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Do Physical and Relational Aggression Explain Adolescents' Friendship Selection? The Competing Roles of Network Characteristics, Gender, and Social Status

Jan Kornelis Dijkstra[1]*, Christian Berger[2], and Siegwart Lindenberg[1]

[1]*Department of Sociology and Interuniversity Center for Social Science Theory and Methodology, University of Groningen, The Netherlands*
[2]*Department of Psychology, Pontificia Universidad Católica de Chile, Santiago*

The role of physical and relational aggression in adolescents' friendship selection was examined in a longitudinal sample of 274 Chilean students from 5th and 6th grade followed over 1 year. Longitudinal social network modeling (SIENA) was used to study selection processes for aggression while influence processes were controlled for. Furthermore, the effects of network characteristics (i.e., reciprocity and transitivity), gender, and social status on friendship selection were examined. The starting assumption of this study was that selection effects based on aggression might have been overestimated in previous research as a result of failing to consider influence processes and alternative characteristics that steer friendship formation. The results show that selection effects of both physical and relational aggression disappeared when network effects, gender, and social status were taken into account. Particularly gender and perceived popularity appeared to be far more important determinants of friendship selection over time than aggression. Moreover, a peer influence effect was only found for relational aggression, and not for physical aggression. These findings suggest that similarity in aggression among befriended adolescents can be considered to be mainly a by-product rather than a leading dimension in friendship selection. Aggr. Behav. 37:1–13, 2011. © 2011 Wiley-Liss, Inc.

Keywords: aggression; friendship selection; perceived popularity; social; preference; longitudinal social network analyses (SIENA)

INTRODUCTION

There is consistent evidence that during early adolescence befriended peers display similarity in several characteristics such as age, gender, race, social class, educational aspirations, and physical attractiveness [e.g., McPherson et al., 2001]. Aggression constitutes no exception to this trend [Cairns et al., 1988; Dishion et al., 1995; Espelage et al., 2003; Kupersmidt et al., 1995; Rose et al., 2004a,b]. On the basis of these findings it has been concluded that similarity in aggression is the result of processes in which aggressive adolescents select each other as friends [Haselager et al., 1998; Snyder et al., 1997; Werner and Crick, 2004].

A major shortcoming of previous research is the fact that we get to know too little about the possible mechanisms that might create similarity in aggression among befriended adolescents. Is it so that similarity in aggression among friends is the result of aggressive youths selecting each other as friends [Haselager et al., 1998; Snyder et al., 1997]? Or does selection plays no role because friends influence each other and become more equal with regard to aggression, resulting in similarity [Haynie, 2001; Steglich et al., 2010; Urberg, 1999]? There is some evidence that friends' aggression may be predictive for one's own aggression over time [Espelage et al., 2003; Rose et al., 2004a,b; Vitaro et al., 1997]. However, the empirical support for this influence effect is inconsistent [Newcomb et al., 1999; Poulin and Boivin, 2000] and there is evidence for the co-occurrence of both selection and influence processes [Mrug et al., 2004; Werner and Crick, 2004]. Cross-sectional studies cannot answer these questions and traditional statistical techniques are not adequate to untangle selection and influence effects.

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*Correspondence to: Jan Kornelis Dijkstra, Department of Sociology/ICS, University of Groningen, Groningen, The Netherlands. E-mail: jan.dijkstra@rug.nl

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Even if similarity in aggression turned out to be mainly the result of selection rather than influence effects, it may be the by-product of other factors than aggression. For example, if aggression correlates with gender and gender correlates with friendship formation, it may look like an effect of similarity in aggression even though this is not the case. Selection effects might also be the by-product of structural network tendencies, such as reciprocity and transitivity [Davis, 1970]. For example, when friendship formation between two aggressive adolescents occurs because they share a third friend (transitivity), leaving out an estimate for transitivity would result in this friendship selection incorrectly being attributed to their aggression. Not controlling for such structural tendencies means that selection effects of any attribute are easily inflated [Steglich et al., 2010].

This study was aimed at contributing to the understanding of the role of aggression in friendship selection by probing more deeply into the mechanisms that may lead to friendship between aggressive youths. To this end, we focus on both physical and relational aggression as distinct forms of aggression [Crick and Grotpeter, 1995].

BACKGROUND

The importance of similarity for friendship formation has often been demonstrated [Bukowski et al., 2000; Byrne, 1971; McPherson et al., 2001]. This argues in favor of some kind of selection effect as an explanation of similarity. However, it does not tell us on what attributes friends are selected, nor does it exclude other effects that are related to active selection. We therefore have to answer three main questions: (a) On what attributes are friends selected? (b) How is aggression related to these attributes? (c) What other effects are likely to influence the similarity among friends with regard to aggression? In order to answer these questions, we proceeded from a goal-framing perspective [Lindenberg, 2001, 2006, 2008], which has successfully been applied to questions of friendship formation before [Dijkstra et al., 2007; Sijtsema et al., 2009; Veenstra et al., 2007].

Goal-framing theory argues that goals that relate to fundamental needs are particularly powerful in affecting cognitive and evaluative processes. Goals can be seen as combinations of representations of desired or undesired end states and knowledge structures about ways to realize them. It can be said that goals in general, but particularly the need-related goals, influence selective attention and evaluations.

Two need-related goals for adolescents are the achievement of status and affection [Dijkstra et al., 2007, 2008; Lindenberg, 1996; Veenstra et al., 2010]. These may be the most important goals for friendship formation [Burns et al., 2008]. Because both are related to social needs, adolescents are likely to pursue them both at the same time and in a compatible way, such that realizing one does not block realizing other [Veenstra et al., 2010]. A possible attribute that may drive a "rough" selection for friendship in early adolescence is gender. At this age, gender may be one of the most important attributes for achieving need-related goals [Maccoby, 1998]. Martin and Halverson [1981] have pointed to "sex schemas" as mental constructs that help interpret gender-related information and regulate sex-appropriate behaviors, and its role in achieving important goals. Although gender boundaries are gradually crossed in adolescence, these sex-schemas are likely to remain influential, favoring same-gender preference in friendship formation [Dijkstra et al., 2007; Nangle et al., 2004]. Gender is thus an important first step to distinguish within the peer group significant others from nonsignificant others for goal achievement, resulting in boys selecting boys as friends, and girls selecting girls. Because boys have been found to be more physically aggressive than girls [Card et al., 2008], gender can be expected to drive an important part of the similarity effect with regard to physical aggression. With regard to relational aggression, gender can be expected to be less important in explaining selection effects, because gender differences appear to be trivial for relational aggression [Card et al., 2008].

Next, in order to make the realization of affection and status compatible, it can be expected that both boys and girls will attempt not to lose status and, if possible, even try to gain status through friendship choice [Dijkstra et al., 2010b]. This creates a tendency for status similarity among friends. By status we mean popularity status (i.e., perceived popularity). Because higher status ("perceived popular") peers are often more aggressive both physically and relationally than less popular peers [Dijkstra et al., 2009; LaFontana and Cillessen, 2002; Rodkin and Berger, 2008], status similarity also implies a certain degree of similarity in aggression, without aggression being causally implicated in producing the similarity. In this light, similarity of physical and relational aggression among friends might be a by-product of the effects of gender and status on the realization of affection.

An additional attribute needs to be introduced. In the literature, social preference (i.e., being liked)

is also seen as a possible conception of status (i.e., sociometric status) [Cillessen and Rose, 2005]. However, contrary to popularity status, sociometric status is not linked to aggression and is thus unlikely to create similarity in aggression among friends as a by-product. There is, of course, some overlap between the two forms of status, but once popularity status is taken into account, sociometric status should have little effect on similarity in aggression among friends.

In order to test these hypotheses on selection effects, we need to be able to control for possible effects of influence [Urberg, 1999]. What is needed is a simultaneous test of selection and influence processes. Until recently, studies in which it was possible to do this were scarce, mostly due to technical statistical problems [Steglich et al., 2010].

In this study we focus on friends' selection considering the active process involved in selecting peers to form close relationships, while simultaneously testing for influence processes, using advanced social network analyses (SIENA) [Veenstra and Dijkstra, 2011]. An increasing number of researchers use this method to untangle selection and influence processes concerning delinquency [Burk et al., 2007], musical taste [Steglich et al., 2006], weapon carrying [Dijkstra et al., 2010], and smoking [Mercken et al., 2009]. In the realm of aggression, Sijtsema et al. [2010a,b] untangled selection from influence processes with regard to different types of aggression, including physical and relational aggression, but they did not relate this to explaining similarity in aggression among friends. For both physical and relational aggression, we controlled for influence effects when testing the hypothesized selection effects.

Finally, there are structural network effects (mainly reciprocity and transitivity) that are likely to affect the similarity of attributes among friends. These network effects had to be considered as well, in order to get reliable estimates for the role of aggression on friendship selection [Steglich et al., 2010]. Reciprocity refers to the fact that best friend nominations are likely to be reciprocated, yielding mutual friendship relations. Transitivity reflects the tendency for two individuals who share a mutual friend to become friends as well, also referred to as "friends of my friends are also my friends" [Davis, 1970]. Both reciprocity and transitivity are relevant in the process of friendship formation. For instance, Espelage et al. [2007] showed that the formation of friendships depends on structural characteristics of the network, such that friendships are more likely to be formed if they imply closing cliques (transitivity). Similarly, the establishment of a mutual friendship relation between two aggressive adolescents might occur via a tendency to reciprocate friendship nomination over time rather than due to similarity in aggression. Thus, when these structural network tendencies are left out of consideration, selection effects for any attribute are easily inflated [Steglich et al., 2010]. In this study, reciprocity and transitivity were taken into account, yielding more reliable estimates for selection effects of aggression.

THE PRESENT STUDY

To our knowledge, this study is the first to date in which the similarity of friends with regard to physical and relational aggression is explained in terms of possible underlying mechanisms that do not directly relate to any form of aggression itself. Following from our argumentation, we hypothesized that when influence, gender, status, and structural network effects are controlled for, the initial effects of physical and relational aggression on friendship selection would disappear.

METHOD

Participants

The participants were part of a larger study on peer relations. Two hundred and seventy-four fifth and sixth graders (135 fifth graders; 142 boys, age range 10–12) from two urban schools in metropolitan Santiago, Chile, were included in the study. In each school four classes participated in the data collection. Active consent was gathered from all students and their parents. For 25 students no information was available at time point 1, and were coded as missing. Attrition analyses showed that these participants did not differ in any of the variables of this study from other participants.

Procedure

Participants were surveyed from June to August (middle of the academic year) and reassessed during the same months after 1 year. Surveys were completed during regular class hours through a group administration, taking 45 min per classroom. Participants were assured that their answers would be kept confidential, and were told that they were not allowed to talk and that they could stop participating at any time. During the survey, one administrator read the instructions and questions aloud while scanning the room to check for potential

problems. Additional administrators provided mobile monitoring and assisted children if necessary. All surveys were identified and distributed in a manner that concealed the identity of the participants. Measures and procedures to protect the confidentiality and rights of all participants were approved by the Institutional Review Board of the local university and by the principals of both schools involved in this research.

Measures

Students were asked to nominate their classmates on a variety of social and personality characteristics, and to state who they considered their best friends. Participants were told that they could nominate same- or cross-gender peers, and that peers could be nominated for more than one item.

Friendships. Participants were asked to write down the names of up to six children who they considered their best friends in their classroom. On average participants selected 2.52 friends at Time 1 and 2.90 at Time 2. These best friend nominations were used to determine peer networks using adjacency matrices, containing information on whether a best friend relation was absent (zero) or present (one). Structural zeros between classroom networks were used to indicate that participants were not able to nominate peers from other classrooms.

Physical aggression. Using common peer nomination procedures [Coie et al., 1982], participants were asked to nominate up to six peers in their classroom who best fit the descriptor for *who starts fights*. After nominations were counted, scores for physical aggression were standardized within class, and subsequently z-standardized in both networks separately (i.e., 5th–6th grade and 6th–7th grade).

Relational aggression. Participants were asked to nominate up to six peers in their classroom who best fit the descriptor for *who ignores others*. Again, nominations were counted, and scores for relational aggression were standardized within class. Subsequently z-standardized in both networks separately (i.e., 5th–6th grade and 6th–7th grade). Because SIENA requires categorical variables, both continuous aggression scores were transformed to a 4-point scale, using increments of .25 of the continuous *z*-score as cut-off points. Although our measures of aggression was based on single-items, scores are based on information from all peers, yielding reliable estimates for behaviors and characteristics [Coie et al., 1990].

Perceived popularity. Participants were allowed to nominate up to six classmates they considered to be "popular" and "not popular". Following LaFontana and Cillessen's [2002] procedure, popularity was calculated by subtracting peer nominations as "not popular" from peer nominations as "popular." After standardization of scores within class and across networks, perceived popularity was transformed to a 6-point scale, using increments of .50 of the continuous *z*-score as cut-off points.

Social preference. For social preference, participants were allowed to nominate six classmates with whom they "liked most" and "liked least" to play. Social preference scores were constructed by subtracting a participant's "liked least" from his or her "liked most" score [Coie et al., 1982]. After scores were standardized within class and across networks, both variables were transformed into a 6-point scale, using increments of .50 of the continuous *z*-score as cut-off points.

Considering the smaller variance in physical and relational aggression compared with perceived popularity and social preference, we used a 4-point scale for our aggression measures and a 6-point scale for our social status measures to represent the data in an optimal way.

Analytical Strategy

The analyses were conducted using the Simulation Investigation for Empirical Network Analyses (SIENA) program. SIENA is one of the statistical modules of StOCNET [Boer et al., 2006], a family of statistical programs for social network analysis. SIENA is used to estimate an actor-based model for the co-evolution of networks and behaviors over time [Snijders et al., 2007a,b]. The effects of attributes on changes in network ties (making new friendships or breaking existing ones) indicate selection effects. Conversely, the effects of the network on changes in individual attributes indicate influence effects.

The estimates of the model are obtained through an iterative simulation procedure within a Markov Chain Monte Carlo approach [Snijders, 2005; Snijders et al., 2007a,b]. The model imputes likely developmental trajectories between time points, in which the information from Time 1 is taken as starting point. These estimates are based on transition probabilities between probable states in the state space of possible configurations of the combination of network and behaviors. Estimates indicate the probability of specific change patterns for both individual attributes and network ties given the observed data. The estimation of changes in network ties and individual attributes are modeled

simultaneously. In this way, the program enables testing of selection and influence effects while each is controlled for the other [Burk et al., 2007; Snijders et al., 2007a,b; Steglich et al., 2006, 2010]. In the context of this study, selection implies that individual levels of aggression remain similar, but friends change in accordance with an individual's own level of aggression; influence implies that friends stay similar, but the level of aggression becomes similar to that of friends over time.

Analyses in SIENA yield two types of parameters. First, parameters with regard to the network represent both structural network effects and changes in the network, reflecting selection dynamics. In this study, we examined three structural network effects: (a) *density*, the number of outgoing ties, and, therefore, the density of the network; (b) *reciprocity*, the extent to which friendship choices are reciprocated; and (c) *transitivity*, the tendency of individuals to be friends with the friends of their friends (transitive triplets). Snijders [2001] recommends taking these three structural effects into account to avoid overestimation of other network-related estimates and influence effects.

Next to these network characteristics, selection effects for aggression were estimated. *Effect of aggression on friendship nominations received* indicates the extent to which aggression affects being nominated as a best friend by peers. Conversely, *effect of aggression on friendship nominations given* indicates the extent to which aggression influences the number of best friend nominations given to peers. Because these effects were included, the parameter *selection of similar aggressive friends* gives a reliable estimate for the extent to which adolescents form new friendships with others who are similar in aggression. This effect is the aggression selection effect.

The same three selection effects were also estimated for gender and social status (i.e., perceived popularity and social preference). As a result of this, we were able to determine the effect of aggression on selecting friends, while controlling for the effects of gender and social status as well as the structural network effects mentioned earlier.

The second type of estimates provided by SIENA indicate the extent to which aggression changes over time, referred to as aggression dynamics. Aggression dynamics reflect influence processes in which participants change their level of aggression in accordance with the aggression of befriended peers. Because potential influence processes for aggression are controlled for, the selection dynamics provide more reliable estimates for the true impact of aggression on friendship selection by ruling out influence as a competing mechanism for similarity in friendship networks. There are three parameters of the aggression dynamics.

First, the *linear shape* effect indicates the overall response toward high or low values on aggression. A negative parameter would indicate that the majority of respondents scored below the mean on the 4-point scale for aggression; a positive parameter would indicate that the majority of respondents scored above the mean. Second, we included the *quadratic shape* effect, which expresses a feedback effect of aggression on itself. A positive parameter indicates that responses tend to occur on the extreme ends of the scale. This reflects a self-reinforcing effect, meaning that when aggression increases, the push toward more aggression increases, and when aggression decreases, the push toward lower levels of aggression also increases. A negative value would suggest that responses are unimodally scattered around the group average. This indicates a self-correcting effect, implying that when aggression increases, the push toward higher levels of aggression decreases, and conversely, when aggression decreases, the push toward lower levels of aggression decreases [see also Snijders et al., 2010].

Together, the linear and quadratic shape effects can be interpreted as a curvilinear function, expressing the results of inclinations and constraints for the possible values of aggression, independent of other effects or explanatory mechanisms.

Third, the *aggression influence* indicates the extent to which participants changed their behavior such as to minimize the average distance from their friends on the aggression scale, the so called average similarity effect in the SIENA software. This parameter represents the *influence effect*.

Analyses were conducted in six steps for both physical and relational aggression separately. First, we ran a model with the aggression selection dynamics and aggression influence dynamics only. Because density as a structural network effect is given as default, this effect was also included in the model. In the second model, reciprocity and transitivity were added to the model. In the following models, selection effects of gender, and social status (perceived popularity and social preference, separately as well as simultaneously) were entered in the model. Following this stepwise procedure, we were able to assess the relative contribution of aggression on friendship selection by taking into account features of the network, gender, and social status. All models were first run for fifth and sixth graders separately. Because findings were similar across both

samples, the SIENA analyses were again conducted on the complete sample. Results from these SIENA analyses are presented here.

To facilitate the interpretation of the results, we calculated the exponential function of the estimates (only presented in the text). For the effects of aggression and social status, we first divided the estimates by the number of answer categories on these scales minus one. As a result of this, the odds ratios for these effects reflect the effect of one unit of increase or decrease on the aggression and social status scale. Because the quadratic term is not linear, we did not calculate an odds ratio for this estimate.

RESULTS

Descriptive Statistics

Descriptive statistics are presented for all variables of this study in Table I. As can be observed, the sample was evenly distributed by gender (dummy coded). The proportion scores for physical aggression were between .06 and .08 in both samples across time points and .04 and .06 for relational aggression. Mean scores for perceived popularity and social preference (before being z-standardized) were both close to zero.

Table II displays correlations between these variables, distinguishing 5th (turning into 6th) and 6th (turning into 7th) graders. Physical and relational aggression appear to be highly correlated at concurrent time points. Although physical aggression was more stable than relational aggression over time, both forms of aggression showed higher stability among older students.

Boys were more physically aggressive than girls at both time points, no gender differences appeared for relational aggression, except boys in 7th grade being slightly more relational aggressive than girls. Furthermore, physical aggression and relational aggression were positively correlated with perceived popularity, except at time point 2 for the 5th–6th graders. Physical aggression was negatively associated with social preference only for the 5th–6th graders, whereas relational aggression was only negatively related to social preference in 5th grade. Perceived popularity and social preference showed a positive correlation, particularly for the 6th–7th graders. No gender differences were found for perceived popularity and social preference, except for girls who scored higher on social preference in 5th grade.

SIENA Results

In Tables III and IV the results of the SIENA analyses are presented for physical and relational aggression, respectively. Results of both analyses are discussed simultaneously.

In the first model the effect of aggression on friendship selection was examined, while a peer influence effect was controlled for. It appeared that physical and relational aggression affected friendship selection 1 year later (Est. $0.91 = t(267) = 4.42$, $P < .01$ and Est. $0.96 = t(267) = 2.21$, $P < .05$). Participants were 1.36 and 1.38 times more likely to select peers who were similar in physical aggression and relational aggression. Moreover, physical aggression slightly increased the number of nominations

TABLE II. Correlations for Main Variables

	1	2	3	4	5	6	7
Physical aggression Time 1	–	.54*	.66*	.26*	.27*	.24*	−.32*
Physical aggression Time 2	.70*	–	.19*	.45*	.34*	.02	−.41*
Relational aggression Time 1	.20*	.12	–	.29*	.00	.30*	−.23*
Relational aggression Time 2	.29*	.51*	.55*	–	−.05	.32*	−.04
Gender (1 = boy)	.47*	.41*	−.16	.03	–	.13	−.22*
Perceived popularity Time 1	.38*	.31*	.12	.28*	.08	–	.32*
Social preference Time 1	.04	.03	−.07	.05	−.09	.62*	–

Above the diagonal 5th–6th grade. Below the diagonal 6–7th grade.
*$P < .05$.

TABLE I. Descriptive Statistics for Main Variables

	5–6th grade				6–7th grade			
	M	SD	Range	*N*	*M*	SD	Range	*N*
Physical aggression Time 1	.07	.14	.00–.79	123	.08	.14	.00–.61	126
Physical aggression Time 2	.06	.15	.00–.87	135	.07	.13	.00–.69	139
Relational aggression Time 1	.04	.07	.00–.46	123	.06	.07	.00–.43	126
Relational aggression Time 2	.05	.07	.00–.44	135	.05	.07	.00–.44	139
Gender (1 = boy)	.51	.50	0–1	135	.53	.50	0–1	139
Perceived popularity Time 1	.03	.14	−.35–.44	123	−.01	.21	−.61–.50	126
Social preference Time 1	.02	.13	−.35–.25	123	−.00	.16	−.38–.36	126

TABLE III. Results SIENA Analyses for physical aggression ($N = 274$)

	Aggression		Network characteristics		Gender		Perceived popularity		Social preference		Soc. pref. and perc. pop.	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Network effects												
Density	−1.18*	0.04	−1.76*	.05	−2.17*	0.07	−2.23*	0.08	−2.21*	.08	−2.22*	.08
Reciprocity			1.34*	.13	1.19*	0.16	1.24*	0.13	1.22*	.17	1.21*	.16
Transitivity			0.28*	.03	0.25*	0.03	0.24*	0.03	0.22*	.03	0.22*	.03
Selection dynamics												
Physical aggression												
Effect of aggression on friendship nominations received	0.08+	0.05	0.04	.06	0.01	0.05	0.00	0.05	0.04	.04	0.05	.05
Effect of aggression on friendship nominations given	0.09*	0.04	0.04	.06	−0.05	0.05	−0.03	0.05	−0.05	.05	−0.02	.05
Selection of similar aggressive friends	0.91*	0.21	0.54*	.19	0.19	0.16	0.14	0.15	0.20	.16	0.18	.16
Gender												
Effect of gender on friendship nominations received					−0.05	0.10	−0.05	0.11	−0.05	.10	−0.05	.10
Effect of gender on friendship nominations given					0.17+	0.10	0.16	0.11	0.17	.11	0.16	.10
Selection of same-gender friends					0.73*	0.08	0.75*	0.08	0.77*	.08	0.76*	.09
Status												
Effect of popularity on friendship nominations received							0.07*	0.03			0.03	.03
Effect of popularity on friendship nominations given							−0.06*	0.03			−0.05+	.03
Selection of same-popular friends							0.51*	0.14			0.47*	.14
Effect of social pref. on friendship nominations received									0.09*	.03	0.08*	.03
Effect of social pref. on friendship nominations given									−0.02	.03	0.00	.03
Selection of same-socially preferred friends									0.25*	.11	0.15	.12
Behavioral dynamics												
Aggression linear shape	−1.12*	0.16	−1.14*	.16	−1.13*	0.16	−1.14*	0.16	−1.13*	.15	−1.14*	.17
Aggression quadratic shape	0.68*	0.07	0.69*	.07	0.69*	0.08	0.69*	0.08	0.69*	.07	0.69*	.09
Aggression influence	1.06	1.09	0.99	.89	1.03	1.02	0.98	1.18	0.98	1.01	0.96	.90

*$P < .05$/+$P < .10$.

TABLE IV. Results SIENA Analyses for Relational Aggression ($N = 274$)

	Aggression		Network characteristics		Gender		Perceived popularity		Social preference		Soc. pref. and perc. pop.	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Network effects												
Density	−1.18*	.06	−1.76*	.07	−2.21*	.09	−2.27*	.07	−2.23*	.08	−2.25*	0.09
Reciprocity			1.38*	.15	1.20*	.17	1.28*	.18	1.20*	.14	1.23*	0.16
Transitivity			0.28*	.04	0.25*	.03	0.24*	.04	0.22*	.03	0.22*	0.03
Selection dynamics												
Relational aggression												
Effect of aggression on friendship nominations received	0.01	.07	−0.07	.07	−0.05	.07	−0.11	.07	−0.02	.06	−0.06	0.10
Effect of Aggression on friendship nominations given	0.08	.07	0.05	.07	0.04	.09	0.09	.09	0.03	.07	0.08	0.08
Selection of similar aggressive friends	0.96*	.43	0.43	.29	0.43	.37	0.33	.34	0.38	.35	0.26	0.27
Gender												
Effect of gender on friendship nominations received					−0.07	.09	0.06	.09	−0.04	.09	−0.03	0.10
Effect of gender on friendship nominations given					0.11	.10	0.12	.09	0.11	.09	0.12	0.10
Selection of same-gender friends					0.76*	.09	0.76*	.08	0.78*	.08	0.78*	0.09
Status												
Effect of popularity on friendship nominations received							0.09*	.03			0.05	0.04
Effect of popularity on friendship nominations given							−0.07*	.02			−0.07*	0.03
Selection of same-popular friends							0.50*	.15			0.46*	0.14
Effect of social pref. on friendship nominations received									0.08*	.02	0.06*	0.03
Effect of social pref. on friendship nominations given									−0.02	.02	0.01	0.03
Selection of same-socially preferred friends									0.23*	.11	0.15	0.15
Behavioral dynamics												
Aggression linear shape	−0.53*	.10	−0.54*	.09	−0.54*	.09	−0.53*	.09	−0.55*	.10	−0.55*	0.09
Aggression quadratic shape	0.37*	.07	0.37*	.08	0.38*	.06	0.38*	.07	0.38*	.07	0.38*	0.07
Aggression influence	1.93*	.97	1.86*	.87	1.82*	.78	1.85*	.93	1.75+	.91	1.78+	1.00

*$P < .05$/$^{+}P < .10$.

received (Est. $0.08 = t(267) = 1.71$, $P = .09$) and nominations given (Est. $0.09 = t(267) = 2.11$, $P < .05$), suggesting physical aggressive adolescents being more attractive for peers as well as more active in the peer network.

The negative aggression linear effects indicate that adolescents were more likely to score below the mean on both physical and relational aggression. The positive aggression quadratic effects show that both forms of aggression were self-reinforcing over time, suggesting that higher values of aggression were more likely to further increase, whereas participants with low values of aggression tended to further decrease their aggression. No influence effect was found for physical aggression, whereas relational aggression appeared to be influenced by peers (Est. $1.93 = t(267) = 1.99$, $P < .05$). Participants were 1.43 times more likely to change their relational aggression in accordance with their friends' than not change their relational aggression. Additionally, we tested whether influence processes differed by gender, which appeared not to be the case (not presented here). Because these effects for aggression dynamics were consistent across all models, these findings for the behavioral dynamics are not reiterated below.

In the second model the network features reciprocity and transitivity were added to the model. Together with density, both effects were significant in the models with physical aggression and relational aggression, showing that nominations as best friend were likely to be reciprocated (OR = 3.81 and OR = 3.89) and sharing a friend increased the likelihood of becoming friends (OR = 1.32 and OR = 1.32). With regard to relational aggression, the initial significant effect of selection of similar aggressive friends disappeared when controlling for these network effects. Although for physical aggression the effect of selection of similar aggressive friends remained significant, the strength of these effects was weakened, whereas the significant effect of physical aggression on nominations received and given disappeared after the inclusion of both network features.

The significant selection effect of similar physically aggressive friends was absent, however, when gender was taken into account. Participants were 2.07 times more likely to select same-gender peers as friends, whereas selection of friends who are similar on physical aggression was unlikely (Est. $0.19 = t(262) = 1.18$, $P = .24$). A similar gender effect was found in the model with relational aggression (OR = 2.14).

In the following models, perceived popularity and social preference were added to the model. It is shown, first, that selection effects for gender remained stable in the models with perceived popularity and social preference. Further, it appeared that in both physical and relational aggression models participants were 1.11 times more likely to select friends who were similar in perceived popularity than peers who were dissimilar. Furthermore, it was found that perceived popularity increased best friend nominations received (Est. $0.07 = t(259) = 2.31$, $P < .05$ and Est. $0.09 = t(259) = 3.26$, $P < .01$), and decreased number of best friend nominations given (Est. $-0.06 = t(259) = -2.25$, $P < .05$ and Est. $-0.07 = t(259) = -2.94$, $P < .01$). With regard to social preference, participants were 1.05 times more likely to select same-socially preferred friends than peers who differed in social preference (for both physical and relational aggression models). Additionally, being socially preferred by peers increased nominations received as best friends (Est. $0.09 = t(259) = 3.39$, $P < .001$ and Est. $0.08 = t(259) = 3.52$, $P < .001$).

Finally, we examined the role of both perceived popularity and social preference in friendship selection simultaneously. In so doing, we were able to assess the relative contribution of both constructs to friendship formation over time. For both the model with physical aggression and relational aggression, being socially preferred increased the number of friendship nominations received (Est. $0.08 = t(256) = 2.42$, $P < .05$ and Est. $0.06 = t(256) = 2.24$, $P < .05$), perceived popularity slightly decreased the number of friendship nominations given (Est. $-0.05 = t(256) = 1.74$, $P = .08$ and Est. $-0.07 = t(256) = 2.06$, $P < .05$). Further, it was found that participants were more likely to select friends who were similar in perceived popularity (Est. $0.47 = t(256) = 3.34$, $P < .001$ and Est. $0.46 = t(256) = 3.23$, $P < .001$) rather than in social preference (Est. $0.15 = t(256) = 1.27$, $P = .21$ and Est. $0.15 = t(256) = .97$, $P = .33$). Thus, as expected, perceived popularity appeared to be more important underlying friendship selection than social preference.

DISCUSSION

It has often been found that aggressive adolescents are friends, reflected by similarity in aggression between friends. In this study we used longitudinal data and longitudinal network analyses (SIENA) to untangle selection and influence processes in order to find out what factors lead to such similarity effects. Previous results on friendship selection are mostly based on cross-sectional studies, making it

difficult to unravel the underlying mechanisms and thus few studies, if any, have been able to look at possible mechanisms that drive these effects. For example, some previous studies found similarity in aggression between friends to be higher compared with the similarity of other attributes, such as prosocial behavior and shyness, which led to the conclusion that, compared with other attributes, aggression has a strong impact on determining who a child associates with [Haselager et al., 1998]. However, in these studies, the relative contribution of various factors could not be adequately assessed. Both physical and relational forms of aggression may not be attributes on which friends are selected. Rather, the similarity in aggression among friends may be the by-product of other factors, including influence processes.

Even longitudinal data are not enough to test possible mechanisms. Owing to recent developments in social network analysis (SIENA), it is now possible to test for changing behaviors within changing networks, and thus to weight the roles of several explanatory factors underlying similarity among friends, including structural network effects, reciprocity and transitivity in friendships [Veenstra and Dijkstra, 2011]. Based on goal-framing theory, we specifically included gender and status effects.

The present findings initially showed that indeed adolescents select peers with similar physically as well as relationally aggression levels as friends. However, this selection effect based on aggression faded once network effects, gender, and social status were taken into account. The similarity effect of physical aggression decreased after we accounted for the fact that best friend nominations were likely to be reciprocated and that peers shared a friend (transitivity). The effect of relational aggression on friendship selection became altogether nonsignificant when structural network effects were controlled for. In other words, mutual consideration as friends and common interpersonal relationships, not aggressiveness, were significant predictors of friends' selection.

Next, as expected, the selection effect of physical aggression vanished when gender was entered into the model. The peer culture of early adolescents is gendered in nature [Adler and Adler, 1998; Maccoby, 1998] particularly with regard to physical aggression [Card et al., 2008]. Similar to existing literature, gender in our study was mainly associated with physical aggression for boys, whereas almost no gender differences were found for relational aggression [Card et al., 2008]. The results showed that in early adolescents similarity in gender trumps similarity in aggression when it comes to friendships, but the gender effects, in turn, may create the semblance of similarity based on aggression.

Also as expected, status had a strong effect on selection. We included two measures of social status, that is, perceived popularity and sociometric status (social preference). Because perceived popularity is related to aggression, whereas sociometric status is not, we expected the former but not the latter to influence the similarity in aggression among friends. Although the effects of aggression on friendship selection were already vanished, perceived popularity was as predicted a consistent factor in friendship selection, whereas sociometric status was not.

From a goal framing theory the finding that perceived popularity was more important in friendship selection than social preference was not surprising. Perceived popularity is most likely to be related to friendship selection, considering its direct link to the need-related goal of status. By contrast, the relation between social preference and need-related goals is diffuse in the sense that both affection and status are entangled within social preference. Specifically, being liked by peers reflects both affection and status, that is, the extent to which someone is seen as affectionate by someone as well as liked by many peers. Because social preference as aggregated score on the group level does not necessarily reflect personal preference on the dyadic level, it does not directly relate to the individual need-related goal of affection. Considering its overlap with status (perceived popularity) [Cillessen and Rose, 2005; Dijkstra et al., 2010a] social preference might, however, initially play a role in friendship selection, when perceived popularity is not controlled for. But once perceived popularity reflecting "pure" status is taken into account, perceived popularity is as found more likely to steer friendship selection than social preference.

Finally, these results on the selection of friends hold while controlling for the possible influence effects for aggression. This means that the selection effects of network, gender, and status factors hold even if there are possible simultaneous influence effects on aggression. For physical aggression, we found no such influence effect, but for relational aggression we found such effect across all models. Maybe this is not so surprising after all. Even though relational aggression is no basis for friendship selection, it is more of a social skill that can be learned than physical aggression and hence skilled friends can teach this form of aggression to others.

Taken together, these findings suggest mechanisms that create the semblance of (physical and relational)

aggression as a selection criterion for friendship in early adolescence, and it challenges any claim that similarity in aggression drives friendship selection. This challenge is supported by recent findings that similarity in aggression among the most aggressive male friends must be seen as a result not of active selection but of default selection, meaning that aggressive children are forced to choose each other as friends in the absence of conventional, nonaggressive peers who would like to associate with them. They would have preferred nonaggressive friends but could not realize this preference [Deptula and Cohen, 2004; Sijtsema et al., 2010a,b].

This study has some limitations that should be considered. One important limitation is the fact that in our study friendship selection was constrained within school classes, leaving out friendship relations outside school. Some studies, however, have shown the importance of outside school friends, particularly in the realm of problem behaviors [Kiesner et al., 2003, 2004]. The fact that the network data was based on limited nominations for friendships might also affect the results particularly regarding the network features. Despite artificially limiting the peer networks to a maximum of six friends, the effects of reciprocity and transitivity on friendship relations were still apparent and were likely to be underestimated rather than overestimated.

The relatively long time interval of 1 year between the two time points may also be a limitation. Although the SIENA program imputes likely developmental trajectories between time points through a simulation process that controls for unobserved changes in networks and behaviors, future research might profit from using shorter time intervals to better capture changes over time. Also, even though two time points allow one to observe selection and influence processes, longitudinal studies with more than two waves and shorter intervals are needed to better assess these processes.

Finally, our study was based on peer interactions in Chile, whereas most research on peer affiliation processes is conducted in the United States or Europe. Initially, this could be seen as challenging the generalizibility of our findings to other countries. However, correlation patterns between our key variables appeared to be consistent with those found in previous research in other countries. Moreover, developing research in diverse international contexts may help to broaden and validate the accumulated evidence on peer dynamics, showing the universal character of selection processes with regard to aggression, gender, and social status in friendship formation.

With regard to future research, we point to the importance of additional factors. Aggression may be more important in some contexts for friendship formation than in others. For instance, aggression might be more salient for the formation of friendships among low-status adolescents, or within particular peer networks characterized by weaker interpersonal bounds. Factors such as attitudes toward aggression, school performance, and depression [cf. Kupersmidt et al., 1995] may also create contexts within which the role of aggression for friendship varies. Incorporating such factors in longitudinal social network design would enhance our understanding of the developmental process in adolescents' networks and behaviors [Veenstra and Dijkstra, 2011].

In addition, the role of aggression might depend on interpersonal processes that are more visible at the peer group level through the definition of group norms [Dijkstra et al., 2008; Ellis and Zarbatany, 2007; Espelage et al., 2007], rather than show up in close, intimate relationships. Further research is needed to identify these different layers of the social experience of adolescents.

In sum, the findings of this study add to the literature on friends' similarity and throws some light on the possible mechanisms that may make aggression look like an important criterion for friendship when it actually is not. Our findings present a picture in which aggression similarity is a by-product of the role of network effects, gender and popularity status. It is due to advanced social network analyses (SIENA) that we were able to disentangle selection and influence effects in friendship formation with regard to physical and relational aggression.

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