indicated that friends' engagement in more types of externalizing behavior (i.e., delinquency, alcohol, tobacco use) was associated with participants' adoption of more types of externalizing behavior over time. The direct effect of pubertal development on externalizing behavior nor the interaction between pubertal development and externalizing behavior influence were significant. In other words, participants' level of pubertal development was not associated with an increase in externalizing behavior over time, nor with differences in adolescents' propensity for peer influence.

DISCUSSION

This study focused on friendship (de-)selection processes in early adolescence. Pubertal development was examined as a potential moderator of the relationship between externalizing behavior and friendship (de-)selection. It was hypothesized that more advanced pubertal development would be associated with an increased tendency for adolescents to select their friends based on their similarities in externalizing behavior engagement. This study is unique in its focus on pubertal development as a moderator of selection effects using contemporary approaches for examining peer selection. Results supported the hypotheses. Overall, results indicated that adolescents are especially likely to select peers as friends if those peers are similar in their externalizing behavior engagement; this effect was increasingly evident for deselection of friends by early adolescents with higher levels of adolescents' pubertal development. Those adolescents with higher pubertal development were more likely to remain friends with peers who have a similar engagement in externalizing behavior, and to break friendship with those who do not. Results have several important implications for adolescent development. First, findings suggest that more pubertally-developed adolescents are not more inclined to externalizing behavior, but are more likely to lose their friends who do not engage in externalizing behavior, thus they might lose an important source of adaptive social support (e.g., Richmond et al., 2012). Research suggests that adaptive social support, from non-deviant peers, may be especially important for helping adolescents cope with stressors, and for socializing adolescents towards adaptive developmental outcomes (e.g., high academic achievement, etc.) (Dishion & Tipsord, 2011). Findings may elucidate a mechanism by which early-starter adolescent externalizing behavior leads to maladaptation in other domains.

Inversely, results suggest that adolescents who are more pubertally-developed are more likely to have stable friendships with other externalizing youth. In other words, these adolescents may be at greater risk for further deviant peer socialization. Note that findings in this study did not demonstrate that pubertal development was associated with greater susceptibility to peer influence, however. An interesting direction for future work will be the examination of these processes over a wider range of development. It is possible that early adolescents selection processes lead to heightened influence processes later in adolescence that were beyond the assessment

window in this study. Alternatively, it is possible that the effects of pubertal development on peer influence processes may be limited to selection effects, and not as relevant for influence effects. Both are intriguing possibilities for future work.

This study revealed several additional interesting results. First, adolescents were likely to select their friends based on similarity in pubertal development, even when taking selection on externalizing behavior into account. Second, although several studies have associated early pubertal development with externalizing behavior during early adolescence (for an overview see Graber, Nichols, & Brooks-Grunn, 2010), this association might disappear when taking friendship selection and influence processes into account.

This study has several strengths. First, by investigating participants at the start of secondary schools it was possible to capture the beginning of new friendship networks, thus allowing us to study selection effects isolated from previous networks. Second, it was possible to look at generalizability of our findings as we studied four independent but similar whole grade friendship networks; which can be found in the supplementary materials. Furthermore, our study builds on previous studies investigating friendship selection and deselection processes in externalizing behavior among adolescents (e.g., Delay et al., 2013; Van Zalk et al., 2010) by showing that deselection based on externalizing behavior is important especially among adolescents with a higher pubertal development and engagement in externalizing behavior.

Future studies should address several limitations of this study. First, to examine cohesive social networks, peer nominations emphasized friendships within children's own school grade. However, deviant peer affiliations in particular may include peers from other grades. Future research allowing cross-grade nominations, and even friendship nominations outside of the school context may reveal additional relevant social influences (Kerr, Stattin, Kiesner, 2007). Although we were able to use a meta-analysis there were some differences between the networks (see the supplementary Table 4, after references) which merit further investigation. Also Mercken and colleagues (2009) showed outcomes to differ across several meta-analyses in different countries, our findings add to this study by showing that differences might also occur while comparing networks within the same country or even within the same school. Possibly, power issues due to the dichotomization of our variables (see Markon, Chmielewski, and Miller, 2011) might have affected

our results, as most significant findings occurred in the larger cohorts examined in this study. Alternatively, differences between the networks might occur because of factors not captured in the current analyses. A recent review (Marschall-Lévesque, Castellanos-Ryan, Vitaro, & Séguin, 2014) pointed out the importance of studying school, neighborhood, and parenting effects when studying the associating between peers and substance use. Parenting effects might be especially important while studying pubertal development (Westling et al., 2008). Therefore, future studies should investigate such factors as potentially affecting the interplay between externalizing behavior, peers, and pubertal development. Third, this study examined an externalizing behavior composite, indicating whether adolescents had engaged in any delinquent behavior, alcohol, or tobacco use. Whether these same processes are relevant for the frequency with which adolescents engage in each of these behaviors remains unexplored as we did not conduct analyses at the individual item level. Especially the role of adolescents who engage very frequently in externalizing behaviors might be important to investigate. Future studies could investigate the role of pubertal development in influence and selection processes related to changes in different forms of externalizing behaviors separately, such as delinquency, alcohol use, and tobacco use. Such studies might benefit from investigating slightly older adolescents, when there is a higher occurrence of and change in externalizing behavior. Last, the sophistication of the models examined in this study prohibited a test of more complex gender or family interactions as even larger sample sizes would be needed. Nevertheless, the study of further moderation is a critical future direction.

In conclusion, this study suggested that during early adolescence pubertal development plays a pivotal role in adolescents' friendship selection. The implications of externalizing behavior engagement on adolescents' social network has been relatively under-explored, but could be a useful direction to consider whether providing psychological services to at-risk youth. Especially pubertally more advanced adolescents should be supported in maintaining friendships with peers who do not engage in externalizing behavior, as such friends provide an important social support network (Richmond et al., 2012).

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PUBERTAL DEVELOPMENT AND EXTERNALIZING BEHAVIOR

TABLE 4

Estimates Evaluation Functions and Standard Errors of Selection and Influence Effects for Externalizing Behavior and Pubertal Development in Friendship Networks for Two Schools, Two Cohorts, Time 1, 2, & 3

VARIABLE NETWORK DYNAMICS		SCHOOL 1 Cohort 1 M (SD)		SCHOOL 1 Cohort 2 M (SD)		SCHOOL 2 Cohort 1 M (SD)		SCHOOL 2 Cohort 2 M (SD)	
[1]Outdegree (density) [1A]	Period 1	-2.12*	(0.24)	-2.44*	(0.23)	-2.53*	(0.29)	0.54	(1.26)
	Period 2	0.08	(0.21)	0.27	(0.21)	0.11	(0.25)	-0.49	(0.51)
Reciprocity [1B]		2.90*	(0.11)	2.39*	(0.09)	2.36*	(0.17)	2.63*	(0.19)
Transitive triplets [1C]		0.56*	(0.02)	0.49*	(0.02)	0.47*	(0.03)	0.57*	(0.05)
Transitive reciprocated triplets [1D]		-0.52*	(0.03)	-0.38*	(0.03)	-0.43*	(0.05)	-0.36*	(0.07)
3-cycles [1E]		-0.04	(0.02)	-0.10*	(0.02)	-0.03	(0.04)	-0.07	(0.06)
Indegree - popularity (sqrt) [1F]	Period 1	0.08*	(0.03)	-0.08*	(0.03)	0.21*	(0.04)	-0.01	(0.08)
	Period 2	-0.11	(0.07)	-0.22*	(0.07)	-0.07	(0.08)	-0.20	(0.15)
Indegree – activity (sqrt) [1G]		-1.10*	(0.14)	-0.76*	(0.10)	-1.13*	(0.23)	-1.79*	(0.58)
Outdegree – activity (sqrt) [1H]		0.15*	(0.03)	0.16*	(0.02)	0.30*	(0.06)	-0.02	(0.08)
[2]Sex received [2A]		-0.19*	(0.04)	-0.05	(0.05)	0.10	(0.06)	-0.17	(0.09)
Sex sent [2B]		-0.02	(0.05)	0.07	(0.05)	-0.15	(0.09)	-0.72*	(0.20)
Sex similarity [2C]		0.67*	(0.04)	0.84*	(0.04)	0.65*	(0.07)	0.59*	(0.09)
Location similarity [2C]		0.43*	(0.05)	0.34*	(0.05)	-		-	
Class similarity [2C]		0.70*	(0.05)	0.84*	(0.05)	0.94*	(0.07)	0.54*	(0.11)
Externalizing behavior received [2B]		0.03	(0.04)	0.21*	(0.04)	0.07	(0.09)	-0.03	(0.10)
Externalizing behavior sent [2A]		0.12*	(0.05)	0.29*	(0.04)	0.18	(0.10)	0.72*	(0.24)
Externalizing behavior similarity [2C]		0.40*	(0.18)	1.00*	(0.15)	0.60	(0.37)	-0.09	(0.43)
Pubertal development received [2B]		-0.03	(0.02)	0.02	(0.02)	-0.08*	(0.03)	0.04	(0.04)
Pubertal development sent [2A]		-0.03	(0.02)	0.01	(0.02)	-0.06	(0.04)	-0.15*	(0.06)
Pubertal development similarity [2C]		0.24*	(0.11)	0.61*	(0.14)	0.55*	(0.22)	-0.12	(0.30)
Pubertal development sent x externalizing behavior similarity maintain [2D]		1.03*	(0.40)	0.54	(0.31)	1.83*	(0.66)	0.19	(0.80)
Pubertal development sent x externalizing behavior similarity create [2E]		-0.42	(0.34)	-0.49	(0.30)	-0.80	(0.55)	0.19	(0.72)

TABLE 4

Estimates Evaluation Functions and Standard Errors of Selection and Influence Effects for Externalizing Behavior and Pubertal Development in Friendship Networks for Two Schools, Two Cohorts, Time 1, 2, & 3

VARIABLE BEHAVIOR DYNAMICS	SCHOOL 1 Cohort 1 M (SD)		SCHOOL 1 Cohort 2 M (SD)		SCHOOL 2 Cohort 1 M (SD)		SCHOOL 2 Cohort 2 M (SD)	
[3]Externalizing behavior change period 1 [3A]	1.33*	(0.18)	1.40*	(0.26)	1.31*	(0.30)	1.48*	(0.33)
Externalizing behavior change period 2 [3A]	1.54*	(0.21)	1.74*	(0.32)	1.54*	(0.37)	0.99*	(0.23)
Externalizing behavior change linear shape[3A]	-1.28*	(0.11)	-1.19*	(0.11)	-1.47*	(0.22)	-1.30*	(0.27)
Externalizing behavior change quadratic shape[3A]	0.28*	(0.08)	0.13	(0.10)	0.33*	(0.15)	0.17	(0.21)
Externalizing behavior influence[3B]	1.19*	(0.31)	1.06*	(0.30)	-0.03	(0.85)	1.86	(1.33)
Effect from pubertal development[3C]	0.11	(0.09)	-0.09	(0.14)	0.32	(0.17)	0.21	(0.23)
Pubertal development x externalizing behavior influence[3D]	0.04	(0.36)	0.85	(0.57)	1.28	(1.32)	-2.51	(1.63)

Note. $p < .10$ * $p < .05$. [1] effects estimating the structure of the friendship network, for descriptions of single effects see the main text. [2] effects estimating friendship selection. [2A] received effects estimate the number of received friendship ties for participants with this characteristic. [2B] sent effects estimate the number of sent out friendship ties for participants with this characteristic. [2C] similarity effects estimate if participants base friendship selection on similarity of this characteristic. [2D, 2E] interaction assessing the impact of pubertal development on likelihood of maintaining/creating friendships based on externalizing behavior. [3] effects estimating the change of behavior. [3A] estimating the development of externalizing behavior, and if this has a linear or quadratic shape. [3B] estimating the effect of this characteristic on the development of externalizing behavior. [3C] estimating the effect of the average externalizing behavior of friends on the development of participants' externalizing behavior. [3D] interaction assessing the impact of pubertal development on friends' influence on the development of participants' externalizing behavior.

CHAPTER 7

THE ROLE OF SELF-CONTROL AND EARLY ADOLESCENTS' FRIENDSHIPS IN THE DEVELOPMENT OF EXTERNALIZING BEHAVIOR: THE SNARE STUDY.

AART FRANKEN [1, 2, 3, 4, 5]
TERRIE E. MOFFITT [1, 3, 4, 5]
CHRISTIAN E. G. STEGLICH [3, 5]
JAN KORNELIS DIJKSTRA [1, 2, 3, 4, 5]
ZEENA HARAKEH [1, 2, 3, 4, 5]
WILMA A.M. VOLLEBERGH [1, 3, 4, 5]

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1 Conceived and/or designed the study
2 Participated in data acquisition
3 Participated in data analysis and interpretation
4 Involved in drafting / revising the manuscript
5 Given final approval

ABSTRACT

This social network study investigated the moderating role of self-control in the association between friendship and the development of externalizing behavior: Antisocial behavior, alcohol use, tobacco use. Previous studies have shown inconsistent findings, and did not control for possible friendship network or selection effects. We tested two complementary hypotheses: (I) That early-adolescents with low self-control develop externalizing behavior regardless of their friends' behavior, or (II) as a result of being influenced by their friends' externalizing behavior to a greater extent. Hypotheses were investigated using data from the SNARE (Social Network Analysis of Risk behavior in Early adolescence) study (N = 1,144, 50% boys, M_{age} = 12.7, SD = 0.47). We controlled for selection effects and the network structure, using a data-analysis package called SIENA. The main findings indicate that personal low self-control and friends' externalizing behaviors both predict early adolescents' increasing externalizing behaviors, but they do so independently. Therefore, interventions should focus on all early adolescents' with a lower self-control, rather than focus on those adolescents with a lower self-control who also have friends who engage in externalizing behavior.

Keywords: Alcohol use, antisocial behavior, self-control, social network analysis, SIENA, tobacco use

Early adolescents' development of externalizing behaviors is influenced by their friends' externalizing behavior (see Veenstra, Dijkstra, Steglich, & van Zalk, 2013). Such externalizing behaviors include antisocial behavior, alcohol use, and tobacco use. Early adolescents' self-control is also associated with the development of such externalizing behaviors (e.g., de Kemp et al., 2009). Several studies have investigated a potential moderating effect of self-control on the tendency to adapt friends' externalizing behavior, focusing primarily on the outcome of delinquency. These studies have provided inconsistent findings: Past research has suggested that higher self-control might be associated with a lower likelihood to adapt behavior based on delinquent peers (Gardner, Dishion, & Connell, 2008; Wright, Caspi, Moffitt, & Silva, 2001), that self-control might not moderate this association (McGloin & O'Neill Shermer, 2009), or that high self-control might even be associated with a higher likelihood to adapt such behaviors (Meldrum, Young, & Weerman, 2009).

The inconsistency in the above findings might stem from several different sources. Some of the studies used adolescents' reports of their own and of their peers' behavior, which is likely to be biased.. Further, these studies did not investigate the continuous co-development of externalizing behavior and friendship over time, did not take friendship selection effects into account, nor did they take both friends' delinquency and the network structure (how friendships are embedded in the network of peers) into account (see Veenstra et al., 2013). The present study aimed to overcome these limitations by using a data set of adolescents' social networks measured repeatedly over time, and by modeling the co-evolution of the network (friendship) and the behavior (externalizing behavior), using stochastic actor-based modeling (SABM; Steglich, Snijders, & Pearson, 2010). SABM modeling allows disentangling selection effects (adolescents become friends with those who have the same characteristics) from influence effects (friends become more similar to each other over time), and takes the friendship network structure into account. Furthermore, although previous studies focused on delinquency, we investigated a composite of multiple externalizing behaviors (antisocial behavior, alcohol use, and tobacco use). This allowed for a more complete understanding of the role of self-control during early adolescence. In sum, this study aimed to test the role of self-control in the spread of externalizing behavior during early adolescence; by studying how self-control is associated with adapting friends' externalizing behavior hereby using longitudinal social network analyses.

Adolescent Onset of Externalizing Behavior

It was important for our study to capture the window of entry into early adolescence, because it is the peak developmental period for initiation of externalizing behaviors. Early adolescents become increasingly engaged in externalizing behaviors such as antisocial behavior, alcohol use, and tobacco use (e.g., Currie et al., 2012; Jennings & Reingle, 2012). This sudden increase of externalizing behavior has been explained by the dual-taxonomy model (Moffitt, 1993). According to this model, adolescents are motivated to overcome the stressful experience of the "maturity gap". This gap is experienced when adolescents feel biologically mature, but do not yet receive adult-like rights and privileges from society. Mimicking externalizing behavior of peers is a way for these adolescents to obtain an adult-like status among their peers, thus bridging the maturity gap. Few studies have tested whether bridging the maturity gap through externalizing behavior depends on the adolescents' pre-existing personality characteristics, such as self-control.

Recent social network studies, using SABM, have been able to disentangle selection effects (adolescents select friends who are similar to them) from influence effects (adolescents become more similar to their friends), while taking the structure of friendship networks into account. These studies have shown that adolescents do mimic their friends' externalizing behavior. Early adolescents not only select friends who are similar to them in antisocial behavior, alcohol use, or tobacco use, but they also adapt their behavior to become more similar to their friends (Burk, Van der Vorst, Kerr, & Stattin, 2012; Huisman & Bruggeman, 2012; Kerr, van Zalk, & Stattin, 2012; Light, Greenan, Rusby, Nies, & Snijders, 2013; Mercken, Steglich, Sinclair, Holliday, & Moore, 2012; Osgood, Ragan, Wallace, Gest, Feinberg, & Moody, 2013; Steglich, Sinclair, Holliday, & Moore, 2012). However, some studies found inconsistent or non-significant effects (Knecht, Burk, Weesie, & Steglich, 2011; Knecht, Snijders, Baerveldt, Steglich, & Raub, 2010; Mercken, Snijders, Steglich, & de Vries, 2009; Mercken, Snijders, Steglich, Vertiainen, & De Vries, 2010a; Mercken, Snijders, Steglich, Vartianen, & De Vries, 2010b; Mercken, Steglich, Knibbe, & de Vries, 2012, Weerman, 2011), indicating that other variables might be needed to better explain the co-development of friendship and externalizing behavior. As not all adolescents are equally susceptible to the influence of their peers (Brechwald & Prinstein, 2011), it is important to investigate variables such as pre-existing personality – in particular personal

self-control –, which might moderate the likelihood to adapt friends' externalizing behavior.

Self-Control and Externalizing Behavior

Since the General Theory of Crime (Gottfredson & Hirshi, 1990), the personality characteristic called self-control (i.e., self-regulation; inhibitory control) has been studied to explain engagement in antisocial behavior and substance use. According to this theory, self-control is important in explaining both delinquency and friendship selection. The main reason adolescents with a low self-control are likely to end up together is that they may not be attractive friends to others. That is, they can be "unreliable, untrustworthy, selfish, and thoughtless. They may however be fun to be with, they are certainly more risk-taking, adventuresome, and reckless than their counterparts" (Gottfredson & Hirshi, 1990, p. 157). Therefore, those adolescents with low self-control who are adventuresome and have trouble making other friends are likely to end up together. At the same time, adolescents who have lower self-control are more likely to engage in delinquent acts. Thus, the association between delinquency and delinquent friends might be explained by self-control. Rather than selecting friends with a similar delinquent behavior, adolescents might select friends who have a similar self-control level and also engage in delinquent behavior.

In general, studies find that self-control plays an important role in the development of adolescent externalizing behavior. Impaired childhood self-control is highly important as it is associated with an abundance of negative life experiences, such as substance use, criminal offending, school dropout, or unplanned teenage pregnancies, and with negative long term health and financial outcomes (Moffitt et al., 2011). Furthermore, having lower self-control might impact adolescents' susceptibility to externalizing behavior (Gardner et al., 2008; McGloin & O'Neill Shermer, 2009; Meldrum et al., 2009). Lower self-control has been associated with engagement in externalizing behaviors, such as antisocial behavior (criminal offending, delinquency; Cauffman, Steinberg, & Piquero 2005; Chapple, 2005; De Kemp et al., 2009), and substance use (Larsen et al., 2010; Marschall-Lévesque, Castellanos-Ryan, Vitaro, & Séguin, 2013). Furthermore, adolescents with lower self-control are more likely to have deviant friends (Evans, Cullen, Dunaway, & Benson, 1997; McGloin & O'Neill Shermer, 2009).

On the one hand, in line with the General Theory of Crime (Gottfredson & Hirschi, 1990) self-control might explain any increase in externalizing behavior independent of friends' externalizing behavior. The influence of friends who engage in externalizing behavior might even decrease with lower self-control (Meldrum et al., 2009). If adolescents with low self-control are more likely to engage in externalizing behavior regardless of their friendships, there would be fewer potential for friends to further influence their externalizing behavior. On the other hand, following the basic associations of self-control with externalizing behavior and self-control with deviant friends, a moderating role of self-control has also been proposed. In line with the social amplification effect (Wright et al., 2001), lower self-control has been found to increase the influence of deviant peers (Gardner et al., 2008; Wright et al., 2001). Thus, adolescents with lower self-control might be more likely to be influenced by their friends who engage in externalizing behavior. In order to properly test these complementary hypotheses, friendship selection and influence processes should be investigated simultaneously and longitudinally. While investigating these hypotheses, it is important to take possible selection effects of self-control into consideration. Although Gottfredson and Hirshi (1990) expected adolescents to select their friends on self-control, Young (2011) found negligible selection effects based on self-control. When taking SES, sex, and grade level friendship selection effects into account, while controlling for triad closure, Young (2011) concluded that self-control is not important in the formation of friendships at school.

Current Study

The current study investigated the moderating role of self-control in the co-development of friendship and externalizing behavior (i.e., antisocial behavior, alcohol use, and tobacco use) during early adolescence. Whole grade friendship networks at the start of secondary school in the Netherlands (when participants are around 12 years old) were investigated using data from the SNARE (Social Network Analysis of Risk behavior in Early adolescence) study. Furthermore, we take possible selection effects and the network structure into account, using stochastic actor-based modelling (SABM) in a data-analysis package called SIENA. Our study tested the hypothesis that self-control moderates the likelihood of adapting friends' externalizing behavior. Specifically, we tested two complementary hypotheses. First, we tested if lower self-control regardless of friends' externalizing behavior would

increase the development of externalizing behavior. Second, we tested if adolescents with lower self-control would be more likely to be influenced by the externalizing behavior of their friends. Additionally, we took friendship selection based on self-control into consideration. Based on recent findings (Young, 2011), we did not expect any selection effects based on self-control. Studying the role of self-control in this association is important as self-control has been proposed to be an important characteristic to train to help prevent engagement in externalizing behavior during adolescence (Moffitt & Caspi, 2001; Piquero, Jennings, & Farrington, 2010).

METHODS

Procedure and Participants

Participants included 1144 students (50% boys), aged 11.1 to 15.6 (Mean 12.7, *SD* = 0.47), 97% were born in the Netherlands (as were 87% of their fathers and 88% of their mothers). Of the participants, 46.1% followed lower level education (including preparatory secondary school for technical and vocational training) and 53.9% followed higher level education (including preparatory secondary school for higher professional education and university).

Hypotheses were examined using data from the SNARE study. This is an ongoing prospective cohort study that focuses on the interplay between social networks and the development of externalizing behavior. The participants were recruited from two high schools, one in the middle and one in the north of the Netherlands; ethical approval for the study was granted by the first author's university (see also Dijkstra et al., 2015). From these schools, all first and second year students were approached to participate in Year 1; these students are referred to as the first cohort of participants. The next year a second cohort of students entered the first year of the schools, and also was approached to take part in the study; these latter students are referred to as the second cohort of participants. All eligible students and their parents received an information letter about the research, in which they were asked to participate. Students or their parents were asked to send a reply card or email within two weeks, if they wished to refrain from participation. In total, 1783 students participated in the SNARE study, and 28 students (2%) refused to participate. For the present study, we only included the first-year students from the first and the second cohort, as we were interested in the early

engagement in externalizing behavior during early adolescence.

We used data from the pre-assessment and the first three waves for this study. The pre-assessment was during the first weeks of secondary school (September). The first assessment took place in October (Time 1), the second in December (Time 2), and the third in April (Time 3) of the same academic year. During these assessments, a teacher and one or more research assistants were present. The research assistant gave a brief introduction and explained that participants' answers would remain confidential and anonymous. During the assessment, students filled in a questionnaire on the computer during one classroom period, around 45 minutes. After the pre-assessment, this questionnaire contained, next to self reports, peer nominations using CS socio software (www.sociometric-study.com). Peer reported variables were assessed by asking participants questions about their classmates. Participants were presented with all names of their classmates on their computer screen in alphabetical order, starting with a random name. For some peer nomination questions it was optional to select peers outside the classroom (but within the SNARE sample), using a search function. Unlimited, both same and cross sex, nominations were allowed. The students who were absent at the day of assessment were, if possible, assessed within a month.

Measures

Self-reported externalizing behaviors (Time 1 – Time 3). At all three time points, participants reported their engagement in three forms of externalizing behavior, including antisocial behavior, alcohol use, and tobacco use. Antisocial behavior was measured by asking participants how often (using a five point scale, ranging between 0 to 12 or more times) they had been involved in 17 types of antisocial behavior during the last month; including stealing, vandalism, burglary, violence, weapon carrying, threatening to use a weapon, truancy, contact with the police, and fare evasion in public transport. For example, participants were asked to indicate "During the last month, how often did you...", "steal something from a shop", "skip school while you should have been in class", or "get in touch with the police for doing something you should not do". The scale was based on the 12 questions used frequently in Dutch research (Nijhof, Scholte, Overbeek, & Engels, 2010), and five additional items which reflect other important antisocial behaviors: Weapon carrying, threatening to use a weapon, truancy, contact with the police, and fare evasion in public transport (e.g., Van der Laan, Veenstra, Bogaerts, Verhulst, &

Ormel, 2010). For alcohol use, participants used a 13 point scale (ranging from 0 to over 40 times) to report on how many occasions they consumed alcohol in the last month (Wallace et al., 2002). For tobacco use, participants used a seven-point scale (ranging from never to more than 20) to indicate how many cigarettes they smoked daily over the past month (e.g., Monshouwer et al., 2011). At Time 1, the average score on antisocial behavior was 0.05 (SD = 0.22), the average alcohol use was 0.24 (SD = 1.02), and the average tobacco use was 0.12 (SD = 0.70). Because data using continuous measures of externalizing behavior frequency were highly skewed, all externalizing behavior data were recoded as binary, indicating no engagement at all (0) or any engagement (1) in any of the three behaviors: Antisocial behavior, alcohol use, and tobacco use. This recoding allowed for an examination of externalizing behavior engagement rather than the frequency of externalizing behavior engagement. An exploratory factor analysis (using maximum likelihood estimations and oblique rotation) tested if the externalizing behaviors loaded on a single factor; they loaded on one factor, explaining 55.3% of the variance. Therefore, a composite variable, representing the number of different externalizing behaviors participants engaged in (i.e., antisocial behavior, alcohol, or tobacco use), was computed; resulting in scores between zero (no externalizing behaviors) and three (all externalizing behaviors).

Self-control (pre-assessment). Self-control was assessed with a shorter 11-item Dutch version (Finkenauer, Engels, & Baumeister, 2005) of the self-control scale (Tangney, Baumeister, & Boone, 2004). This scale assessed the ability of the person to control him or herself; for example "I have a hard time breaking bad habits", "I have trouble concentrating", "I get carried away by my feelings" (Tangney et al., 2004). Participants could respond on a scale from (1) not at all, to (5) very much. To facilitate interpretation, these scores were recoded, with higher scores indicating higher self-control. For our analyses, the mean scores were used. Cronbach's alpha was .77.

Friendship nominations (Time 1 – Time 3). Participants were asked to name their best friends. Participants could nominate friends within their class and, afterwards, friends from their grade. Grade networks were used for the current analyses.

Analysis Strategy

Descriptive statistics for each of the four social networks (i.e., 2 cohorts in 2

schools) were calculated, including the average age, percentage of boys, average externalizing behavior level, frequency of externalizing behavior per assessment, self-control level, and the missing fraction (i.e., absent participants) of the networks. Furthermore, the Jaccard index, showing the relative stability over time, was calculated.

All network analyses were conducted using SIENA (Simulation Investigation for Empirical Network Analyses), version 4 (278), in R. SIENA is actor based, and models the longitudinal co-evolution of social networks and individual characteristics (Ripley, Snijders, Boda, Vörös, & Preciado, 2014). SIENA estimates the changes in networks and behavior over time. While controlling for structural network effects (i.e., the structure of friendships in the network), SIENA estimates both network dynamics and behavior dynamics longitudinally. The changes in individual behavior were modeled as an increase or decrease in the number of externalizing behaviors participants engaged in (ranging from zero to three externalizing behaviors). SIENA estimates changes between two points in time. For the current analyses the dependent variables are the network ties (friendships) and the number of externalizing behaviors participants engaged in (antisocial behavior, alcohol use, and tobacco use). For these analyses, SIENA disentangles selection (network dynamics) from influence (behavior dynamics) processes. The outcomes of SIENA analyses are based on an iterative Markov chain Monte Carlo approach (Snijders, van de Bunt, & Steglich, 2010; Ripley et al., 2014).

Commonly used structural network effects were added, and as suggested by the SIENA manual (Ripley et al., 2014, see also Veenstra et al., 2013) other network effects were added to optimally capture the friendship structure in the current networks. The effects which are generally included in SIENA analyses were network density, reciprocity, transitive triplets (likelihood to befriend friends of friends), three-cycles (indicates hierarchies), indegree popularity (square root version; likelihood for participants who receive many friendship nominations to receive extra friendship nominations), indegree activity (square root version; likelihood for participants who receive many friendship nominations to send extra friendship nominations), and outdegree activity (square root version; likelihood for participants who send out many friendship nominations to send out extra friendship nominations); for more details see Ripley et al. (2014). To improve model fit, density and indegree popularity were allowed to vary between assessment periods. Furthermore, transitive reciprocated triplets were modeled to estimate the likelihood for

triads (a group of three friends) to reciprocate friendships.

Before examining study hypotheses, several factors potentially affecting the social network (i.e., network dynamic effects) were estimated as covariates (see Veenstra et al., 2013). The effects of same-gender friendship selection (i.e., girls nominate girls; boys nominate boys; girls were coded as 0, boys as 1) were estimated as well as the effects of proximity by using adolescents' classroom and school locations as covariates (School 1 consisted of four locations). The effects of gender on sending (ego) and receiving of (alter) friendship nominations also was controlled. To investigate possible selection effects, the likelihood of sending (ego) or receiving (alter) friendship nominations, and selecting similar friends, was modeled based on externalizing behavior and self-control. To test if lower self control would be associated with an increased likelihood of selecting friends who engage in externalizing behavior two interaction effects were added. These effects examine the potentially moderating role of self-control on friendship selection based on similarity in externalizing behavior. The first interaction effect (self-control ego x externalizing behavior similarity) models if self-control affects the likelihood for participants to select friends with a similar level of externalizing behavior. The second interaction effect (self control alter x externalizing behavior similarity) models if participants take their peers self-control into account when selecting friends based on similarity in externalizing behavior.

To test our main hypotheses, several behavior dynamic effects (including influence effects) were estimated (see Veenstra et al., 2013). Behavior dynamic effects model changes in externalizing behavior. They model the rate of change, and whether behavior change conforms to linear or quadratic trends. A main effect of influence is estimated as the likelihood that participants adapt their externalizing behavior to become more similar to the average externalizing behavior of their friends (the "average alter effect"). A main effect of self-control was also modeled, testing our first hypothesis and estimating if self-control influences the likelihood for participants to change their externalizing behavior regardless of their friends' externalizing behavior. Furthermore, to test our second hypothesis, an interaction effect between self-control and externalizing behavior was estimated. This effect modeled if participant's self-control changes their likelihood to adapt their friends' externalizing behavior.

TABLE 1 **Descriptive Statistics of Friendship Networks for School 1 (cohort 1 *N* = 432, cohort 2 *N* = 390) and School 2(cohort 1 *N* = 186, cohort 2 *N* = 136), Time 1-Time 3**

VARIABLE		SCHOOL 1 Cohort 1 Mean (*SD*)		SCHOOL 1 Cohort 2 Mean (*SD*)		SCHOOL 2 Cohort 1 Mean (*SD*)		SCHOOL 2 Cohort 2 Mean (*SD*)	
Age	Time 1	12.65	(0.43)	12.65	(0.43)	12.66	(0.48)	12.70	(0.68)
% boys	Time 1	0.50	(0.50)	0.48^{ab}	(0.50)	0.47^{ab}	(0.50)	0.61^{b}	(0.49)
Antisocial behavior	Time 1	0.22	(0.41)	0.27	(0.45)	0.21	(0.41)	0.29	(0.46)
	Time 2	0.25	(0.43)	0.27	(0.45)	0.21	(0.41)	0.29	(0.45)
	Time 3	0.25	(0.43)	0.27	(0.45)	0.27	(0.44)	0.29	(0.46)
Smoking	Time 1*	0.11^{ab}	(0.31)	0.14^{a}	(0.34)	0.07^{b}	(0.25)	0.05^{b}	(0.22)
	Time 2	0.11	(0.31)	0.10	(0.30)	0.07	(0.26)	0.09	(0.29)
	Time 3	0.12	(0.33)	0.14	(0.35)	0.11	(0.31)	0.14	(0.35)
Alcohol	Time 1*	0.06^{ab}	(0.31)	0.10^{a}	(0.42)	0.01^{b}	(0.11)	0.00^{b}	(0.00)
	Time 2	0.05	(0.28)	0.10	(0.42)	0.04	(0.20)	0.05	(0.22)
	Time 3*	0.13^{ab}	(0.44)	0.19^{a}	(0.56)	0.05^{ab}	(0.22)	0.09^{b}	(0.29)
EXTERNALIZING BEHAVIORS									
Time 1	1 behavior	17.82%		19.23%		15.05%		24.26%	
	2 behaviors	5.79%		5.39%		5.37%		4.12%	
	3 behaviors	2.08%		4.87%		0.05%		0.00%	
Time 2	1 behavior	22.45%		17.95%		15.05%		22.06%	
	2 behaviors	5.09%		6.41%		3.76%		6.62%	
	3 behaviors	1.85%		2.82%		2.15%		1.47%	
Time 3	1 behavior	19.91%		21.78%		20.43%		22.06%	
	2 behaviors	4.40%		7.69%		6.99%		5.88%	
	3 behaviors	3.94%		3.85%		1.61%		2.94%	
Self-Control	Pre-assessment	3.63^{ab}	(0.87)	3.57^{a}	(0.53)	3.75^{b}	(0.61)	3.70^{ab}	(0.67)
Missing fraction	Time 1	0.01		0.03		0.05		0.01	
	Time 2	0.01		0.04		0.03		0.01	
	Time 3	0.03		0.03		0.02		0.02	
Jaccard index	Time 1 – Time 2	0.46		0.47		0.44		0.45	
	Time 2 – Time 3	0.46		0.48		0.44		0.45	

Note. * One-way ANOVA between group differences at $p < .05$. Within each time point (i.e., row), Mean scores with different superscripts differ significantly from each other at $p < .05$; calculated with a post-hoc Tukey Honestly Significant Difference test.

RESULTS

Descriptive Statistics of the Networks, and Externalizing Behaviors within Networks

Table 1 lists descriptive statistics for each of the four networks examined in this study. Results at Time 1 suggested that all four networks did not differ in age or antisocial behavior. There were some small differences in gender distribution, alcohol use, tobacco use, overall externalizing behavior, and self-control. None of the students of the smallest network, cohort 2 of School 2 used tobacco at Time 1.

Table 1 also includes network characteristics for each cohort. There were between 1% and 5% absent participants during the assessments. The Jaccard index indicates the relative stability of each network over time. The Jaccard indices were between .44 and .48, well within the desired range for longitudinal social network analyses (Veenstra et al., 2013).

SIENA Estimates of Friends' Influence and Self-Control

The outcomes of the SIENA analyses are shown in Table 2. First, the structural network effects model the network structure, and optimize the goodness of fit of the networks. For three out of four networks there was a negative density effect, indicating that participants are likely to be selective in their friendship nominations (they nominate less than half the network as friends). There was a positive reciprocity effect in all networks, indicating that participants are likely to reciprocate friendship nominations. There was a positive transitive triplet effect in all networks, which shows that participants are likely to be friends with the friends of their friends. Moreover, in School 1 there was a negative three-cycle effect. In combination with the positive transitive triplet effect, this indicated that there was hierarchy in the networks (within triads few participants receive many nominations, while many participants receive fewer nominations). Furthermore, as shown by a negative transitive reciprocated triplet effect in all networks, triads were less likely to have reciprocated ties than dyads, which is another indication of hierarchy in the network. Particularly in period 1 we found a positive indegree – popularity effect in two networks and a negative effect in another. This indicated that those with many friends were more likely to increase their number of friends (positive effect), or that they are less likely to increase their number of friends

TABLE 2 **Estimates of Effects for Externalizing Behavior, Self-Control, and the Friendship Networks for Two Schools, and Two Cohorts for Time 1-Time 3**

VARIABLE		SCHOOL 1				SCHOOL 2			
		Cohort 1 Mean (*SD*)		Cohort 2 Mean (*SD*)		Cohort 1 Mean (*SD*)		Cohort 2 Mean (*SD*)	
NETWORK DYNAMICS									
Outdegree (density)	Period 1	-2.23*	(0.24)	-2.46*	(0.18)	-2.51*	(0.33)	0.57	(1.22)
	Period 2	0.06	(0.19)	0.25	(0.20)	0.09	(0.26)	-0.44	(0.49)
Reciprocity		2.86*	(0.08)	2.38*	(0.08)	2.36*	(0.18)	2.65*	(0.21)
Transitive triplets		0.55*	(0.02)	0.48*	(0.02)	0.48*	(0.04)	0.58*	(0.06)
Transitive reciprocated triplets		-0.51*	(0.03)	-0.37*	(0.02)	-0.44*	(0.06)	-0.37*	(0.07)
3-cycles		-0.05*	(0.02)	-0.10*	(0.02)	-0.03	(0.04)	-0.06	(0.07)
Indegree - popularity (sqrt)	Period 1	0.08*	(0.03)	-0.08*	(0.03)	0.20*	(0.04)	-0.01	(0.07)
	Period 1	-0.10	(0.06)	-0.21*	(0.07)	-0.05	(0.08)	-0.22	(0.15)
Indegree – activity (sqrt)		-1.04*	(0.10)	-0.73*	(0.08)	-1.13*	(0.25)	-1.81*	(0.55)
Outdegree – activity (sqrt)		0.14*	(0.02)	0.15*	(0.03)	0.29*	(0.06)	-0.01	(0.08)
Sex alter		-0.18*	(0.04)	-0.06*	(0.04)	0.10	(0.07)	-0.21*	(0.08)
Sex ego		0.02	(0.05)	0.05	(0.05)	-0.15	(0.09)	-0.61*	(0.21)
Sex similarity		0.68*	(0.04)	0.84*	(0.05)	0.66*	(0.07)	0.58*	(0.10)
Location similarity		0.42*	(0.04)	0.34*	(0.04)	-		-	
Class similarity		0.70*	(0.05)	0.82*	(0.05)	0.92*	(0.07)	0.54*	(0.10)
Self-control alter		0.02	(0.03)	-0.01	(0.03)	-0.09*	(0.04)	-0.08	(0.05)
Self-control ego		-0.10*	(0.03)	0.01	(0.04)	-0.05	(0.06)	0.05	(0.08)
Self-control similarity		0.32*	(0.11)	0.09	(0.13)	0.93*	(0.20)	-0.37	(0.28)
Externalizing behavior alter		0.04	(0.04)	0.19*	(0.04)	0.05	(0.09)	-0.02	(0.12)
Externalizing behavior ego		0.09	(0.05)	0.30*	(0.04)	0.11	(0.10)	0.67*	(0.23)
Externalizing behavior similarity		0.45*	(0.19)	0.99*	(0.13)	0.86*	(0.37)	-0.10	(0.48)
Self-control ego x externalizing behavior similarity		0.04	(0.18)	-0.34	(0.18)	0.31	(0.36)	-0.43	(0.40)
Self-control alter x externalizing behavior similarity		0.01	(0.17)	0.15	(0.18)	0.20	(0.34)	-0.72	(0.39)

BEHAVIOR DYNAMICS								
Externalizing behavior change period 1	1.33*	(0.23)	1.48*	(0.22)	1.41*	(0.29)	1.65*	(0.43)
Externalizing behavior change period 2	1.56*	(0.23)	1.89*	(0.31)	1.58*	(0.35)	1.15*	(0.29)
Externalizing behavior change linear shape	-1.26*	(0.11)	-1.22*	(0.12)	-1.44*	(0.20)	-1.17*	(0.20)
Externalizing behavior change quadratic shape	0.25*	(0.08)	0.13	(0.09)	0.33*	(0.14)	0.20	(0.15)
Externalizing behavior influence	1.15*	(0.33)	1.17*	(0.27)	0.93	(0.60)	1.24*	(0.57)
Effect from self-control	-0.16	(0.16)	-0.61*	(0.20)	-0.47*	(0.23)	-0.42	(0.26)
Self-control x externalizing behavior influence	-1.20	(0.93)	0.49	(0.61)	1.12	(1.16)	0.50	(1.01)

Note. * $p < .05$.

(negative effect). The negative effects of indegree—activity in all networks indicate that those participants who received many friendship nominations were less likely to send out nominations themselves. Last, the outdegree—activity modeled individual differences in the number of friends nominated by participants, this was positive in three networks indicating that those with a higher outdegree were more likely to increase the number of friends they select.

Second, the effects of externalizing behavior, self-control, and control variables were estimated. They estimate the effects of externalizing behavior, self-control, and control variables on selection effects. The main effects of the control variables were generally consistent with prior research. Participants' selection of friends was significantly associated with similarity in gender, location, and class. Self-control was associated with fewer received friendship nominations (negative self-control alter effect) in one network. In another network, self-control was associated with sending out less friendship nominations (negative selfcontrol ego effect). In two networks participants were likely to select their friends based in a similarity in selfcontrol [positive self-control similarity effect, School 1 Cohort 1 b (*SE*) = 0.32 (0.11), School 1 Cohort 1, b (*SE*) = 0.93 (0.20)]. In one network the number of friendship nominations participants receive was associated with externalizing behavior (positive externalizing alter effect), and in two networks the number of friendship nominations send out was associated with externalizing behavior (positive externalizing behavior ego effect). In three networks, participants base their friendship on similarity in externalizing behavior

[School 1 Cohort *b* (*SE*) = 10.45 (0.19), School 1 Cohort 2 *b* (*SE*) = 0.99 (0.13), School 2 Cohort 2 *b* (*SE*) = 0.86 (0.37)]. Neither of the interaction effects between self-control and selection based on similarity in externalizing behavior reached significance: self-control did not moderate the likelihood to select friends or to be selected as a friend based on similarity in externalizing behavior.

Third, the change in externalizing behavior dynamics was estimated. These behavior dynamics model the change in externalizing behavior. Results revealed a significant negative linear effect in all networks: Externalizing behavior increased over time. Furthermore, there was also a positive quadratic effect for externalizing behavior in cohort 1 of School 1 and cohort 1 of School 2. This indicates that externalizing behavior has a tendency to escalate once it develops: Participants were likely to either engage in multiple externalizing behaviors or engage in none. In three out of four networks, participants were influenced by their friends; participants adapt their externalizing behavior to become more similar to the average externalizing behavior of their friends (positive externalizing influence effect, School 1 Cohort 1 *b* (*SE*) = 1.15 (0.33), School 1 Cohort 2 *b* (*SE*) = 1.17 (0.27), School 2 Cohort 2 *b* (*SE*) = 1.24 (0.57)). To test our hypotheses, the role of self-control was estimated in the behavior dynamics. Testing our first hypothesis, in two of the four networks self-control was negatively associated with the development of externalizing behavior (negative effect form self-control, School 1 Cohort 2 *b* (*SE*) = -0.61 (0.20), School 2 Cohort 1 *b* (*SE*) = -0.47 (0.23)). Thus a lower self-control was associated with a higher likelihood to engage in more externalizing behaviors over time. Testing our second hypothesis, the interaction effect between self-control and externalizing behavior influence was not significant (self-control x total exposure): Self-control did not change the likelihood for participants to be influenced by their friends' externalizing behavior.

DISCUSSION

This study investigated how self-control affects the co-development of early adolescents' friendship and externalizing behavior (antisocial behavior, alcohol use, tobacco use). Following after inconsistent findings by previous studies, a more rigorous approach was needed to test the hypotheses that adolescents' personal level of self-control makes adolescents initiate externalizing behavior regardless of their friends' externalizing behavior, or if

it moderates the extent to which they will initiate externalizing behavior to become more like their friends (e.g., Gardner et al., 2008; McGloin & O'Neill Shermer, 2009; Meldrum et al, 2009; Wright et al., 2001). Using Stochastic Actor Based Modelling (SABM; Steglich et al., 2010), a stringent test of these hypothesized moderation effects was possible. The main findings indicate that self-control, in two out of four networks, directly impacts the development of externalizing behavior (in line with hypothesis 1), but that it does not affect if they adapt their friends' externalizing behavior (not in line with hypothesis 2).

In line with the General Theory of Crime (Gottfredson & Hirschi, 1990) and supporting our first hypothesis, self-control rather than the interaction between self-control and friends' externalizing behavior seems to further the development of externalizing behavior during early adolescence. Self-control is strongly associated with an abundance of negative outcomes for teenagers (Moffitt, et al, 2011), which might suggest that adolescents with lower self-control do not need the influence of friends to engage in externalizing behaviors. However, even when taking the direct effects of self-control into consideration, we found that early adolescents do select their friends to match their externalizing behaviors and also adapt their externalizing behavior to become more similar to their friends. Furthermore, the lack of a significant interaction between self-control and friends' influence indicates that adolescents are influenced by their peers regardless of their self-control level (not supporting our second hypothesis). Thus, having lower self-control and having friends who engage in externalizing behavior are both predictive of engaging in externalizing behavior, and the effect of self-control seems additive rather than synergistic. As there was no interaction between self-control and externalizing behavior selection or influence effects, the selection and influence processes causing similarity on externalizing behavior between early adolescents are similar for those with a low self-control and their peers. However, as early adolescents with a low self-control are in some networks more likely to develop externalizing behaviors they are also likely to befriend peers with similarly high externalizing behaviors and to influence their friends to engage in externalizing behaviors.

In addition to our main research question focusing on self-control and the development of externalizing behavior, several other findings emerged. First, previous research using SABM has focused on one behavior rather than on a broader spread of externalizing behaviors. Such studies have shown that early adolescents select friends based on similar externalizing behaviors, and that

they are influenced by their friends to engage in externalizing behaviors. This study shows that early adolescents are also likely to select friends based on the presence or absence of externalizing behavior, and also adopt externalizing behaviors based on their friends' externalizing behaviors. Furthermore, our study provided a unique test of the association between self-control and friendship and allowed for further testing of some assumptions made by Gottfredson and Hirshi (1990). In line with their expectations, but against our hypothesis based on Young (2011), early adolescents select friends who have similar levels of self-control; the results indicate that adolescents with a lower self-control tend to cluster together (the "birds of a feather" phenomenon). Although the study by Young (2011) took some network characteristics into consideration, the current study was able to control for more network effects (such as reciprocity, and the likelihood to send or receive friendship nominations), and also take friendship selection based on externalizing behaviors into account. In addition, our findings also indicate that low self-control does not (or only in some networks) necessarily reduce the number of friends that early adolescents have. Only in one of the four networks was there a negative effect of self-control on sending friendship nomination and in another network on receiving friendship nominations. Thus, only in some networks early adolescents with low self-control might indeed have difficulty making and keeping friends as they are as likely or less likely to send and receive friendship nominations, and they seem to end up surrounded with friends with a similar level of self-control; in line with the expectations of Gottfredson and Hirschi (1990).

This study has several strengths, such as a focus on early adolescence and early engagement in externalizing behavior, as participants were just entering secondary school, and were on average only around 12.5 years old. This allowed us to study the very beginning of the spread of externalizing behavior during early adolescence. Furthermore, we used a direct measure of externalizing behavior of peers rather than an indirect measure (when adolescents estimate the externalizing behavior of their peers) – a major shortcoming in other studies (see Meldrum et al., 2009). Moreover, we were able to perform our analyses on several similar networks. This allowed to compare replication of robust findings across different networks.

Future studies could build on our findings in several ways. First, by taking other network structures into account, such as cliques (McGloin & O'Neill Schermer, 2009), or classroom attitudes towards externalizing behavior

(Rambaran, Dijkstra, & Stark, 2013). Investigating cliques might be especially important when studying self-control as our results show that the early adolescents tend to select their friends based on the friends' similar level of self-control, and therefore cliques of early adolescents who have a low self-control and engage in externalizing behavior can be expected (Gottfredson and Hirshi, 1990). Second, as we focused on externalizing behavior during the last month before assessments, behaviors which took place longer than a month before the assessment might have been missed. Future studies could investigate if similar results can be found taking the whole development of externalizing behavior between assessments into consideration. However, taking last month prevalence into account does ensure that we have captured the externalizing behaviors of adolescents who tend to be engaged in externalizing behaviors on a more structural basis. Third, our study focused on the occurrence rather than frequency of externalizing behavior as we were interested in the very beginning of spread of adolescent externalizing behavior rather than the further quantitative development of these behaviors. However, this leaves room for investigation on the role of self-control in the development of the frequency of externalizing behavior. Furthermore, instead of focusing on friendship in school, future studies could investigate peers or also include friendships outside of the school context. Moreover, it would be interesting to learn more about changes over time later in adolescence. Future studies could compare these findings with findings in older adolescents.

Conclusion

This study shows that both personal self-control and friendship are important forces in the development of externalizing behavior. However, our findings show that these two effects co-exist rather than interact. Both having a lower self-control and having friends who engage in externalizing behavior increases adolescents' chance to increase the number of externalizing behaviors they engage in. Our findings also suggest that self-control, although it is very important in the development of adolescents (Moffitt et al., 2011), is not always associated with the development of externalizing behavior when taking the effects of friendships into account. To prevent the spread of externalizing behavior in young teens, it will be important to focus on adolescents who have friends who engage in externalizing behavior and on adolescents with low self-control. Although increasing self-control might be a good way to prevent externalizing behaviors for several reasons (Piquero et al.,

2010), this might not be effective in all friendship networks. It might be beneficial to train self-control already during childhood to prevent adolescents to engage in behaviors which could ensnare them in longer term negative behavior (Moffitt et al., 2011). Furthermore, as self-control seems to be more malleable for females than for males (Piquero et al., 2010), perhaps especially in classes with more females training self-control could be a way to prevent externalizing behaviors. Future studies should further investigate what makes early adolescents more susceptible to peer influence processes on externalizing behavior.

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CHAPTER 8

MUSIC PREFERENCES, FRIENDSHIP, AND EXTERNALIZING BEHAVIOR IN EARLY ADOLESCENCE: A SIENA EXAMINATION OF THE MUSIC MARKER THEORY; THE SNARE STUDY.

AART FRANKEN [1, 2, 3, 4, 5]
LOES KEIJSERS [1, 3, 4, 5]
JAN KORNELIS DIJKSTRA [1, 2, 3, 4, 5]
TOM F. M. TER BOGT [1, 3, 4, 5]

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1 Conceived and/or designed the study
2 Participated in data acquisition
3 Participated in data analysis and interpretation
4 Involved in drafting / revising the manuscript
5 Given final approval

ABSTRACT

Music Marker Theory posits that music is relevant for the structuring of peer groups and that specific nonmainstream music preferences relate to externalizing behavior (Ter Bogt et al., 2013). The present study investigated the role of music preference similarity in friendship selection and the development of externalizing behavior, while taking the effects of friends' externalizing behavior into account. Data were used from the first three waves of the SNARE (Social Network Analysis of Risk behavior in Early adolescence) study (N = 1,144; 50% boys; M_{age} = 12.7; SD = 0.47), including students who entered the first-year of secondary school. Our hypotheses were that: (1) early adolescents would select each other as friends based on their music preference, and (2) non-mainstream music preference would predict externalizing behavior; above and beyond effects of externalizing problems on friendship selection and influence processes. Stochastic Actor-Based Modeling indicated that adolescents select their friends based on both externalizing behavior and highbrow music preference. Moreover, both friends' externalizing behavior and a preference for non-mainstream (i.e., dance) music predicted the development of externalizing behavior. Intervention programs might focus on adolescents with specific non-mainstream music preferences.

Keywords: Alcohol use, antisocial behavior, music preference, social network analysis, SIENA, tobacco use

Music is a highly significant and meaningful medium, particularly in adolescence. Compared to older people, adolescents and young adults attribute more importance to music, and listen to music more often and in a wider variety of contexts (Bonneville-Roussy, Rentfrow, Xu, & Potter, 2013). Particularly in adolescence, music is not only important for mood management, but also for identity and social identity development (North & Hargreaves, 1999; North, Hargreaves & O'Neill, 2000). Music, its lyrics and visuals on TV, and the internet can be defining elements in the development of adolescent identity and social identity, particularly among those adolescents that are highly involved in music (North et al., 2000; Ter Bogt, Mulder, Raaijmakers, & Nic Gabhain, 2010). Empirical evidence confirms that music is a factor in the formation of friendships, peer groups and peer culture (Selfhout, Branje, Ter Bogt & Meeus, 2009; Steglich, Snijders & West, 2006).

Not only has music preference been linked to selecting friends with a similar music taste, particular preferences for non-mainstream music types have also been linked to the development of externalizing behavior. For instance, heavy metal fans have been characterized by more externalizing behavior (e.g., Arnett, 1996, Mulder, Ter Bogt, Raaijmakers, & Vollebergh, 2007; North & Hargreaves, 2007; Selfhout, Delsing, Ter Bogt, & Meeus, 2008, Tanner, Asbridge, & Wortley, 2008, Weinstein, 1991). Furthermore, young people liking rap and hip-hop were more prone to delinquency compared to fans of other types of music (Miranda & Claes, 2004; Mulder et al. 2007; North & Hargreaves, 2007; Selfhout et al., 2008; Tanner et al., 2008) and in ten countries across Europe a preference for dance music emerged as the most potent musical indicator for externalizing behaviors such as substance use (Ter Bogt et al., 2012).

This study aimed to better understand the link between music preference and externalizing behavior, specifically while taking the influence of friends' externalizing behavior into account. We tested whether adolescents select friends on the basis of a pre-existing similarity in music preferences, and/or the similarity in externalizing behavior (H1). Second, we examined whether these music preferences would be indicative of later externalizing behavior, above and beyond the effects the influence of friends' externalizing behavior (H2).

Effects of Music Preference

In their Music Marker Theory (MMT) Ter Bogt, Keijsers, and Meeus (2013) conceptualize the mechanisms through which music preferences translates into externalizing behavior. A fundamental hypothesis within Music Marker Theory states that it is not primarily the music itself or its lyrics that promote adolescent externalizing behavior. Instead, music preferences may work as a badge (Frith, 1981), communicating values, attitudes and opinions. Adolescents are sensitive to the images that they themselves and their peers project, and hold normative expectations about the characteristics of fans of particular musical styles (North & Hargreaves, 1999; Rentfrow & Gosling, 2006). Through showing their badge adolescents identify themselves as belonging to or desiring to belong to specific peer groups and they may be drawn to other youth with similar taste. As such, peer involvement is thought to mediate between music and externalizing behavior; that is, through music, adolescents are drawn to specific crowds varying in externalizing behavior, which may influence their behaviors positively or negatively. In particular, listening to non-mainstream music is expected to lead to befriending others with similar music taste. Among such friends, in turn, externalizing behavior is expected to occur more frequently and escalate more quickly (Ter Bogt et al., 2013).

Several studies suggest that music preference plays a central role in friendship formation. From the seventies onwards, a series of ethnographic studies among youth involved in sub-cultures revealed the central role of music in the structuring of peer groups or scenes (e.g., Willis, 1978; Hebdige, 1979; Bennett, 2000, 2004). Indeed, similarity in music preferences has been shown to increase the likelihood of friendship (Frith, 1981; Steglich et al., 2006); Selfhout and colleagues (2009) have shown high similarity among stable friends over time in liking rock (divergent types of rock music), urban (i.e., Hip hop, R&B and reggae), pop/dance (mainstream music and the most popular forms of electronic dance music) and elite music (classical music and jazz). Furthermore, the study indicated that future friendships were created based on similarity in music preference. Thus, preferences for specific genres seem to indicate friendship similarity selection in early adolescence.

As noted earlier, empirical studies confirm that non-mainstream music preference predicts later externalizing behavior (e.g., Selfhout et al., 2008). For instance, in a rare longitudinal study Ter Bogt, Keijsers et al. (2013) showed

that adolescents with an early, strong preference for noisy, rebellious and non-mainstream music such as hip-hop, heavy metal, gothic, punk, and techno/hardhouse were more prone to later externalizing behavior; in contrast to those liking the most popular type of pop music, Top 40/chart music, or fans of classical music and jazz. It is noteworthy that early adolescent music preferences emerged as more powerful predictors of later externalizing behavior than early adolescent externalizing behavior.

Effects of Externalizing behavior

Like music preference, externalizing behavior has been shown to be important for both friendship creation and further development of externalizing behavior (see Moffitt, 1993; Moffitt & Caspi, 2001). The dual-taxonomy model (Moffitt, 1993) states that adolescents aim to obtain a mature status among peers through externalizing behavior. Adolescents want to obtain a mature status among peers when they become biologically mature while this maturity is not yet reflected socially by adults or society at large; adolescents do not yet have mature rights or responsibilities. Therefore, externalizing behavior might also work like a badge for such adolescents; signaling maturity among their peers.

Empirical studies using Stochastic Actor-Based Modeling (SABM) have shown the importance of externalizing behavior for both friendship similarity selection and influence processes (for an overview see Veenstra, Dijkstra, Steglich, & Van Zalk, 2013). Such studies also indicate the importance of disentangling friendship similarity selection and influence processes. Similarity selection takes place when adolescents select their friends based on similarities in behavior, for example when adolescents who engage similarly in externalizing behavior become friends. Friendship influence processes take place when adolescents become more similar to their friends, for example when adolescents adapt their externalizing behavior to become more similar to their friends. It is important to disentangle these processes as they both lead to the same outcome: Friends are similar to one another.

Music preference, externalizing behavior, and friendship

Although most likely the effects of music and externalizing problems on the selection of friendships and the development of externalizing behaviors are intertwined, to our knowledge, only one study has simultaneously

investigated the role of music preference and externalizing behavior in friendship formation and the development of externalizing behavior. Illustrating their stochastic actor-based modeling approach, Steglich et al. (2006) studied 129 adolescents and showed that while taking friendship selection based on alcohol use into consideration adolescents select their friends based on a similarity in classical music preference, but not based on similarity in techno or rock music preference. Controlling for friendship selection based in similarity in music preference and the positive effects of adolescents' friends' alcohol use, they did not find any effects for techno, rock, or classical music on the development of alcohol consumption. Although this study used stochastic actor-based modeling, they did not take hip-hop and RnB into account as types of music preference, nor did they investigate other types of externalizing behavior apart from alcohol us. Moreover, the assessments were one year apart. Possibly using a shorter interval between assessments provides a more complete picture of the co-development of music preference, externalizing behavior, and friendship. Therefore, more studies investigating the spread of externalizing behavior with more complete variables of music preference and externalizing behavior, and assessing these variables more frequently are needed.

The Present Study

This study investigated assumptions of the Music Marker Theory that adolescents are likely to select friends based on similarity in music preference and that non-mainstream music preference is predictive of development of externalizing behavior. Crucially, however, as externalizing behavior is known to affect friendship selection and friends' externalizing behavior is known to affect the development of externalizing behavior (e.g., Veenstra et al., 2013) this will be controlled for. The two research questions are: (1) To what extent are, respectively, music preferences and externalizing behaviors important for friendship similarity selection, and (2) assuming that early externalizing behaviors predicts later externalizing behavior, is there an additional effect of music preferences above and beyond the friends' externalizing behavior influence processes. On the basis of our review of the literature we propose two hypotheses:

H1: Adolescents select friends based both on a similarity in externalizing behavior and music preference.

H2: A preference for non-mainstream music will predict the development of externalizing behavior, even when taking friends' influence effects on externalizing behavior into account.

METHODS

Participants and Procedure

As this study focused on the entrance to secondary education, participants were 1,144 first grade students (50% boys), aged 11.1 till 15.6 at Time 1 (Mean 12.7, *SD* = 0.47). A total of 97% of participants were born in the Netherlands (as were 87% of their fathers and 88% of their mothers). Data stem from the SNARE (Social Network Analysis of Risk behavior in Early adolescence) study; a longitudinal project on the social development of early adolescents with a specific focus on adolescents' involvement in risk behavior. Two secondary schools were asked and willing to participate: One in the middle and one in the North of the Netherlands. Subsequently, all first- and second-year secondary school students (i.e., similar to 7th-8th grades in the US) from these schools were approached for enrollment in SNARE (2011-2012). All eligible students received an information letter for themselves and their parents, in which they were asked to participate. If students wished to refrain from participation, or if their parents disagreed with their children's participation, they were requested to send a reply card or email within ten days. One year later (2012-2013) all new first year students were again approached for participation in the study. In total, 1,826 students were approached for this study, of which 40 students (2.2%) refused to participate for several reasons, for example, the parent and/or adolescent had no interest, the adolescent was dyslectic, or it was too time consuming. A total of 1,786 students participated in SNARE (M_{age} time 1 = 12.91 years, *SD* = 0.70, 50.1% male, 83.9% Dutch). Thus there were four samples, two cohorts coming from two schools (see also Dijkstra et al., 2015; Franken et al., 2015).

In September 2011, just when participants entered the first or second year of secondary school we started with a pre-assessment. Subsequently, in 2012, all new first-year students also completed a pre-assessment. After the pre-assessment there were follow-up regular measurement waves in October

(Time 1), December (Time 2), and April (Time 3). After two years (2011-2013), data collection was continued for another two years among the participating students.

During the assessments a teacher and research assistants were present. The research assistant gave a brief introduction followed by the students filling in a questionnaire on the computer during class, containing both self-reports as well as peer nominations. Data were collected via the questionnaires using CS socio software (www.sociometric-study.com). This software was particularly developed for this study and allowed students to fill in sociometric questions. The assessment of the questionnaires took place during regular school hours within approximately 45 minutes. The students that were absent were, if possible, assessed within a month. The anonymity and privacy of the students were warranted. The study was approved by the Internal Review Board of one of the participating universities.

Measures

Self-reported externalizing behaviors (Time 1 – Time 3). At all three time points, participants reported their engagement in three forms of externalizing behavior: Antisocial behavior, alcohol use, and tobacco use. Participants were asked if they engaged in the behavior during the last month. Antisocial behavior was measured with 17 items by asking participants how often (between 0 to 12 or more times) they had been involved in 17 types of delinquent behavior; including stealing, vandalism, burglary, violence, weapon carrying, threatening to use a weapon, truancy, contact with the police, and fare evasion in public transport (see also, Nijhof, Scholte, Overbeek, & Engels, 2010; Van der Laan, Veenstra, Bogaerts, Verhulst, & Ormel, 2010). For alcohol use, participants used a 13 point scale (ranging from 0 to over 40 times) to report on how many occasions they consumed alcohol (Wallace et al., 2002). For tobacco use, participants used a 7 point scale (ranging from never to more than 20) to indicate how many cigarettes they smoked daily (e.g., Monshouwer et al., 2011). Based on recommendations of Farrington and Loeber (2000), all three externalizing behavior scales were recoded as binary, indicating no engagement at all (0) or any engagement (1) in antisocial behavior, alcohol use, or tobacco use, respectively. As externalizing behaviors are known to cluster together during early adolescence (e.g., Monshouwer et al., 2012), an exploratory factor analysis (using maximum likelihood estimations and oblique rotation) revealed that the externalizing behaviors

loaded on a single factor; explaining 55.3% of the variance. Therefore, a composite variable, representing the number of different externalizing behaviors participants engaged in (i.e., antisocial behavior, alcohol, tobacco use), was computed; resulting in scores between zero (no externalizing behaviors) and three (all externalizing behaviors).

Friendship nominations (Time 1 – Time 3). Participants were asked to name their best friends. Participants could nominate friends within their class and, in addition, friends from their grade. Grade networks were used for the current analyses. Thus, there were four networks (i.e., two schools and two cohorts per school).

Music preference (Time 1). Participants were asked to indicate their music preferences. Fifteen music types were presented: International popular, Dutch popular, rock, alternative rock, heavy metal, gothic, rap/hip-hop, RnB, reggae, house/dance/trance, techno/dubstep, hardhouse, classical music, jazz, and folk. For each type of music participants could tick a box; indicating they had a preference for this type of music. Thus for each music type participants had a score of either zero, indicating no preference, or one, indicating a preference for this type of music. A factor analysis (principle component analyses with oblimin rotation) revealed that 12 of these items could be meaningfully integrated into a five factor structure similar to ones that that have been found in earlier studies on the structure of music preferences (Table 1) (e.g., Mulder et al., 2007; Rentfrow, Goldberg & Levitin, 2011; Ter Bogt et al. 2012). On the basis of these results we created five overall music preference scores: Rock, Dance, Highbrow, Popular, and Urban music. Three less popular or less well known music types were not included in the current analyses: folk, reggae, and Dutch popular music.

TABLE 1 **Exploratory Factor Analysis of music preferences at Time 1, with Oblimin Rotation**

MUSIC ITEM	FACTOR				
	Rock	Dance	Highbrow	Popular	Urban
Rock	0.78				
Heavy metal	0.69				
Alternative rock	0.68				
Gothic	0.48				
Techno/dubstep		0.68			
Hard house		0.66			
House/dance/trance		0.61			
Classical music			0.87		
Jazz			0.49		
International popular music				0.94	
Rap/hip-hop					0.82
RnB					0.70

Note. Loadings greater than (-) .32 are displayed. Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.75. Bartlett's Test of Sphericity: Chi2 1296.22 (66), $p < .01$.

Analysis Strategy

Correlations between the music preference types and externalizing behavior were calculated. For each of the four friendship networks (i.e., two cohorts in two schools), descriptive statistics were also calculated; including the average age, percentage of boys, average externalizing behavior level, and the percentage of absent participants of the networks. Furthermore, the Jaccard index, showing the relative stability of the friendship network over time, was calculated.

All friendship network analyses were conducted using SIENA (Simulation Investigation for Empirical Network Analyses), version 4, in R. SIENA is an actor based model for the longitudinal co-evolution of social networks and individual behavior (Ripley, Snijders, Boda, Vörös, & Preciado, 2014). SIENA estimates changes in friendship nominations and externalizing behavior between two points in time. In this study changes were calculated between Time 1 and Time 2 (Period 1), and between Time 2 and Time 3 (Period 2). While controlling for structural network effects (i.e., the structure of

friendships in the network), SIENA estimates both network dynamics (i.e., changes in the network) and behavior dynamics (i.e., changes in behavior) longitudinally. The outcomes of SIENA analyses are based on an iterative Markov Chain Monte Carlo approach (Snijders, van de Bunt, & Steglich, 2010; Ripley et al., 2014). For all analyses, the dependent variables consist of the network ties (friendships) and the number of externalizing behaviors participants engaged in (antisocial behavior, alcohol use, and tobacco use). Two analyses were run. The first analysis only contained the estimated effects of music preferences on similarity selection (i.e., if participants befriend each other based on similar music preferences) and the development of externalizing behaviors (i.e., if some music preferences are associated with a faster development of externalizing behavior). In the second analysis, for externalizing behavior similarity selection effects (i.e., if participants select their friends based on similarity in externalizing behavior) and influence effects (i.e., if participants adapt their externalizing behavior based on their friends' externalizing behavior) were added.

Both models contained commonly used structural network effects, effects which capture friendship relations (Ripley et al., 2014; Veenstra et al., 2013). Furthermore, additional network effects to optimally capture the friendship structure in the current networks were added. These included density, reciprocity, the likelihood to befriend friends of friends (transitive triplets), hierarchy (three-cycles), the likelihood for participants who receive many friendship nominations to receive extra friendship nominations (indegree popularity, square root version), the likelihood for participants who receive many friendship nominations to send extra friendship nominations (indegree activity, square root version), and the likelihood for participants who send out many friendship nominations to send out extra friendship nominations (outdegree activity, square root version); for more details see Ripley et al. (2014). To improve model fit, density and indegree popularity were allowed to vary between assessment periods. Furthermore, transitive reciprocated triplets were modeled to estimate the likelihood for triads (a group of three friends) to reciprocate friendships.

Additionally, several factors potentially affecting the friendship selection in the social networks (i.e., network dynamic effects) were estimated as covariates (see Veenstra et al., 2013). Specifically, the effects of same-gender friendship selection (i.e., girls nominate girls; boys nominate boys; girls were coded as 0, boys as 1) were estimated as well as the effects of proximity by

using adolescents' classroom and school locations as covariates (School 1 consisted of four locations). The effects of gender and music preference on sending (called an ego effect) and receiving (called an alter effect) friendship nominations also was controlled for. To assess the first hypothesis (H1) that adolescents select friends based on similarity in music preference and externalizing behavior, selecting similar friends was modeled based on the different music preferences for the first and second analysis, and also on externalizing behavior for the second analysis.

Behavior dynamic effects modelled changes in externalizing behavior, and include the effects from music preference and friends' externalizing behavior on the development of externalizing behavior (see Veenstra et al., 2013). In both analyses these dynamics include the rate of change, and whether externalizing behavior changes conform to linear or quadratic trends. Furthermore, the effects from music preference (effect from) on the development of externalizing behavior were included in both analyses. These effects from music preference assess the second hypothesis (H2), that non-mainstream music preference predicts the development of externalizing behavior. The second analysis also included effects from friends' externalizing behavior (influence average alters); assessing if participants change their externalizing behavior to become more similar to their friends' externalizing behavior.

In a final step, after having estimated all these effect for the four networks separately, the estimated effects were summarized using the SIENA likelihood based method for meta-analyses (for more information see Ripley et al., 2014). The means and variances were normal, which indicates trustworthy outcomes of such a meta-analysis.

RESULTS

Descriptive Statistics

Over the whole sample, there were significant and positive correlations ($p < .01$) between preferences for dance ($r. = .24$) and urban ($r. = .09$) music, and externalizing behavior. The correlations for highbrow ($r. = -.10$) and popular ($r. = -.09$) music with externalizing behavior were negative and significant ($p < .01$). A preference for rock music ($r. = .03$) was not correlated with engagement in externalizing behavior.

Table 2 lists descriptive statistics for each of the four networks examined in this study. Results at Time 1 suggested that all four networks did not differ in age, and that there were only some small differences in gender distribution, and externalizing behavior. Table 2 also includes network characteristics for each cohort. Per network and measurement moment, there were between 1% and 5% absent participants during the assessments. The Jaccard index indicates the relative stability of each friendship network over time. The Jaccard indices were between .44 and .48, well within the desired range for longitudinal social network analyses (Veenstra et al., 2013).

TABLE 2

Descriptive Statistics of Friendship Networks for School 1 (cohort 1 *N* = 432, cohort 2 *N* = 390) and School 2 (cohort 1 *N* = 186, cohort 2 *N* = 136), Time 1-Time 3

VARIABLE		SCHOOL 1				SCHOOL 2			
		Cohort 1 Mean (*SD*)		Cohort 2 Mean (*SD*)		Cohort 1 Mean (*SD*)		Cohort 2 Mean (*SD*)	
Age	Time 1	12.65	(0.43)	12.65	(0.43)	12.66	(0.48)	12.70	(0.68)
% boys	Time 1*	0.50^{a}	(0.50)	0.48^{ab}	(0.50)	0.47^{ab}	(0.50)	0.61^{b}	(0.49)
Externalizing behavior	Time 1*	0.36^{a}	(0.69)	0.47^{b}	(0.82)	0.29^{a}	(0.60)	0.34^{ab}	(0.56)
	Time 2	0.39	(0.68)	0.42	(0.75)	0.31	(0.66)	0.41	(0.69)
	Time 3	0.44	(0.78)	0.51	(0.81)	0.42	(0.71)	0.47	(0.76)
Rock preference	Time 1*	0.16^{a}	(1.07)	-0.06^{b}	(0.93)	-0.07^{b}	(1.06)	-0.27^{b}	(0.77)
Dance preference	Time 1*	-0.16^{a}	(0.94)	0.06^{b}	(1.02)	0.14^{b}	(1.08)	0.16^{b}	(0.95)
Highbrow preference	Time 1	0.02	(1.07)	-0.08	(0.92)	0.15	(1.03)	-0.03	(0.91)
Popular preference	Time 1	0.02	(1.02)	0.00	(1.00)	-0.04	(1.01)	0.00	(0.94)
Urban preference	Time 1*	-0.07^{a}	(0.98)	-0.07^{a}	(0.96)	0.27^{b}	(1.10)	0.06^{ab}	(0.99)
Missing fraction	Time 1	0.01		0.03		0.05		0.01	
	Time 2	0.01		0.04		0.03		0.01	
	Time 3	0.03		0.03		0.02		0.02	
Jaccard index	Time 1 - Time 2	0.46		0.47		0.44		0.45	
	Time 2 - Time 3	0.46		0.48		0.44		0.45	

Note. * One-way ANOVA between group differences at $p < .05$. Within each time point (i.e., row), Mean scores with different superscripts differ significantly from each other at $p < .05$; calculated with a post-hoc Tukey Honestly Significant Difference test.

TABLE 3 **Descriptive Statistics of Friendship Networks for School 1 (cohort 1 *N* = 432, cohort 2 *N* = 390) and School 2 (cohort 1 *N* = 186, cohort 2 *N* = 136), Time 1-Time 3**

NETWORK DYNAMICS		MUSIC ONLY		MUSIC AND EXTERNALIZING BEHAVIOR	
[1]Outdegree (density) [1A]	Period 1	-2.17*	(0.15)	-2.25*	(0.12)
	Period 2	0.09	(0.12)	0.11	(0.12)
Reciprocity [1B]		2.58*	(0.11)	2.57*	(0.12)
Transitive triplets [1C]		0.52*	(0.02)	0.51*	(0.02)
Transitive reciprocated triplets [1D]		-0.43*	(0.04)	-0.43*	(0.04)
3-cycles [1E]		-0.06*	(0.02)	-0.06*	(0.02)
Indegree - popularity (sqrt) [1F]	Period 1	0.05	(0.06)	0.05	(0.06)
	Period 2	-0.13*	(0.04)	-0.14*	(0.04)
Indegree – activity (sqrt) [1G]		-1.03*	(0.09)	-0.99*	(0.09)
Outdegree – activity (sqrt) [1H]		0.15*	(0.04)	0.16*	(0.04)
[2]Sex received [2A]		-0.05	(0.07)	-0.05	(0.07)
Sex sent [2B]		-0.11	(0.11)	-0.02	(0.03)
Sex similarity selection [2C]		0.69*	(0.06)	0.69*	(0.05)
Class similarity selection [2C]		0.75*	(0.06)	0.76*	(0.06)
Location similarity selection [2C]		0.39	(0.03)	0.38	(0.03)
Rock received [2A]		-0.04	(0.02)	-0.04	(0.02)
Rock sent [2B]		-0.03	(0.02)	-0.02	(0.02)
Rock similarity selection [2C]		-0.20	(0.11)	-0.23	(0.11)
Dance received [2A]		-0.02	(0.03)	-0.02	(0.03)
Dance sent [2B]		0.05	(0.04)	0.03	(0.03)
Dance similarity selection [2C]		0.25	(0.14)	0.25	(0.13)
Highbrow received [2A]		0.05	(0.02)	0.05	(0.02)
Highbrow sent [2B]		0.03	(0.05)	0.04	(0.05)
Highbrow similarity selection [2C]		0.48*	(0.15)	0.52*	(0.14)
Popular received [2A]		-0.01	(0.02)	0.00	(0.02)
Popular sent [2B]		0.00	(0.03)	0.01	(0.03)
Popular similarity selection [2C]		0.00	(0.05)	-0.02	(0.05)
Urban received [2A]		0.00	(0.02)	0.00	(0.02)
Urban sent [2B]		0.07*	(0.01)	0.07*	(0.01)
Urban similarity selection [2C]		0.34*	(0.11)	0.34	(0.11)

Externalizing behavior received [2A]			0.12	(0.04)
Externalizing behavior sent [2B]			0.21*	(0.05)
Externalizing behavior similarity selection [2C]			0.68*	(0.18)
Effect from Popular on externalizing behavior [3B]	-0.11	(0.05)	-0.09	(0.05)
Effect from Urban on externalizing behavior [3B]	0.11	(0.04)	0.13	(0.05)
Externalizing behavior influence average alter [3C]			1.00*	(0.18)
BEHAVIOR DYNAMICS	**MUSIC ONLY**		**MUSIC AND EXTERNALIZING BEHAVIOR**	
[3]Externalizing behavior change period 1 [3A]	1.38*	(0.13)	1.43*	(0.12)
Externalizing behavior change period 2 [3A]	1.51*	(0.14)	1.54*	(0.15)
Externalizing behavior change linear [3A]	-1.27*	(0.07)	-1.26*	(0.07)
Externalizing behavior change quadratic [3A]	0.32*	(0.04)	0.21*	(0.05)
Effect from Rock on externalizing behavior [3B]	0.02	(0.04)	0.03	(0.05)
Effect from Dance on externalizing behavior [3B]	0.19*	(0.04)	0.16*	(0.05)
Effect from Highbrow on externalizing behavior [3B]	-0.12*	(0.03)	-0.13	(0.06)
Effect from Popular on externalizing behavior [3B]	-0.11	(0.05)	-0.09	(0.05)
Effect from Urban on externalizing behavior [3B]	0.11	(0.04)	0.13	(0.05)
Externalizing behavior influence average alter [3C]			1.00*	(0.18)

Note. $p < .10$, * $p < .05$. 1 the structure of the friendship network. 2 estimating friendship selection. 2A received effects estimate the number of received friendship ties for participants with this characteristics. 2B sent effects estimate the number of sent out friendship ties for participants with this characteristic. 2C similarity effects estimate if participants base friendship selection on similarity of this characteristic. 3 estimating the change of behavior. 3A the development of externalizing behavior, and if this has a linear or quadratic shape. 3B the effect of this characteristic on externalizing behavior. 3C the effect friends' average externalizing behavior on externalizing behavior.

SIENA Estimates of Friends' Influence

The outcomes of the meta-analysis of SIENA analyses of four network are shown in Table 3 for both analyses. First, the structural network effects model the friendship network structure, and optimize the goodness of fit of the networks. These effects were similar for both analyses and will therefore be explained once. There was a negative density effect ([1A]), indicating that participants were likely to be selective in their friendship nominations. There was a positive reciprocity effect ([1B]), indicating that participants were likely to reciprocate friendship nominations. There was a positive transitive triplet effect ([1C]), which shows that participants were likely to be friends with the friends of their friends. Furthermore, as shown by a negative transitive reciprocated triplet effect ([1D]), triads were less likely to have reciprocated ties

than dyads, which is an indication of hierarchy in the network. Moreover, there was a negative three-cycle effect ([1E]). In combination with the positive transitive triplet effect, this indicated that there was hierarchy in the networks (within triads few participants received many nominations, while many participants received fewer nominations). Particularly in period 2, between Time 2 and Time 3, we found a negative indegree – popularity effect ([1F]). This indicated that those with many friends were less likely to increase their number of friends. The negative effects of indegree – activity ([1G]) indicated that those participants who received many friendship nominations were less likely to send out nominations themselves. The outdegree activity ([1H]) was positive, indicating that those with a higher outdegree were more likely to increase the number of friends they select.

Second, to examine the first hypotheses that adolescents select their friends both on music preference and on externalizing behavior, the similarity selection effects were estimated for both analyses (Table 3). Three types of effects are important for this part of the model. First, received (or alter) effects ([2A]); which model if participants are nominated as friends more frequently based on a certain characteristics. Second, sent (or ego) effects ([2B]); which model if participants with certain characteristics are more likely to nominate friends. Third, similarity selection effects ([2C]); which model if participants are likely to select friends based on similarity in certain characteristics. The main effects of the control variables were generally consistent with prior research. Participants' selection of friends was significantly associated with similarity in gender, and class. The effect of similarity selection based on location was marginally significant at $p = .06$, possibly as it was estimated on only two of the four networks for the meta analyses; as only the two cohorts of school 1 consisted of several locations. While controlling for the number of friends adolescents select (sent effects) and the number of times they are selected as friends (received effects).

Partial support was found for the first hypothesis that friendship selection is based on music preferences. In the first analysis, participants were likely to select their friends based on a similarity in both highbrow and urban music preference (positive highbrow and urban similarity selection). In the second analysis, including the effects of externalizing behavior, similarity selection based on urban music became non-significant ($p = 0.06$). Next to similarity selection based on externalizing behavior, friendship selection was based on a similar preference for highbrow music (positive highbrow similarity selection

effect). There was no selection based on similarity in other types of music.

Third, to enable a test of the second hypothesis, the change in externalizing behavior was estimated (Table 3). Behavior dynamics (i.e., changes in behavior) model the change in externalizing behavior. The first effects ([3A]) estimated the change of participants' externalizing behavior. There was negative linear effect, and a positive quadratic effect for the development of externalizing behavior. The combination of a negative linear effect and a positive quadratic effect indicates that externalizing behavior has a tendency to escalate once it develops: Participants were likely to either engage in no externalizing behavior, or to engage in multiple externalizing behaviors.

To test the second hypothesis that non-mainstream music preference would be associated with an increased likelihood to develop externalizing behavior, effects from music preference on the development of externalizing behavior were tested ([3B]). In the first analysis, without externalizing behavior, music preference in rock, popular, or urban music did not affect the development of externalizing behavior (non-significant effects from these types of music preference on externalizing behavior). However, preference for dance music was positively associated and preference for highbrow music was negatively associated with the development of externalizing behavior. Thus, participants who had a preference for dance music were more likely to increase their externalizing behavior while those with a preference for highbrow music were less likely to increase their externalizing behavior. In the second analysis, including effects of externalizing behavior, the effect of highbrow was no longer significant ($p = 0.10$). Moreover, there was a positive effect of friendship influence on externalizing behavior (positive externalizing behavior average alter ([3C]), and a preference for dance music still predicted an increase in externalizing behavior. This indicates that participants were likely to adapt their engagement in externalizing behavior to become more similar to their friends, and that there was an additional likelihood for participants who preferred dance music to develop externalizing behavior.

In sum, in support of hypothesis 1, adolescents were likely to select friends both based on music preference and on externalizing behavior. However, the selection of music preference was limited to a similarity in highbrow music, when taking selection based on externalizing behavior into account. Furthermore, above and beyond the effects of friends' externalizing behavior, adolescents with a preference for non-mainstream music, particularly dance music, were likely to develop externalizing behavior.

DISCUSSION

This study set out to investigate if (1) adolescents select friends based on music preference and/or on a similarity in externalizing behavior, and whether (2) adolescents' non-mainstream music preference adds to the development of externalizing behavior beyond the influence effects of friends' externalizing behavior. Results were based on two analyses, one excluding and one including the effects of externalizing behavior on friendship selection and on the development of externalizing behavior. Results provide partial support for both hypotheses. Adolescents were likely to select friends based on similarity in music preference, both on a preference for urban and highbrow music in the model excluding effects of friendship selection based on externalizing behavior. In the model including externalizing behavior, friendships were only based on a similarity in highbrow music preference; next to similarity in engagement in externalizing behavior. Moreover, independent of friends' externalizing behavior non-mainstream music, especially dance music, was indicative for a faster increase in externalizing behavior. In the model without taking friends' influence in the development of externalizing behavior into account, highbrow music negatively predicted the development of externalizing behavior. However, this effect disappeared when taking the (significant) effect of friends' externalizing behavior into account.

This study provides support for claims by the Music Marker Theory (Ter Bogt et al., 2013) that non-mainstream music preference is an important indicator for externalizing behavior development. Both a preferences for non-mainstream music (i.e., dance music) and friends who engage in externalizing behavior may influence adolescents' engagement in externalizing behavior. Interestingly, the negative effect of highbrow music on the development of externalizing behavior disappeared when taking the influence of friends' externalizing behavior into account. Thus, the negative effect of a preference for highbrow music on the development of externalizing behavior may partially be explained by having fewer friends who engage in externalizing behavior.

This study took into account that adolescents are likely to befriend peers who are similar in music preference and in externalizing behavior and controlled for the effect of friends' externalizing behavior on participants own externalizing behavior. Even while controlling for these alternative explanations of the development of externalizing behavior, music preference

predicted later externalizing behavior; in line with the findings of Ter Bogt and colleagues (2013). However, this is in contrast to the study of Steglich et al. (2006) who did not find such influence effects from music preference while investigating alcohol use among 129 adolescents of the age of 13, using three yearly assessments. Possibly effects were not found by Steglich et al. (2006) as they focused on alcohol use rather than a more global construct of externalizing behavior, as there were too few participants, as other music preferences such as hip-hop or RnB were important at the time of the study (data was collected in starting 1995), or as measurement moments were too far apart; during secondary school friends might change their classrooms from one year to another.

Friendship selection was not based on similarity in rock, dance, popular, or urban music preferences when taking friendship selection based on externalizing behavior into account. Urban music, however, was associated with friendship selection if friendship selection on externalizing behavior was not taken into account. Thus, friendship selection based on externalizing behavior partially explains friendship selection based on a preference for urban music. In both models with and without externalizing behavior, friendship similarity selection was based on a preference for highbrow music. The selection effect based on highbrow music is in line with the finding of Steglich and colleagues (2006) and might indicate that there is a strong basis for early adolescents to select one another on a similarity in preference for highbrow music. When looking at these findings from the perspective as music and externalizing behavior working as 'badges' (Frith, 1981), it is possible that externalizing behavior takes over the role of badge which non-mainstream music would otherwise have. Possibly the 'badge' of engagement in externalizing behavior, which Moffitt (1993) expects to signal social maturity, is more prominent than the musical badge during early adolescence. This would help explain why similarity selection based on a preference for urban music lost its significance when taking friendship selection based on externalizing behavior into account; as urban music preference was positively associated with externalizing behavior. Highbrow music was negatively associated with externalizing behavior, which may help explain why next to externalizing behavior adolescents selected friends with a similar preference for highbrow music.

It would be interesting to further investigate these friendship similarity selection processes, and their underlying motivations. For example,

comparing which roles group formation based on music preference and externalizing behavior fulfill would allow a better understanding of these underlying motives. Both externalizing behavior and non-mainstream music might serve to signal friendship selection based on a more mature status or badge, but there might also be different reasons for such friendship selection. For example in the case of highbrow music preference, music preference might help adolescents obtain a different social goal than signaling maturity. Future studies could further investigate such mechanisms.

Strengths and Limitations

The main strength of this longitudinal network study is that both music preference and externalizing behavior were estimated while taking friendship, embeddedness of friendship in networks, and changes of friendship and externalizing behavior into account. This was done every three moments after adolescents entered a new network of friends; thus the effects found in this study are likely based on current music preference and externalizing behavior rather than pre-existing friendships. Therefore, allowing a stringent test of the assumption that music preference plays an important role explaining both friendship selection and the development of externalizing behavior during adolescence. Moreover, these analyses were done in two models; one with and one without the effects of externalizing behavior. A second strength of the current study is that we identified profiles of music preference, using principal component analyses. This allowed adolescents to have a profile of music preference, which is more informative compared to basing music preference solely on some exemplary items.

As any study, this study also has some limitations. One important limitation is that changes in music preference were not accounted for. It would be interesting to investigate how externalizing behavior and friendship affect changes in music preferences, and how these changes in turn impact externalizing behavior and friendship. Second, although friendship similarity selection was modeled, the Music Marker Theory (Ter Bogt et al., 2013) might even better explain effects based on friendship groups or cliques, rather than individual friendships. Second, this study focused on the occurrence of adolescents' externalizing behaviors rather than the frequency adolescents engage in such behaviors. Future studies should investigate this frequency, perhaps during later years in adolescence when there is more engagement in externalizing behavior.

CONCLUSIONS

This study showed that both music preference and friends' externalizing behavior are important in explaining the spread of early adolescent externalizing behavior, and that they do so in an additive manner. Both dance music and friends' externalizing behavior predicted increases in externalizing behavior. Therefore, it is important to take adolescent music preference into account when studying the development of early adolescent externalizing behavior. Especially adolescents who listen to non-mainstream music, specifically dance music, might be more likely than their peers to develop externalizing behaviors. Prevention programs could aim prevention efforts to adolescents who listen to dance music, as they can be easily targeted through their music stations or dance related events.

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CHAPTER 9

SUMMARY AND DISCUSSION

Aims of this thesis

This thesis set out to further our understanding of the spread of early adolescent externalizing behaviors such as antisocial behavior, alcohol use, and tobacco use. Based on the dual-taxonomy model (Moffitt, 1993, 2007) it was investigated whether (1) an early onset of externalizing behavior was associated with an increased social status among peers, (2) early adolescents were influenced by their friends to (start to) engage in externalizing behavior, and (3) individual characteristics individual characteristics had an impact on the co-development of friendship and externalizing behavior.

Main findings

The findings in this thesis suggest that early adolescents who were experienced in externalizing behavior were popular, but not well liked or more befriended. Moreover, early adolescents were influenced by their friends in (dis)continuation of externalizing behavior rather than in the onset of such behavior. Furthermore, several individual characteristics had an impact on the co-development of friendship and externalizing behavior. First, especially popular adolescents were influential in the spread of externalizing behavior, rather than their well liked peers. Second, for adolescents with an early pubertal development who engaged in externalizing behavior, friendship retention based on similarity in externalizing behavior was important. Third, self-control had an impact on the development of externalizing behavior, although this influence was additive rather than synergetic to the influence of friends. Early adolescents with a lower self-control were more likely to engage in externalizing behavior rather than to be influenced by their friends to engage in this behavior. Fourth, adolescents with a preference for non-mainstream music types, such as dance music, were more likely to engage in externalizing behavior compared to their peers who preferred other types of music.

The social status of adolescents with an early onset of externalizing behavior

The first part of this thesis (Chapters 2 and 3) showed that during early adolescence experience in externalizing behavior was associated with popularity. First, in Chapter 2, we showed that an early onset of externalizing

behavior was positively associated with popularity, negatively with being liked, and unrelated to the quantity of friends. Moreover, there was an additional effect of having an onset of multiple externalizing behaviors; those early adolescents who had an onset of multiple externalizing behaviors were more popular and less liked compared to their peers who had an onset of only one type of externalizing behavior. In Chapter 3, we showed that there was a predictive association between childhood antisocial behavior (indicated by the child, the caretaker, and the teacher), and adolescent popularity (indicated by peers). The association between childhood antisocial behavior and adolescent popularity was especially strong for adolescents who were attractive or good at sports.

In line with expectations based on the dual-taxonomy model (Moffitt, 1993), especially those early adolescents already experienced with externalizing behavior during early adolescence, thus likely to have an early onset of this behavior, were popular to their peers. This finding builds on several studies, which also showed a positive association between adolescent externalizing behavior and popularity (e.g., Agan et al., 2014; Cillessen & Mayeux, 2004; Dijkstra, Lindenberg, Verhulst, Ormel, & Veenstra, 2009; Hawke & Rieger, 2013; Mayeux, Sandstrom, & Cillessen, 2008). We aimed to build on these studies by investigating the onset of several externalizing behavior at the very start of secondary school; thus making it possible to identify those adolescents who were most likely characterized by an early onset of externalizing behavior. Two previous studies identified a profile of persistent externalizing behavior and showed that such adolescents have fewer friends than their peers (Rulison, Kreager, & Osgood, 2014; Young, 2013). Building on these studies, we assessed multiple types of social status: Popularity, likeability, and the quantity of friends. Our findings show the importance of distinguishing and simultaneously studying several types of social status in order to obtain a more complete picture of adolescents' social status. Last, it seems that individual characteristics might moderate the association between popularity and externalizing behavior (see also Dijkstra et al., 2009), and therefore merit further investigation.

Although neither study could assess causality, together they support the hypothesis that an early onset of externalizing behavior is associated with adolescent popularity, but not necessarily with being liked or befriended by peers. Moreover, these findings are in line with the expectation that

adolescents with an early onset of externalizing behavior will become role models (Moffitt, 1993); as popular adolescents are expected to be more influential than their peers (cf. Cillessen, 2011).

The social influence of adolescents with an early onset of externalizing behavior in the onset and (dis)continuation of externalizing behavior

Following the finding that adolescents with an early onset of externalizing behavior were likely to be popular during early adolescence, their social influence was assessed. To assess whether adolescents with an early onset of externalizing behavior influence their friends in the onset and further continuation of externalizing behavior, friendship influence processes were investigated while controlling for the structure of the friendship network and friendship similarity selection effects. We showed that adolescents were influenced by their more experienced peers in further (dis)continuation of externalizing behavior, but not in the onset of such behavior (see Chapter 4).

As this was the first study to investigate friendship influence processes in both the onset and the further (dis)continuation of externalizing behavior, it was unexpected that these processes differed from each other. Although the significant influence effects for the (dis)continuation of externalizing behavior were in line with previous studies (see Veenstra et al., 2013), the lack of influence between friends for the onset of externalizing behavior was not (Light et al., 2013). Based on our findings, it seems that the processes related to the onset and further (dis)continuation of externalizing behavior might be qualitatively different for the spread of externalizing behavior among friends.

Intervention studies have shown the importance of differentiating between the onset and further continuation of externalizing behavior. Such intervention studies indicated that parents might help prevent the onset rather than further continuation of alcohol use (e.g., Dekovic, Buist, & Reitz, 2004; Koning, Engels, Verdurmen, & Vollebergh, 2010; Van der Vorst, Engels, Meeus, & Dekovic, 2006). Possibly parents rather than peers affect the onset of externalizing behavior. Light and colleagues (2013) focused on adolescents at middle school, and the minority of their sample was assessed at the first year of middle school. Moreover, Light and colleagues (2013) showed that influence of friends in the onset increased during later grades of middle school. Thus, it might be that friendship influence in the onset of externalizing behavior takes place among friends who are better acquainted with one another during later

grades in secondary school, rather than in a new network of friends at the start of secondary school. Alternatively, early adolescents might copy their first externalizing behavior from more experienced peers who are not (yet) their friends, or not same-grade friends. Indeed, girls who are especially likely to engage in externalizing behavior, those with an early pubertal development, were likely to select older friends outside of school who engaged in externalizing behavior (see Stattin, Kerr, & Skoog, 2011). Therefore, possibly such outside of school friends may further explain the onset of externalizing behavior.

In sum, it seems that the onset of externalizing behavior is not dependent on friends at the start of secondary education. Alternative explanations should be investigated, including the role of parents and outside of school friends. Friends, however, do seem to play an important role in the further (dis) continuation of externalizing behavior.

Individual characteristics moderating the co-development of friendship and externalizing behavior.

The third part of this thesis investigated the interplay between friendship processes and several important individual characteristics which are known to affect both friendship selection and the development of externalizing behavior. Social status, pubertal development, self-control, and music preference were investigated.

Social status (Chapter 5), and particularly popularity, affected how early adolescents were influenced by their friends in the engagement in externalizing behavior. Early adolescents were especially likely to be influenced by popular friends. Likeability, in contrast, did not affect these peer influence processes.

Therefore, it seems that externalizing behavior is associated with popularity (see Chapter 2) and popularity in turn affects the spread of externalizing behavior among friends. These findings provide some support for the assumptions (Moffitt, 1993) that adolescents with an early onset of externalizing behavior become popular during early adolescence, and that their peers copy their externalizing behavior; as popular adolescents were more influential. Rambaran and colleagues (2013) also investigated how popularity impacts externalizing behavior by studying to what extent peers were influenced in their attitudes towards externalizing behaviors via norms

in the classroom. Adolescents tend to mimic norms towards externalizing behavior especially in classrooms where popularity and positive norms towards externalizing behavior were associated. It would be interesting to disentangle both influence processes. The positive association between popularity and externalizing behavior might impact peer influence processes in general (as indicated by Rambaran et al., 2013) or might be explained by friends of popular adolescents being more likely to adapt their externalizing behavior (in line with our findings). Future studies could compare both possibilities. Interestingly, increased influence was not found for adolescents who were more liked than their peers. Thus it seems that early adolescents are not especially likely to copy externalizing behavior from their more liked friends.

Future studies might aim to identify and follow adolescents with a profile of early onset externalizing behavior over time to investigate whether specifically these adolescents become popular and influence their friends in externalizing behavior. Moreover, it would be interesting to investigate whether popular adolescents are also more likely to spread positive behaviors (e.g., academic achievement, or helping peers) among their friends or whether especially well liked adolescents help spread positive behaviors.

Pubertal development (Chapter 6) was shown to impact friendship selection based on externalizing behavior. More specifically, especially early adolescents who engaged in externalizing behavior and had an early pubertal development were likely to remain friends with peers based on similarity in externalizing behavior and thus break friendships with dissimilar peers. However, adolescents with an early pubertal development were not more likely to create friendships based on similarity in externalizing behavior nor did pubertal development impact the development of externalizing behavior.

Adolescents with an early biological maturity, as indicated by an early pubertal development, are expected to be especially likely to feel trapped in the maturity gap (Moffitt, 1993), which is in turn expected to impact the development of externalizing behavior (see also Dijkstra et al., 2015). An alternative explanation for the association between pubertal development and externalizing behavior is that pubertal development is associated with an increased susceptibility for social rewards combined with a postponed development of cognitive control (e.g., Blakemore & Mills, 2014; Crone & Dahl, 2012; Somerville, 2013). Indeed, previous studies frequently found an

association between pubertal development and externalizing behavior (see Graber, Nichols, & Brooks-Grunn, 2010; Negriff & Susman, 2011). Chapter 6, however, showed that, while taking friendship influence processes into account, pubertal development by itself did not impact the development of externalizing behavior. Our findings further indicated that the impact of friends on adolescents' engagement in externalizing behavior was independent of adolescents' pubertal development.

Thus, the association between pubertal development and externalizing behavior might be partially explained through friends' externalizing behavior. Indeed, especially among adolescents experienced in externalizing behavior who also had an early pubertal development there was a tendency to drop dissimilar friends. Thus, although pubertal development might not directly affect the development of externalizing behavior, nor the susceptibility to friends' influence, being surrounded by friends who also engage in externalizing behavior might increase the chance for adolescents with an early pubertal development to engage in externalizing behavior. An alternative reason why pubertal development did not predict an increase in externalizing behavior, might be that pubertal development by itself is not a strong enough predictor of the maturity gap. Indeed, another study using SNARE data showed that especially the interplay between an early pubertal development, and postponed social recognition of this maturity predicted conflict with parents, which in turn was associated with higher levels of externalizing behavior (see Dijkstra et al., 2015). Therefore, future studies might aim to incorporate a more comprehensive assessment of the maturity gap and directly assess how experiencing the maturity gap affects the co-development of friendship and externalizing behavior.

In sum, rather than a direct effect of pubertal development on the increase of early adolescent externalizing behavior, it seems that friendship choices based on externalizing behavior are influenced by pubertal development. Losing dissimilar friends might cause adolescents with an early pubertal development to lose an important source of adaptive social support (e.g., Richmond, Mermelstein, & Metzger, 2012). Especially peers who do not engage in externalizing behavior might help adolescents socialize towards adaptive developmental outcomes (Dishion & Tipsord, 2011). Therefore, rather than aiming interventions for the prevention of externalizing behavior at adolescents with an early pubertal development, it might be worthwhile to investigate the ways in which ways friendship retention can be influenced for

such adolescents. Schools might try to change their seating arrangements, for example, to help influence friendships (see Van den Berg, Segers, & Cillessen, 2012).

Self-control (Chapter 7) is known to impact friendship selection and the development of externalizing behavior (Gottfredson and Hirshi, 1990). The findings of Chapter 7 indicated that in half the friendship networks adolescents with a low self-control were more likely to develop externalizing behaviors, but that they did so independently of their friends' externalizing behavior. Moreover, it is important to note that regardless of self-control level, adolescents were likely influenced by their friends in the development of externalizing behavior. Our findings thus indicate that, at least in some friendship networks, adolescents with a low self-control were more likely to develop externalizing behavior; regardless of their friends externalizing behavior.

Thus, it seems that both low self-control and friends who engage in externalizing behavior likely predict which adolescents will engage in adolescent externalizing behavior. It is interesting that a characteristic as important as self-control (see Moffitt, et al., 2011) explained the development of externalizing behaviors in only half the friendship networks, while the influence of friends was found in three out of four networks. Nonetheless, it might be possible to prevent adolescent-onset externalizing behavior by training self-control, at least in some friendship networks.

Music preference (Chapter 8) is expected to work as a 'badge' (Frith, 1981; Ter Bogt, Keijsers, & Meeus, 2013) which signals belonging to a specific peer group, which in turn might influence behaviors within such groups. Indeed, preference for non-normative music, specifically dance music, was predictive of further engagement in externalizing behavior. This effect existed even while controlling for friendship influence processes, signaling that effects of music preference go beyond the influence of same-grade school friends.

Similar to non-mainstream music preference, externalizing behavior is expected to work as a badge to signal maturity among peers (Moffitt, 1993). It seems possible that a preference for non-mainstream music is part of signaling maturity among peers. It would be interesting to compare the processes behind these possible 'badges'. Specifically, it would be interesting to investigate how reasons to engage in externalizing behavior and to prefer non-mainstream music might differ or overlap.

The importance of studying both friendship and individual characteristics

This thesis underscores the importance of friends for understanding the development of externalizing behavior. Friendship influence effects were found consistently across studies investigating the (dis)continuation of externalizing behavior regardless of which other individual characteristics were taken into consideration. Even when taking the role of social status, pubertal development, self-control, or music preference into account, early adolescents seem to be influenced by their friends in the development of externalizing behavior. Therefore, friends seem to play an important role in the development of externalizing behavior; above and beyond important individual characteristics.

This thesis indicated that several individual characteristics interact with the co-development of externalizing behavior. Studying such interactions might lead to valuable insights. For example, by studying both the direct effect of self-control and the interaction of self-control with friendship influence we were able to disentangle both possibilities and show that self-control had a direct impact on the development of externalizing behavior rather than through an increased susceptibility to friends' externalizing behavior. Thus, future studies might also benefit from studying individual characteristics and friendship processes in one model; especially individual characteristics that are known to impact both friendship selection and the development of externalizing behavior might be relevant to study.

Strengths and limitations

There are several strengths to this thesis. One of the main strengths is that we managed to disentangle two assumptions of the dual-taxonomy model (Moffitt, 1993) focusing on adolescents with an early onset of externalizing behavior. The assumptions that they become popular and the that they are influential in the spread of externalizing behavior were investigated.

A second strength is that our study used sophisticated methodology to study social networks (stochastic actor-based modeling). The sampling of adolescents who had just started secondary school allowed us to assess adolescents in a relatively new friendship network and thus catch new friendship creation based on current behaviors, rather than previous acquaintanceship. Using full grade friendship networks three times a year allowed studying a quite complete network of friends and changes of

friendship at the start of secondary school. Moreover, as participants indicated who their friends were, but characteristics of these friends were self-reported by these peers, possible rater bias was prevented; which would occur if participants both indicate who their friends are and the externalizing behavior they think their friends engage in (see Meldrum, Young, & Weerman, 2009).

Third, the interplay between several individual characteristics and externalizing behavior was taken into consideration. The stochastic actor-based models focused on different (interaction) effects. The study in Chapter 4 was the first to assess friendship influence processes in both the onset and the (dis)continuation of externalizing behavior in one study. The study on pubertal development disentangled selection and de-selection effects, while studying the interaction between pubertal development and externalizing behavior. The studies on popularity and self-control investigated both direct and interaction effects of these characteristics and friends' influence on externalizing behavior. Last, the study on music preference compared music preference and friendship effects in the co-development of friendship and externalizing behavior.

There are also several limitations to this current thesis. A main limitation is that friendship networks were the core of this thesis. Although processes between friends are important and merit studying, they may not portray the full picture of the spread of externalizing behavior as the spread of externalizing behavior might not be limited to friendships and for example out of school friends might also be important (Stattin et al., 2011). Future studies should investigate whether the spread of externalizing behavior is further explained by processes between adolescents who want to become friends, who are in proximity, or perhaps outside of school friends. Furthermore, although there are substantial benefits of using stochastic actor-based modeling, interaction effects seem to have difficulty reaching significance in such analyses; possibly due to methodological or power issues. Future studies might rely on even larger sample sizes, or further development of the SIENA software might help overcome this potential issue.

Another limitation is that this thesis focused on the first year of secondary school. Although this is a very important year in adolescence, it would be interesting to understand the processes leading up to this year, and after this year. Moreover, while investigating the social status of adolescents with an early onset of externalizing behavior, the current design did not allow testing

causality. Although we assume that an early onset of externalizing behavior leads to popularity in early adolescence, it is possible that externalizing behavior is already associated with popularity during childhood. However, the link between externalizing behavior, aggression, and perceived popularity was not or even negatively associated between grades 3 and 5, while this association became positive only at grade 7 or 9 (Rose, Swedson, & Waller, 2004); indicating that externalizing behavior and popularity might only be associated after childhood. Future studies investigating a longer timespan stretching from before to after adolescents might help overcome this limitation.

General conclusion

Early adolescents who were experienced in externalizing behavior were likely to be popular, but less liked, among their peers. Although friends did not seem to influence one another in the onset of externalizing behavior, friendship influences in the further continuation of this behavior seemed to be very important. Next to the call by Dishion (2013) for more advanced models such as multilevel analyses when investigating the co-development of friendship and behavior, a fruitful line of future studies might assess how friendship processes affect individual characteristics known to be associated with both the development of externalizing behavior and having friends who engage in externalizing behavior. Indeed, both friendship influences and individual characteristics affected the development of externalizing behavior. First, adolescents with a low self-control and/or non-mainstream music preference had an increased likelihood to develop externalizing behavior, while taking friends' influences into account. Second, adolescents with an early pubertal development were not more likely to develop externalizing behavior, but were more likely to drop friends who did not equally engage in externalizing behavior. Last, early adolescents seemed to be especially likely to be influenced in externalizing behavior by their more, rather than less, popular friends.

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NEDERLANDSTALIGE SAMENVATTING / SUMMARY IN DUTCH

Doel van dit proefschrift

Het doel van dit proefschrift was om de verspreiding van externaliserend gedrag, zoals antisociaal gedrag, alcoholgebruik en tabaksgebruik, onder jongeren te onderzoeken. Op basis van het 'dual-taxonomy model' (Moffitt, 1993, 2007) werd onderzocht of een vroeg begin van externaliserend gedrag samenhing met een hoge sociale status onder leeftijdsgenoten. Verder werd onderzocht of jongeren werden beïnvloed door hun vrienden bij het begin en de voortzetting van externaliserend gedrag. Bovendien werd onderzocht of individuele eigenschappen invloed hadden op de gelijktijdige ontwikkeling van vriendschap en externaliserend gedrag.

Het dual-taxonomy model (Moffitt, 1993) probeert de toename van externaliserend gedrag gedurende de adolescentie te verklaren. Dit model stelt dat jongeren tijdens de adolescentie zich biologisch volwassen beginnen te voelen, maar dat sociale erkenning van deze volwassenheid door ouders of de maatschappij vooralsnog achterwege blijft. Deze stressvolle ervaring, genaamd de 'maturity gap', willen jongeren overbruggen door externaliserend gedrag te vertonen. Jongeren verwachten met externaliserend gedrag een volwassen status onder hun leeftijdsgenoten te krijgen. De meeste jongeren beginnen tijdens de adolescentie met externaliserend gedrag en kopiëren dit van een kleine groep jongeren (5 a 10% van hun leeftijdsgenoten) die al sinds hun kindertijd externaliserend gedrag vertonen. Deze laatste groep wordt dus gekenmerkt door een 'vroeg begin' (early onset) van externaliserend gedrag. Het is de verwachting dat deze selecte groep jongeren tijdens de adolescentie populair zullen zijn vanwege hun externaliserend gedrag. Bovendien is de verwachting dat ze hun leeftijdsgenoten beïnvloeden door externaliserend gedrag, omdat hun leeftijdsgenoten op die manier de maturity gap willen overbruggen.

De studies uit dit proefschrift maakten, op één studie na, gebruik van de data van de SNARE (Social Network Analysis of Risk behavior in Early adolescence) studie. De gebruikte dataset bestaat uit 1144 jongeren die net zijn begonnen aan de middelbare school. Deze groep bestond voor de helft uit jongens, de gemiddelde leeftijd was 12.7 jaar, en de meeste jongeren (97%), hun vaders (87%) en hun moeders (88%) waren geboren in Nederland. Iets minder dan de helft van de jongeren (43.9%) zat op het VMBO en de rest (54.1%) zat op de HAVO of het VWO. Eén hoofdstuk maakte gebruik van data van de TRAILS studie (828 jongeren, gemiddeld 11.1 jaar op tijdstip 1 en 13.6 jaar op tijdstip 2, 51% jongens).

De sociale status van jongeren met een vroeg begin van externaliserend gedrag

Het eerste deel van dit proefschrift (hoofdstukken 2 en 3) liet zien dat tijdens de vroege adolescentie ervaring met externaliserend gedrag positief samenhing met populariteit, en negatief samenhing met aardig gevonden worden, maar los stond van het aantal vrienden dat jongeren hadden. Bovendien waren jongeren die ervaring hadden met meer dan één type externaliserend gedrag populairder en werden ze minder aardig gevonden dan jongeren die slechts met één type externaliserend gedrag ervaring hadden. Ook was er een voorspellende associatie tussen antisociaal gedrag in de kindertijd en populariteit in de adolescentie. Deze associatie was vooral sterk voor jongeren die aantrekkelijk waren of goed waren in sport.

Deze bevindingen lagen in lijn met verwachtingen op basis van het dual-taxonomy model (Moffitt, 1993). In het bijzonder waren jongeren die aan het begin van de middelbare school al ervaring hadden met externaliserend gedrag, en dus waarschijnlijk al vroeg dit gedrag vertoonden, populair onder hun leeftijdsgenoten. Deze bevindingen sluiten ook aan bij verschillende voorgaande studies. Zulke studies hebben ook laten zien dat er tijdens de adolescentie een associatie was tussen verschillende vormen van externaliserend gedrag en populariteit (bijvoorbeeld Agan et al., 2014; Cillessen & Mayeux, 2004; Dijkstra, Lindenberg, Verhulst, Ormel, & Veenstra, 2009; Hawke & Rieger, 2013; Mayeux, Sandstrom & Cillessen, 2008). Bovendien hebben twee studies (Rulison, Kreager & Osgood, 2014; Young, 2013) de status van adolescenten met een profiel van aanhoudend externaliserend gedrag onderzocht, wat kenmerkend is voor jongeren die vroeg beginnen met externaliserend gedrag. Deze studies toonden aan dat dergelijke jongeren minder vrienden hadden dan hun leeftijdgenoten. Omdat wij jongeren aan het begin van hun middelbare schoolcarrière onderzochten, was het mogelijk om de status te onderzoeken van jongeren die waarschijnlijk gekenmerkt werden door een vroeg begin met externaliserend gedrag. Bovendien hebben we niet alleen naar vriendschap gekeken, maar ook gekeken naar populariteit en aardig gevonden worden. Onze bevindingen lieten zien dat het belangrijk is om een onderscheid te maken tussen verschillende typen sociale status en ze gelijktijdig te bestuderen.

Hoewel geen van de twee studies causaliteit kon testen, ondersteunen ze samen wel de verwachting dat een vroeg begin van externaliserend gedrag

geassocieerd is met populariteit aan het begin van de adolescentie. Bovendien zijn deze bevindingen in lijn met de verwachting dat adolescenten die al vroeg externaliserend gedrag vertonen, rolmodellen worden voor hun leeftijdsgenoten (Moffitt, 1993); aangezien populaire jongeren meer invloed lijken te hebben op hun leeftijdsgenoten (zie Cillessen, 2011 en hoofdstuk 4 van deze dissertatie).

De invloed van vrienden bij het begin en de voortzetting van externaliserend gedrag

In het tweede deel van dit proefschrift werd de invloed van vrienden op de verspreiding van externaliserend gedrag bestudeerd. Er werd gekeken naar vriendschap invloedprocessen, wanneer jongeren hun gedrag aanpassen om meer op hun vrienden te lijken. Hierbij werd rekening gehouden met de structuur van het vriendschapsnetwerk en vriendschap selectieprocessen, als jongeren hun vrienden selecteren op vergelijkbaar gedrag. Jongeren werden beïnvloed door hun meer ervaren vrienden in de voortzetting van externaliserend gedrag, maar ze werden niet beïnvloed om met dit gedrag te beginnen (zie hoofdstuk 4).

Omdat dit het eerste onderzoek was dat tegelijkertijd onderzocht hoe vrienden elkaar beïnvloeden aan het begin en bij de verdere voortzetting van externaliserend gedrag, werd niet verwacht dat deze vriendschapsprocessen van elkaar zouden verschillen. Hoewel de invloed van vrienden bij de verdere voortzetting van externaliserend gedrag in lijn was met eerdere studies (zie Veenstra, Dijkstra, Steglich, & Van Zalk, 2013), was het gebrek aan invloed aan het begin van externaliserend gedrag dit niet (Light, Greenan, Rusby, Nies, & Snijders., 2013). Het lijkt dan ook dat de vriendschapsprocessen die een rol spelen aan het begin en bij de verdere voortzetting van externaliserend gedrag kwalitatief van elkaar verschillen.

Een verschil met de studie van Light en collega's (2013) was dat zij zich richtten op jongeren die op een Amerikaanse 'middle school' zaten en de minderheid van deze jongeren uit het eerste jaar van de school kwam. De invloed van vrienden op het begin van externaliserend gedrag nam in hun studie toe tijdens latere jaren van de middle school. Het zou dus kunnen dat invloed aan het begin van externaliserend gedrag vooral plaatsvindt onder jongeren die elkaar al beter kennen en minder in een nieuw netwerk van jongeren die net aan de middelbare school zijn begonnen. Een alternatief is

dat ouders, meer dan leeftijdgenoten, invloed zouden kunnen hebben op het ontstaan van externaliserend gedrag tijdens de vroege adolescentie. Ouders speelden namelijk wel een rol bij het voorkomen van het begin van alcohol gebruik, maar niet bij de verdere voortzetting van dit gedrag (zie bijvoorbeeld Dekovic, Buist, en Reitz, 2004; Koning, Engels, Verdurmen, & Vollebergh, 2010; Van der Vorst, Engels, Meeus, & Dekovic, 2006). Het zou ook kunnen dat jongeren hun eerste externaliserend gedrag kopiëren van hun meer ervaren leeftijdsgenoten die (nog) geen vrienden zijn, of vrienden die niet bij hen in het leerjaar zitten. In lijn met dit idee selecteerden meisjes met een vroege puberteitsontwikkeling, met een grotere kans op het ontstaan van externaliserend gedrag, vooral oudere vrienden buiten hun school die zich al bezighielden met externaliserend gedrag (zie Stattin, Kerr, en Skoog, 2011).

Kortom, het lijkt erop dat het begin van externaliserend gedrag niet afhangt van vrienden aan het begin van de middelbare school. Alternatieve verklaringen moeten worden onderzocht, inclusief de rol van ouders en vrienden buiten de school. Vrienden lijken echter wel een belangrijke rol te spelen in de verdere voortzetting van externaliserend gedrag.

Individuele kenmerken die de ontwikkeling van vriendschap en externaliserend gedrag mogelijk beïnvloeden

In het derde deel van dit proefschrift is de wisselwerking onderzocht tussen vriendschapsprocessen en een aantal belangrijke individuele kenmerken die samenhangen met zowel vriendschap als de ontwikkeling van externaliserend gedrag. Sociale status, puberteitsontwikkeling, zelfcontrole, en muzikale voorkeur werden onderzocht. *Sociale status* (hoofdstuk 5), in het bijzonder populariteit, zorgde ervoor dat jongeren meer invloed hadden op hun vrienden bij de ontwikkeling van externaliserend gedrag. Jongeren die aardig werden gevonden, een andere vorm van sociale status, waren echter niet meer invloedrijk dan hun leeftijdsgenoten.

Externaliserend gedrag was dus geassocieerd met populariteit (zie hoofdstuk 2) en populariteit had invloed op de verspreiding van externaliserend gedrag onder vrienden. Deze bevindingen sluiten aan bij de verwachtingen van Moffitt (1993) dat adolescenten met een vroeg begin van externaliserend gedrag populaire rolmodellen worden tijdens de adolescentie en dat hun leeftijdsgenoten dit gedrag van hen overnemen. Rambaran en collega's (Rambaran, Dijkstra, & Stark, 2013) hebben laten zien dat jongeren attitudes

ten opzichte van externaliserend gedrag vooral van hun leeftijdsgenoten overnemen wanneer deze attitudes samenhangen met populariteit. De positieve relatie tussen populariteit en externaliserend gedrag zou een algemeen effect kunnen zijn van populariteit (in lijn met Rambaran et al., 2013) of verklaard kunnen worden doordat jongeren eerder externaliserend gedrag overnemen van hun populaire vrienden. Toekomstige studies zouden beide processen kunnen bestuderen om te kijken wat het waarschijnlijkst is.

Toekomstige studies zouden jongeren met een profiel van een vroeg begin van externaliserend gedrag kunnen identificeren en hen gedurende een langere tijd kunnen volgen. Zo zou onderzocht kunnen worden of, zoals naar verwachting volgens het dual-taxonomy model (Moffitt, 1993), juist deze jongeren populair worden en daarna extra invloed hebben op de ontwikkeling van externaliserend gedrag van hun vrienden. Het zou bovendien interessant zijn om te onderzoeken of populaire jongeren meer invloed hebben op de ontwikkeling van positieve gedragingen (bijvoorbeeld betere schoolprestaties, of vaker leeftijdsgenoten helpen), of dat dit misschien iets is waar jongeren die aardig worden gevonden het meeste invloed op hebben.

In hoofdstuk 6 hebben we laten zien dat *puberteitsontwikkeling* invloed had op vriendschapsselectie op basis van externaliserend gedrag. Jongeren met een vroege puberteitsontwikkeling die externaliserend gedrag vertoonden, hadden een grotere kans om vriendschappen te behouden op basis van gelijkheid in externaliserend gedrag en daarmee dus een grotere kans vrienden te verliezen die geen externaliserend gedrag vertoonden. Maar de jongeren met een vroege puberteitsontwikkeling hadden niet meer kans om vriendschappen te sluiten op basis van gelijkheid in externaliserend gedrag. Bovendien had puberteitsontwikkeling geen directe invloed op de ontwikkeling van externaliserend gedrag.

Adolescenten met een vroege biologische volwassenheid, met onder andere een vroege puberteitsontwikkeling, hebben een bijzonder grotere kans zich gevangen te voelen in de 'maturity gap' (zie Dijkstra et al., 2015). Bovendien hebben jongeren met een vroege puberteitsontwikkeling wellicht een hogere ontvankelijkheid voor sociale beloningen in combinatie met een uitgestelde ontwikkeling van cognitieve controle over hun gedrag (zie bijvoorbeeld Blakemore & Mills, 2014; Crone & Dahl, 2012, Somerville, 2013). Voorgaande studies hebben inderdaad een verband tussen puberteitsontwikkeling en externaliserend gedrag laten zien (zie Graber, Nichols & Brooks-Grunn, 2010;

Negriff & Susman, 2011). De resultaten in hoofdstuk 6 lieten echter geen direct verband zien tussen puberteitsontwikkeling en externaliserend gedrag, als rekening werd gehouden met de invloed van vrienden op de ontwikkeling van externaliserend gedrag. De resultaten lieten verder zien dat de invloed van vrienden op de ontwikkeling van externaliserend gedrag los stond van puberteitsontwikkeling en dat jongeren met een vroege puberteitsontwikkeling dus niet meer ontvankelijk zijn voor de invloed van hun vrienden dan hun leeftijdsgenoten. De associatie tussen puberteitsontwikkeling en externaliserend gedrag zou daarom deels verklaard kunnen worden door externaliserend gedrag van vrienden. In het bijzonder de jongeren met een vroege puberteitsontwikkeling die externaliserend gedrag vertoonden, lieten hun vrienden vallen die geen externaliserend gedrag vertoonden. Het kan zijn dat omringd zijn met vrienden die ook externaliserend gedrag vertonen ervoor zorgt dat externaliserend gedrag zich sneller ontwikkelt. Hoewel de invloed van vrienden gelijk blijft, zijn er dan relatief meer vrienden die externaliserend gedrag vertonen. Een alternatieve verklaring waarom puberteitsontwikkeling geen direct effect had op de ontwikkeling van externaliserend gedrag, zou kunnen zijn dat puberteitsontwikkeling onvoldoende de maturity gap kan voorspellen. Een andere SNARE studie heeft inderdaad laten zien dat de interactie tussen een vroege puberteitsontwikkeling en uitgestelde sociale erkenning van deze biologische volwassenheid, conflicten met ouders voorspelde. Deze conflicten voorspelden weer meer externaliserend gedrag bij jongeren (zie Dijkstra et al., 2015). Daarom zouden toekomstige studies een completere voorspeller voor de maturity gap, op basis van pubertijdsontwikkeling en conflict met ouders, kunnen meenemen om een directer effect van de maturity gap te onderzoeken voor de ontwikkeling van externaliserend gedrag.

Kortom, jongeren die externaliserend gedrag vertonen met een vroege puberteitsontwikkeling lijken hun vriendschapselectie te laten afhangen van externaliserend gedrag. Het verbreken van vriendschappen met vrienden die geen externaliserend gedrag vertonen, kan samengaan met het verlies van een belangrijke bron van sociale steun (zie bijvoorbeeld Richmond, Mermelstein, & Metzger, 2012). Juist leeftijdsgenoten die zich niet bezighouden met externaliserend gedrag kunnen helpen met het socialiseren naar een goede ontwikkeling (Dishion & Tipsord, 2011). Het lijkt daarom belangrijk om preventies te richten op vriendschappen van jongeren met een vroege puberteitsontwikkeling, specifiek op het behoud van vrienden die

geen externaliserend gedrag vertonen. Wellicht zouden scholen de zitplaatsen van zulke jongeren kunnen veranderen, om vriendschapsbehoud te bevorderen (zie Van den Berg, Segers, & Cillessen, 2012).

Zelfcontrole (hoofdstuk 7) heeft ook invloed op vriendschapsvorming en externaliserend gedrag (Gottfredson en Hirshi, 1990). De bevindingen in hoofdstuk 7 lieten zien dat in de helft van de vriendschapsnetwerken jongeren met een lagere zelfcontrole meer kans hadden op het ontwikkelen van externaliserend gedrag. Deze ontwikkeling was onafhankelijk van het externaliserende gedrag van vrienden. Adolescenten werden beïnvloed door hun vrienden in externaliserend gedrag, ongeacht hoe laag of hoog de zelfcontrole van jongeren was. Deze bevindingen laten dus zien dat, in sommige vriendschapsnetwerken, jongeren met een lagere zelfcontrole een grotere kans hebben om externaliserend gedrag te ontwikkelen – onafhankelijk van het externaliserend gedrag van hun vrienden. Zowel zelfcontrole als externaliserend gedrag van vrienden lijken dus invloed te hebben op de ontwikkeling van externaliserend gedrag van jongeren. Het is interessant dat zo een belangrijke eigenschap als zelfcontrole (zie Moffitt et al., 2011) in slechts de helft van de vriendschapsnetwerken invloed had op de ontwikkeling van externaliserend gedrag, terwijl in drie van de vier netwerken vrienden invloed hadden op de ontwikkeling van externaliserend gedrag. Toch lijkt zelfcontrole, rekening houdend met het effect van vrienden, ten minste in sommige gevallen van belang te zijn bij het ontstaan van externaliserend gedrag.

Muziekvoorkeur (hoofdstuk 8) zou kunnen werken als een 'badge' (Frith, 1981; Ter Bogt, Keijsers, & Meeus, 2013) die kan uitstralen tot een bepaalde groep te horen, wat weer invloed zou kunnen hebben op het gedrag binnen de groep. In lijn met verwachtingen had een voorkeur voor niet-normatieve muziek, in het bijzonder dancemuziek, invloed op de ontwikkeling van externaliserend gedrag. Jongeren die een voorkeur hadden voor dancemuziek hadden meer kans om externaliserend gedrag te vertonen, rekening houdend met vriendschapsselectie- en invloedprocessen.

Net als niet-mainstream muziek, kan volgens Moffitt (1993) externaliserend gedrag werken als een 'badge' voor een volwassen status onder leeftijdsgenoten. Het zou dus kunnen dat voor jongeren niet-mainstream muziek deel uitmaakt van het uitstralen van een volwassen status onder leeftijdsgenoten. Het zou dan ook interessant zijn om de processen achter deze

'badges' van niet-mainstream muziek en externaliserend gedrag te vergelijken. Specifiek zou het interessant zijn om te kijken naar de redenen waarom jongeren een voorkeur hebben voor dancemuziek en waarom jongeren zich bezighouden met externaliserend gedrag om zo te kijken waar deze redenen overlappen of verschillen.

Conclusie

Jongeren die aan het begin van de adolescentie al externaliserend gedrag hebben vertoond, hebben een grotere kans om populair te zijn, maar ook om minder aardig gevonden te worden. Vrienden lijken een belangrijke rol te spelen in het verspreiden van externaliserend gedrag, maar een minder belangrijke rol bij het ontstaan van dit gedrag. Hoewel vrienden belangrijk lijken te zijn bij de ontwikkeling van externaliserend gedrag, hebben individuele eigenschappen hier ook invloed op. Ten eerste had *sociale status*, in het bijzonder populariteit, invloed op de ontwikkeling van externaliserend gedrag. Jongeren nemen eerder externaliserend gedrag over van populaire vrienden. Jongeren die aardig werden gevonden, een andere vorm van sociale status, hadden niet meer invloed dan hun leeftijdsgenoten. Ten tweede had een vroege *puberteitsontwikkeling* invloed op vriendschapsselectie. Jongeren die een vroege puberteitsontwikkeling hadden en die externaliserend gedrag vertoonden, hadden meer kans hun vrienden te laten vallen die geen externaliserend gedrag vertoonden. Ten derde had *zelfcontrole* invloed op de ontwikkeling van externaliserend gedrag. Jongeren met een lagere zelfcontrole hadden een grotere kans om externaliserend gedrag te vertonen. Deze invloed vond in de helft van de vriendschapsnetwerken plaats en was onafhankelijk van de invloed die vrienden hadden op de ontwikkeling van externaliserend gedrag. Tot slot hadden jongeren met een voorkeur voor *niet-mainstream muziek*, in het bijzonder dance muziek, een grotere kans om externaliserend gedrag te vertonen in vergelijking met hun leeftijdsgenoten met een andere muziekvoorkeur. Toekomstige studies zouden de invloed van andere eigenschappen kunnen bestuderen waarvan bekend is dat ze zowel vriendschapsprocessen als externaliserend gedrag beïnvloeden. Bovendien zouden toekomstige studies kunnen onderzoeken hoe de opgedane kennis toegepast kan worden bij het voorkomen van externaliserend gedrag aan het begin van de adolescentie.

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ABOUT THE AUTOR

Curriculum Vitae

Aart Franken (1985) started his high school education (VWO) at the Carolus Clusius College in Zwolle. Afterwards, in 2008, he obtained his bachelor degree in psychology from the Radboud University in Nijmegen. During these years he mainly focused on developmental and clinical psychology, and had the chance to spend one year at the University of Barcelona in Spain to study additional courses. He also completed the two-year Research Master of Bevioural Science at the Radboud University. His master thesis was about the effects of bullying-victimization on adjustment problems, supervised by Professor Toon Cillessen, Professor Pam Maras, and Dr. Ron Scholte. For the data collection of his thesis he visited the University of Greenwich in the United Kingdom for four months. Next to his studies, he was an active member of several student associations. He spent several years working with the Dutch psychology students' association (www.spsnip.nl), finally becoming the vice-president of the national association. Furthermore, he became active in the European Federation of Psychology Students' Associations (www.efpsa.org). In 2008, he became the president of this association.

In 2010, Aart Franken started his PhD project at Utrecht University at the department of Interdisciplinary Social Sciences. He was supervised by Professor Wilma Vollebergh, and Dr. Zeena Harakeh from the same department, and Dr. Jan Kornelis Dijkstra from the University of Groningen at the department of Sociology. Furthermore, he obtained a Fulbright scholarship to visit Professor Terrie Moffitt at Duke University and Professor Mitch Prinstein at the University of North Carolina at Chapel Hill for four months. This thesis was completed in October 2015.

During his PhD he presented his research at several international conferences and taught several courses. Moreover, he supervised an international group of students during and after a summer school organized by EFPSA, which led to a publication in the European Journal of Developmental Psychology. Also, he became a trainer/facilitator of the Council of Europe Pestalozzi Programme: He co-facilitated a module on 'education for the prevention of violence in schools', and two summer schools. Last, Aart was active in the Dutch Psychological Association where he is currently the treasurer of the Sector Health.

Currently Aart is working as a postdoctoral researcher at the department of

Developmental Psychology at Utrecht University, under supervision of Professor Marcel van Aken. During this research he continues to focus on adolescent development and the interplay between adolescents' and their social surroundings. Moreover, future collaboration is planned with Professor Kirby Deater-Deckard and Dr. Guangui Chen at Shandong Normal University in Jinan, China, and with Professor Louise Arseneault at King's College London, in the United Kingdom.