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Disentangling dyadic and reputational perceptions of prosociality, aggression, and popularity in explaining friendship networks in early adolescence

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Abstract

This study examined the differential effects of two forms of adolescents' perceptions of peers' prosociality, aggression, and popularity, on friendship selection. Individuals' reports of their peers' behaviors (*dyadic perceptions*) and the aggregated classmates' reports (*reputational perceptions*) were disentangled. The findings indicated that adolescents were more likely to befriend classmates widely perceived as prosocial (reputational perception) and were less likely to befriend classmates they perceived as aggressive (dyadic perception). For popularity, the effect of dyadic perception disappeared when including the reputational perception. The findings highlight the differences between the dyadic and reputational perceptions of peer behavior. Not only dyadic perceptions of behaviors but also reputational perceptions exert a role in befriending peers.

KEYWORDS
aggression, friendship, perception, popularity, prosociality, RSiena

1 | INTRODUCTION

During late childhood and adolescence, friendships play an increasingly important role in achieving the fundamental goals of affection and status (Giordano, 2003; Johnson et al., 2011; Ojanen et al., 2005). While affection is associated with having warm and close relationships with others, status refers to the relative social position of a person in the peer hierarchy. In light of these goals, adolescents' evaluations of their peers' behaviors and characteristics are based on whether these are likely to help them to maintain or gain affection or status. Being perceived as prosocial, aggressive, and popular has been associated with the number of friendship nominations adolescents are given (Cillessen & Rose, 2005; Rodkin et al., 2000). Peers' prosocial and aggressive behaviors may give early adolescents information about the affection they can expect to obtain through befriending those peers, whereas peers' popularity may offer information on the status they might gain through friendships. However, little research has been done into whether adolescents rely on their own perceptions of a peer's behavior (*dyadic perceptions*) or the reputation of that peer (*reputational perceptions*) when selecting friends, referring to making, keeping, ending, and avoiding friendships.

Most research into the characteristics, which contribute to friendships, has aggregated peer nominations (e.g., who is popular?, who cooperates with others?) at the group level by counting the number of nominations received by each student in the classroom (or grade), and then either standardized these scores (*z*-scores) or divided them by the total number of possible nominations (proportion scores). These scores reflect the agreement among peers about friendships, status, or behaviors. However, individual students differ in who they nominate as, for instance, aggressive and as a friend. Disentangling dyadic nominations from aggregated scores might elucidate, for example, why previous researchers have consistently found that although aggressive peers are usually rejected by others (Ladd, 2006), they still have a considerable number of friends (Rodkin et al., 2000). Perhaps some classmates consider aggressive peers violent and, therefore, do not nominate them as friends; conversely, those students who nominate aggressive peers as friends might not perceive them as aggressive. Unfortunately, analyses that focus exclusively on the aggregated level are unable to disentangle the dyadic from the reputational perceptions.

Therefore, we examined whether the dyadic perceptions of peers' characteristics add any value to the conventional reputational measures by studying their differential effects on the formation and maintenance of friendship networks.

We aimed to tackle this issue by distinguishing between how early adolescents' own perceptions (*dyadic perceptions*) and peers' reputations (*reputational perceptions*) regarding their behaviors and characteristics are related to friendships. Specifically, we were interested in disentangling: (1) the effect of student *i*'s perception of student *j*'s characteristics on student *i*'s friendship nomination to *j* (e.g., How does Jenny's perception of Jim as aggressive affect her friendship nomination to Jim?); and (2) the effect of other peers' nominations to *j* on *i*'s friendship nomination to *j* (e.g., How does Jim's reputation for being aggressive affect Jenny's friendship nomination to him).

However, dyadic and reputational perceptions are not independent. First, dyadic perceptions are subsumed in an aggregated reputational perception. Second, the reputation of a peer's behavior is one information source of my perception of that peer. We hypothesized that adolescents would positively evaluate prosociality and popularity and negatively evaluate aggression by befriending or avoiding peers with these characteristics, respectively. Furthermore, we expected that the reputation of peers' prosociality, aggression, and popularity would affect friendships through dyadic perceptions. To help disentangle these processes, we used longitudinal social networks analysis. Disentangling both processes might allow understanding peer processes and the effects of both types of perceptions on friendships. Our findings can inform researchers about the processes that underlie how children establish their social relationships.

1.1 | Early adolescent friendships

Peer relationships become very important in adolescence as youth spend increasingly more time with friends (Larson & Richards, 1991). Friendships not only gradually increase in intimacy and emotional support (Furman & Buhrmester,

1992; Shulman et al., 1997), but also play a role in adolescents' adaptation (Bagwell & Schmidt, 2011). Social behaviors (i.e., aggression and prosociality) may serve the goal of establishing both intimate relationships with peers and an individual's standing in a group (Ojanen et al., 2005). The goal-framing theory (Lindenberg, 2001, 2008) proposes that individuals pay close attention to what they think is instrumental in (or impedes) the achievement of their goals. Based on this framework, earlier studies have shown that adolescents would prefer friends who increased the amount of affection and status they received, and avoid befriending those who caused this to be decreased (Dijkstra et al., 2010; Huitsing et al., 2014; Veenstra et al., 2010). As friendships contribute to the achievement of both affection and status, identifying which characteristics make peers attractive as friends is crucial (Lindenberg, 1996). In this study, we assumed that students would be aware of peer characteristics that could potentially help or hinder the pursuit of affection and status.

1.2 | Dyadic and reputational perceptions of prosociality and aggression, and friendships

Friendships reflect personal preferences at the dyadic level, which directly links to the goal of affection. Friendships become more important as adolescents increasingly interact with each other (Newcomb & Bagwell, 1995) and are, therefore, central to fulfilling the needs for intimacy and belonging (Bukowski & Sippola, 2005). Behavioral characteristics such as prosociality and aggression might indicate the affection that a potential friendship will yield. Friendships made up of at least one aggressive member are characterized by more frequent, lengthy, and intense conflicts, whereas friendships among prosocial peers show positive qualities and less conflict (Cillessen et al., 2005). Here, we argue that early adolescents' perceptions of peers' prosocial and aggressive behaviors may provide valuable information about the quality of the potential friendship. Perceptions of peers' prosocial and aggressive behavior might enable adolescents, on the one hand, to obtain affection by establishing supportive and trustful friendships with prosocial peers, and, on the other hand, to avoid detrimental friendships by avoiding aggressive peers.

Starting in early adolescence, peers play a central role as recipients and sources of support (del Valle et al., 2010). Prosocial behavior is closely related to friendship emergence, stability, and satisfaction (Barry & Wentzel, 2006; Hiatt et al., 2015; Parker & Asher, 1993), because intimacy and mutuality, two important aspects of friendships, can be reached through the exchange of help and support. Prosocial peers tend to form and maintain friendships more frequently than their less prosocial peers (Bowker et al., 2010), and to establish more positive interactions and experience positive well-being (Cillessen et al., 2005). Furthermore, compared with other classmates, prosocial adolescents are inclined to value their interactions more and be more intrinsically motivated to build relationships (Hawley et al., 2002). These findings highlight the importance of being nice, kind, and helpful for friendships. Prosocial peers are likely to be viewed as attractive potential friends with whom one can have fun and whom one can trust (Asher et al., 1996). Because prosocial behavior is linked to establishing intimate and close interactions, we expected that early adolescents would befriend peers based on their own perceptions of their peers' prosocial behavior (*Hypothesis 1*).

Conversely, physical aggression is usually seen as a negative feature because it directly compromises closeness and intimacy with a peer (Ojanen et al., 2012). Aggressive youth tend to develop poorer interactions with their peers: for example, excluding their peers and experiencing diminished well-being (Slee, 1995). Aggressive adolescents tend to have an unclear understanding of relational expectations, often hampering the establishment of social relations by being perceived as unfriendly (Veenstra, 2006). Furthermore, some aggressive children lack the necessary social skills to provide emotional and practical support, causing them to be less attractive as potential friends (Sijtsema et al., 2010a). Moreover, aggressive children can develop instrumental friendships. For example, bullies usually pursue friendships strategically to attain power and status instead of personal fulfillment (Hawley et al., 2002; Ryan & Shim, 2008). As aggression is linked to having detrimental relationships, we expected that early adolescents would avoid befriending peers based on their own perceptions of peers' aggressive behavior (*Hypothesis 2*).

1.3 | Dyadic and reputational perceptions of popularity and friendships

Social status becomes increasingly important for early adolescents, in particular perceived popularity, which is usually understood as an indicator of social prominence (Cillessen, 2011). Popularity has been portrayed as a shared recognition among peers that a particular individual holds power, prestige, visibility, and social dominance (Cillessen et al., 2011; Bellmore & Cillessen, 2006). Consequently, peer relationships and groups are, to a large extent, defined along the dimension of popularity (Dijkstra et al., 2013). In order for adolescents to be popular, it is necessary that others want to be associated with them (Dijkstra et al., 2010). Popular peers possess characteristics that make them more attractive as friends. These characteristics include being physically attractive, being fun to hang around with, being visible, and being socially powerful (Adler & Adler, 1998; Hawley et al., 2007; Vaillancourt & Hymel, 2006). From a goal-framing perspective, it may be useful for early adolescents to befriend popular peers to achieve status (Dijkstra et al., 2010; LaFontana & Cillessen, 2010). Befriending high-status peers can enhance one's own status, a phenomenon known as "basking in reflected glory" (Cialdini & Richardson, 1980). This potential improvement of status would act as motivation to befriend popular peers. We expected that early adolescents would befriend peers based on their own perceptions of their peers' popularity. Specifically, individuals would recognize that some peers are more popular than others, and then selectively befriend those peers (*Hypothesis 3*).

Although the goal of the present study is to disentangle and test the contribution of the dyadic and reputational perceptions' separately, these effects might not be independent. Reputation of peers' behavior is built on adolescents' individual perceptions; therefore, any dyadic perception will be subsumed within a reputational perception. Consequently, we expected that reputational perceptions of peers' prosociality, aggression, and popularity would operate through dyadic perceptions. This means that adolescents would befriend peers that they perceived as prosocial and popular, and avoid befriending peers that they perceived as aggressive. For this purpose, we used longitudinal social networks analysis: specifically, the stochastic actor-oriented models (SAOM) (Ripley et al., 2018).

2 | METHODS

2.1 | Sample

Participants were 1171 fourth, fifth, and sixth graders (48% girls $_{T1}$; age range $_{T1}$ = 10–12 years) from 30 classrooms in four private subsidized schools in metropolitan Santiago, Chile. Private subsidized schools represent 54.6% of schools in Chile (Ministerio de Educación de Chile, 2015). According to the Chilean national socioeconomic classification, one school corresponds to lower-middle, two schools to middle, and one school to upper-middle socioeconomic status (based on parents' educational level, family income, and the school vulnerability index, which measures the percentage of students in a school that is considered vulnerable based on family income, medical needs, birth weight, and residential conditions). In the Chilean education system, students tend to spend their entire elementary education (first to eighth grade) with the same classmates and in the same schools. Therefore, classrooms are stable environments in which peer relationships unfold. Despite this particularity, research into adolescent peer relationships using Chilean samples has shown patterns similar to those found in American and European populations (Berger et al., 2015, 2019).

In view of SAOM missing data requirements, only classrooms that had an average participation rate higher than 80% between the two waves were included in the analyses, resulting in a sample of 18 classrooms (for excluded classrooms, see Table A1 in the Appendix). Because the participation rate declined considerably from the third wave onwards, we only examined Waves 1 and 2 (collected in April and October of the same academic year). The final sample contained 728 students from 18 classrooms (47% girls) (see Table 1).

TABLE 1 Changes in networks variables across the two observations in the included classrooms ($N = 18$)

Class	Size	Miss. T1	Miss. T2	Miss. Av.	Jacc.	Dist.	FR T1	FR T2	FR 0 → 1	FR 1 → 0	FR 1 → 1	% girls	PR T1	AG T1	PO T1
1	38	.13	.00	.06	.19	249	6.97	4.47	79	170	60	63.2	.14	.10	.21
2	40	.15	.00	.07	.19	381	8.50	7.12	182	199	90	55.0	.13	.10	.17
3	38	.05	.00	.02	.32	255	7.36	6.05	107	148	117	36.8	.08	.12	.17
4	40	.17	.02	.10	.33	311	9.66	8.51	146	165	154	52.5	.19	.13	.20
5	41	.02	.05	.04	.21	486	12.90	7.10	145	341	130	39.0	.19	.14	.29
8	41	.09	.14	.12	.37	360	10.27	11.17	166	140	181	42.5	.19	.14	.24
9	41	.07	.19	.13	.37	291	9.13	11.09	171	120	168	51.2	.16	.14	.17
11	37	.11	.10	.10	.32	190	6.31	5.27	78	113	90	51.4	.16	.16	.20
12	38	.10	.18	.15	.39	235	9.26	10.25	140	95	152	44.7	.12	.15	.23
13	39	.13	.05	.09	.34	238	7.13	8.43	139	110	127	53.8	.22	.12	.26
14	36	.17	.14	.15	.33	197	6.73	7.48	108	89	98	44.4	.14	.12	.22
17	38	.26	.10	.18	.35	179	6.51	8.85	106	73	97	31.6	.16	.14	.17
18	40	.15	.15	.15	.35	367	12.55	10.73	154	213	193	60.0	.23	.09	.32
20	45	.35	.00	.18	.37	259	9.55	8.93	131	128	149	42.2	.16	.14	.17
21	43	.14	.00	.07	.38	240	7.73	6.62	103	137	149	48.8	.12	.06	.09
22	43	.25	.02	.14	.44	305	15.53	9.42	73	232	238	46.5	.24	.10	.23
23	45	.40	.00	.20	.43	253	11.59	8.24	127	126	187	.35.6	.20	.05	.18
24	45	.22	.00	.11	.47	235	9.60	7.20	108	127	209	40.0	.08	.03	.13
Tot/Av.	728	.16	.06	.11	.34	279.50	9.29	8.16	125.7	151.4	143.8	47.27	.16	.11	.20

Note. Jacc, Jaccard index; Dist., Hamming distance; FR 0→1, number of created friendships ties; FR 1→0, number of dissolved friendships ties; FR 1→1, number of maintained friendships ties; PR T1, proportion score of prosociality at Time 1; AG T1, proportion score of aggression at Time 1; PO T1, proportion score of popularity at Time 1.

2.2 | Procedure

Principals were approached and informed about the study and asked for their authorization. Surveys were administered to the whole classroom during regular classroom hours in the presence of research assistants; this took approximately 45 min per classroom. The participants answered the questionnaire individually; trained administrators assisted when needed. All instruments and procedures were approved by the Institutional Review Board of the local university and the funding institution. Parents' active consent and students' assent were gathered for all participants taking part in a 3-year research project (five assessments, with 6-month intervals) focused on peer relationships (see also Berger & Caravita, 2016; Cuadros & Berger, 2016; Palacios & Berger, 2016).

2.3 | Measures

A standard peer-nominations procedure was used to assess prosociality, aggression, popularity, and friendships (Berger & Rodkin, 2012; Cillessen & Mayeux, 2004; Logis et al., 2013). Participants were asked to nominate classmates from a roster with all names listed.

Friendship (T1–T2). Participants could nominate an unlimited number of their classmates whom they considered to be their best friends ("Who are your best friends?").

Using the best friends' networks allowed us to focus on close relationships instead of general friendships or acquaintance relationships. Being best friends is closely linked to characteristics of friendship quality, such as affection and intimacy (Berndt & Keefe, 1995; Cleary et al., 2002; Sebanc et al., 2007), rather than only hanging out with peers. We constructed adjacency matrices for friendships, for each classroom in each wave; 0 and 1 represented the absence and presence of a nomination between actors *i* and *j*, respectively.

A small number of students named almost everyone (above 85%) in their classrooms as friends (seven and four participants in the first and second wave, respectively). These eleven students were scattered across seven classrooms. As these students may have interpreted the question differently from their classmates, we recoded their outgoing nominations as missing data while retaining their incoming nominations. Similar strategies to handle outliers have been used in previous research using longitudinal social network analyses (Light et al., 2013; Van Rijsewijk et al., 2019).

Prosociality, aggression, and popularity (T1). Participants could nominate an unlimited number of their classmates whom they considered prosocial ("Who cooperates? They help and share with others"), aggressive ("Who starts fights? They hit, kick, or punch others"), and the most popular in their classroom ("Who are the most popular and visible students in your class?"). For dyadic perceptions, we constructed adjacency matrices for each classroom in Wave 1, with 0 and 1 representing the absence and presence of a nomination between actors *i* and *j*, respectively. For reputational perceptions, we computed proportion scores for each variable (at Wave 1) by taking the number of nominations received for each variable and dividing them by the number of participants in the classroom minus 1. Overall, the distributions of the proportion scores for prosociality, aggression, and popularity in classrooms exhibited a similar pattern, with left-skewed and leptokurtic distributions, indicating a large concentration of students with low values for the three variables (for details, see Table A2 in the Appendix).

Sex. Boys were coded 0, and girls were coded 1.

2.4 | Analytic strategy

Analyses were conducted using longitudinal social network modeling (SAOM) (Snijders et al., 2013). This approach allows the effects of dyadic and reputational perceptions of prosociality, aggression, and popularity on friendship networks to be unraveled while taking network structural effects (e.g., reciprocity, transitivity) and students' individual covariates (e.g., sex) into account. SAOM (Snijders et al., 2010) assume that actors (here: students) modify their

relationships (here: friendships) between assessments based on structural (network) and individual preferences. The model determines likely trajectories between observations using information from the first wave as a starting point. The estimates of the model are obtained through an iterative simulation following a Markov Chain approach, expressing the strength of the effects included in the model. The unstandardized estimates resemble regression coefficients in logistic regression, indicating the strength of each effect in creating or maintaining a tie. Model parameters were tested using *t*-ratios, referring to the parameter estimate divided by its standard error.

Missing data due to non-response were handled through the RSiena default missing data method, and participants who joined and left the classroom network between time points were treated using structural zeros (i.e., impossible nominations). The model was estimated for each classroom separately using the Methods of Moments estimator and specifying 5000 iterations in phase 3 for calculating standard errors. The estimation was performed in two steps. First, we analyzed each classroom separately and made sure that the algorithm converged well. The convergence criterion used for the analyses was an overall maximum convergence ratio of less than .25, and for all the individual parameters *t*-ratios for convergence of less than .1 in absolute value (Ripley et al., 2018). Second, for each model, the findings of all classes' analyses were combined in a meta-analysis using the Snijders-Baerveldt test (Snijders & Baerveldt, 2003). The meta-analysis combined the analyzed parameter estimates across classrooms by testing the mean and variance of parameter values among classrooms, and making inferences about the sample parameters in the target population.

Goodness-of-fit tests were conducted for each class to assess how well the model reproduced the observed data (Lospinoso & Snijders, 2019). Overall, the results for the four types of networks indicated a good representation of the indegree, outdegree, and geodesic distance distributions, and the triad census in all classrooms (*p* values between .10 and .90).

2.5 | Model selection procedure

We included four types of effects: rate effects that model students' opportunities to maintain ties, drop existing ties, or create new ties; structural network effects that model how the changes in each network depend on the network itself; dyadic covariate effects for measuring the impact of dyadic perceptions on friendships; and covariate effects that model how changes in each network depend on the attributes of actors (e.g., same-sex effect, reputational perceptions).

Structural network effects were included to control for the basic tendencies of actors to form and maintain friendship relationships. *Reciprocity* is the tendency toward reciprocation of friendships. We used the transitive version of the geometrically weighted edgewise shared partners (*GWESPFF*) to measure *transitivity*, which reflects the tendency to befriend friends of friends. In addition, we included three degree-related effects to differentiate between actors who received or sent relatively more (or few) friendship nominations. The *indegree-popularity* effect reflects the tendency of actors with an already relatively high number of incoming nominations to attract additional friendship nominations, whereas the *outdegree-activity* effect reflects the tendency of actors with an already high tendency to nominate others to send additional friendship nominations. Finally, the *outdegree-popularity* effect reflects the tendency to which nominating relatively more peers as friends leads to relatively more incoming friendship nominations.

In order to test our hypotheses, we analyzed both the dyadic and the reputational level dependencies. On the one hand, to measure the effect of dyadic perceptions on friendships, we operationalized prosociality, aggression, and popularity nominations as constant dyadic covariates. Specifically, we examined whether dyadic prosociality, aggression, or popularity nominations led to friendship nominations. On the other hand, we operationalized reputational perceptions as the proportion of incoming prosociality, aggression, and popularity nominations and then incorporated the *alter* effect for the three variables in the model. Thus, we analyzed whether the received number of nominations for prosociality, aggression, or popularity led to friendship nominations. Moreover, we included the *ego* and *similarity* effects for prosociality, aggression, and popularity to control for the tendency of students high in those covariates

to nominate more friends and to befriend classmates who are similar in those covariates, respectively. We used the dyadic nominations and reputation scores for prosociality, aggression, and popularity at Wave 1.

Furthermore, we controlled for sex in the analyses. Research has shown that sex has an impact on friendship, prosociality, aggression, and popularity nominations (Card et al., 2008; van der Ploeg et al., 2020; Van Rijsewijk et al., 2016; Veenstra et al., 2013). We included the *same-sex* effect, indicating whether nominations tend to occur more often between students of the same sex.

Additionally, we constructed selection tables. These selection tables enabled us to interpret the combination of the ego, alter, and similarity effects (Ripley et al., 2018). The values in the selection tables represent the attractiveness of befriending similar peers (values on the diagonal) vs. dissimilar peers (off-diagonal values).

3 | RESULTS

3.1 | Descriptive statistics

Table 1 provides the descriptive statistics averaged across the 18 classrooms. The average degree shows that students nominated around nine classmates as friends in the first assessment and eight classmates in the second assessment. The Jaccard indices, which indicate the proportion of stable nominations among the total number of created, dissolved, and stable friendships, showed enough stability (.34 on average) for SAOM estimations. Only two classrooms had Jaccard indices below the recommended .30 threshold (Ripley et al., 2018), but this did not cause estimation difficulties. Regarding the dyadic nominations at Wave 1, students identified, on average, six students as prosocial, five as aggressive, and eight as popular. Regarding students' reputations on the same variables, the proportion scores at Wave 1 were, on average, .16 for prosociality, .11 for aggression, and .20 for popularity.

3.2 | Longitudinal social network analysis

Table 2 presents the results of the SAOM meta-analysis for friendship networks. The estimates and standard errors are based on the three models estimated separately for the 18 classrooms. We present three different models, which all include the structural network and the same-sex effects. The dyadic model includes the dyadic effects of prosociality, aggression, and popularity as well, whereas the reputational model includes the reputational effects of prosociality, aggression, and popularity. The full model contains both the dyadic and the reputational effects. As the results were similar across the three models, we report the findings of the full model below, unless we state differently.

Structural network effects and sex. Students had, on average, 17 opportunities for changing (or not) their friendship ties. Friendships were likely to be reciprocated (Est. = 1.16; $p < .001$), and friends of friends tended to be friends as well (Est. = 1.27; $p < .001$). We also found a tendency toward *same-sex* friendships (Est. = .44; $p < .001$). The negative *indegree-popularity* effect indicates that students who received many nominations were less likely to receive more nominations over time (Est. = −.05; $p < .001$). Moreover, the negative *outdegree-popularity* effect indicated that students who sent many nominations received fewer nominations over time (Est. = −.05; $p < .001$). The positive *outdegree-activity* effect indicated the tendency for students who had already nominated many others as friends to send extra friendship nominations (Est. = .01; $p < .01$).

Prosociality. We found that adolescents befriended classmates based on similar levels of prosociality (Est. = .26; $p < .01$), but there was no significant effect of prosociality on the number of outgoing friendship nominations. Regarding Hypothesis 1, and contrary to our expectations, we found that widely perceived prosocial peers were more likely to be nominated as friends (Est. = .81; $p < .01$), but there was no significant dyadic effect (Est. = .03; $p = .589$). Thus, only reputational perceptions of peers' prosociality played a role in friendship selection. The selection table (upper section of Table 3) revealed that adolescents strongly prefer prosocial peers. Highly prosocial adolescents had the strongest

TABLE 2 SAOM meta-analysis (18 classrooms): estimates, standard errors, *p* values, and differences between classrooms

	Dyadic model			Reputational model			Full model		
Friendship networks	**Est.**	***SE***	σ	**Est.**	***SE***	σ	**Est.**	***SE***	σ
Rate parameter[a]	18.85***	1.06	3.06***	18.64***	1.01	3.16***	17.72***	.79	1.83*
Density	−2.28***	.11	.33**	−2.22***	.10	.26*	−2.24***	.10	.28*
Reciprocity	1.20***	.10	.35***	1.16***	.11	.37***	1.16***	.10	.36***
Transitivity GWESPFF	1.30***	.07	.13	1.26***	.07	.14	1.27***	.07	.12
Indegree-popularity	−.03***	.01	.02	−.05***	.01	.00	−.05***	.01	.00
Outdegree-popularity	−.07***	.01	.03***	−.06***	.01	.03***	−.05***	.01	.03***
Outdegree-activity	.01†	.00	.01**	.01***	.00	.01**	.01*	.00	.01**
Same-sex	.40***	.04	.12	.45***	.05	.17***	.44***	.06	.19***
Prosociality ego	–	–		−.38	.38	1.35***	−0.49	.39	1.40***
Prosociality similarity	–	–		.25*	.11	.24†	.26**	.11	.25†
Aggression ego	–	–		.29	.25	.71**	.25	.25	.73***
Aggression similarity	–	–		.14	.16	.49**	.16	.15	.45***
Popularity ego	–	–		−.77***	.18	.47**	−.74***	.17	.42***
Popularity similarity	–	–		.27*	.11	.34*	.24*	.12	.35**
Prosociality (dyadic)	.06	.05	.16**	–	–		.03	.05	.14†
Prosociality alter (reputational)	–	–		.81***	.24	.59†	.81**	.26	.67†
Aggression (dyadic)	−.15**	.06	.14†	–	–		−.13†	.07	.15
Aggression alter (reputational)	–	–		−.29	.22	.58*	−.18	.23	.56*
Popularity (dyadic)	.17**	.06	.23***	–	–		.03	.08	.27***
Popularity alter (reputational)	–	–		1.02***	.14	.00	1.01***	.16	.20

Notes. †$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$. ; Est. = unstandardized coefficients; σ = across-classrooms standard deviation; SE = standard error.

[a]Due to the large standard errors (above 5), the rate parameter was fixed to the average of the rest of the classes in four classrooms in the dyadic and full model, and in two classrooms in the reputational model.

aversion to peers with lower levels of prosociality. Friendships based on similarity in prosociality were the most likely preference for highly prosocial adolescents.

Aggression. We found no significant ego and similarity effects for aggression (Est. = .25; $p = .31$; Est. = .16; $p = .30$), suggesting no differences in outgoing friendship nominations based on aggression levels, or in friendships based on similar levels of aggression. Regarding Hypothesis 2, we found that adolescents have a slight tendency to avoid befriending peers who they perceive as aggressive (Est. = −.13; $p = .06$). Conversely, we did not find that peers with an aggressive reputation were less befriended (Est. = −.18; $p = .42$). These results were in line with our hypothesis regarding aggression: adolescents avoid befriending aggressive peers based on their own perceptions rather than on the reputational perceptions of those peers. The selection table (middle section of Table 3) showed an aversion of students with lower aggression levels to befriending peers with high aggression levels.

Popularity. We found that popular adolescents were less likely to nominate friends than less popular peers (Est. = −.74; $p < .001$). Moreover, friendships were based on similar levels of popularity (Est. = .24; $p < .05$). Regarding Hypothesis 3, we found that students with relatively more incoming nominations were more likely to be named as friends (Est. = 1.01; $p < .001$). However, a dyadic effect was found only in the dyadic model (Est. = .17; $p < .01$), but not in the full model when the reputational effect was controlled (Est. = .03; $p = .735$). These results only partially

TABLE 3 Selection table for friendship networks showing the attractiveness of different prosocial, aggression, and popularity values

	Prosociality alter values			
Prosociality ego values	**Null**	**Low**	**Moderate**	**High**
Null	−.00	.12	.25	.37
Low	−.20	.08Z	.20	.33
Moderate	−.40	−.12	.16	.29
High	−.59	−.31	−.04	.24
	Aggression alter values			
Aggression ego values	**Null**	**Low**	**Moderate**	**High**
Null	.03	−.08	−.20	−.31
Low	.03	.05	−.06	−.18
Moderate	.02	.05	.08	−.04
High	.02	.04	.07	.10
	Popularity alter values			
Popularity ego values	**Null**	**Low**	**Moderate**	**High**
Null	.01	.15	.29	.43
Low	−.28	.08	.22	.36
Moderate	−.57	−.21	.16	.30
High	−.87	−.50	−.14	.23

Note. This table shows the net effects of prosociality, aggression, and popularity of ego and alter on the evaluation function (the tendency to select or not select friends based on their prosociality, aggression, or popularity values). As our covariates were measured as proportion scores, we established four values for ego and alter values: null (0% nominations), low (25% of potential nominations), moderate (50% of potential nominations), and high (75% of potential nominations).

support our hypothesis regarding popularity, in which we expected that the dyadic effect would drive the selection of friends rather than the reputational one. Moreover, the selection table (lower section of Table 3) suggests that adolescents strongly prefer popular peers. Highly popular adolescents had the strongest aversion to peers with lower levels of popularity, and friendship based on similarity in popularity was the most likely preference for popular adolescents.

4 | DISCUSSION

In this study, we aimed to disentangle the extent to which the dyadic and reputational perceptions of prosociality, aggression, and popularity affect friendship networks in a sample of early adolescents in Chilean schools. We tested whether conventional measures of reputational perceptions or dyadic perceptions matter for friendship selection. We aimed to disentangle the extent to which the dyadic and reputational perceptions of prosociality, aggression, and popularity affect friendship networks. We distinguished between the effects of ego befriending alter based on ego's own perception of alter behavior (dyadic perception), and ego befriending alter based on alter's reputation (reputational perception).

Based on the goal-framing theory, we assumed that students would be aware of peer characteristics that could potentially help or hinder the pursuit of affection and status. We anticipated that adolescents would evaluate prosociality and popularity positively, and evaluate aggression negatively by befriending or avoiding peers with these characteristics, respectively. To this end, we used a longitudinal network approach, which yields a richer understanding of the development of early adolescents' friendship dynamics. The novelty of our approach was to disentangle the dyadic

and reputational perception of these characteristics as drivers for friendship selection. Because dyadic and reputational perceptions are not independent (dyadic perceptions are subsumed in an aggregated reputational perception), we expected that the reputation of peers' prosociality, aggression, and popularity would operate through dyadic perceptions. Therefore, we hypothesized that adolescents would befriend peers that they perceived as prosocial and popular, and would avoid befriending peers that they perceived as aggressive.

First, we hypothesized that adolescents would befriend classmates based on their own perceptions of peers' prosociality. However, our findings indicated the opposite: early adolescents preferred to befriend peers with a prosocial reputation. No significant results were found for befriending peers who were perceived as prosocial on the dyadic level. These findings also held in the model in which we excluded the reputation effect. This finding is in contrast to previous literature showing that prosocial behaviors might facilitate the formation of friendships in early adolescence (Bowker et al., 2010; Gest et al., 2001). Why would adolescents befriend peers based on the perception of their prosocial reputation rather than the dyadic perception? Peers with a prosocial reputation are often seen as likeable (Peeters et al., 2010; Warden & Mackinnon, 2003). This likeability is associated with the quality of a friendship, including the closeness and intimateness to their peers (Cillessen & van den Berg, 2012; Rubin et al., 2006).

Second, we hypothesized that adolescents would avoid befriending aggressive peers based on their own perceptions. As expected, early adolescents were less likely to befriend classmates they perceived as aggressive (dyadic perception), whereas we did not find evidence that peers who were widely regarded as aggressive were less befriended (reputational perception). In other words, for aggression, it was the dyadic rather than the reputational perception that matters for friendship selection. Our findings indicated that aggression is seen as an undesired characteristic as it might not allow the establishment of supportive, intimate, and meaningful friendships (Ojanen et al., 2012; Sijtsema et al., 2010b). Friendships are usually based on positive features such as intimacy and support, and the absence of negative features such as conflict, competition, and aggression (Berndt, 1996; Buhrmester, 1996). The risks of befriending an aggressive peer may be perceived as high. In addition, being dissimilar in physical aggression may lead to friendship dissolution (Hartl et al., 2015), because dissimilarity could lead to unequal relationship costs in which the less aggressive friend is likely to be on the receiving end of partner aggression (Crick & Nelson, 2002).

Third, we expected that adolescents would befriend popular peers based on their own perceptions of peers' popularity. However, the findings are mixed because the effect of dyadic popularity was present in the dyadic model (without the reputational effect), but it became absent when reputational perception was included in the full model. These results suggest that the reputational effect better captures peers' popularity than a dyadic nomination. Popularity is salient in adolescents' peer relationships by being strongly connected to friendship selection. Early adolescents give increasing importance to power, prestige, visibility, and social dominance in the transition from late childhood to adolescence (Cillessen, 2011). Popular adolescents are considered attractive as friends, probably because they are fun to hang around with, are active and socially powerful (Hawley et al., 2007; Vaillancourt & Hymel, 2006), and can contribute to the enhancement of one's own status (Cialdini & Richardson, 1980). However, searching for status through befriending popular peers is not necessarily straightforward as popular peers are selective in reciprocating friendships (Berger & Dijkstra, 2013). This has repercussions for those who befriend popular adolescents, because individuals tend to discontinue unreciprocated relationships (Gould, 2002), as the one-sided display of respect and admiration might lower one's status. In sum, the dyadic perceptions are related to friendship formation and maintenance, but are overruled as soon as the popularity reputation is taken into account. This provides support for the common practice to measure popularity based on aggregated peer nominations, which reflects the reputation instead of the dyadic perception.

Overall, these findings seem only partially support the goal-framing theory. Adolescents would pursue both affection and status (Veenstra et al., 2010) by befriending classmates that they perceive as popular and avoid befriending classmates that they perceive as aggressive. In this way, they can obtain more status and avoid detrimental relationships that do not lead to affection.

Furthermore, the distinction between dyadic and reputational perceptions offers a fine-grained picture of the ways in which perceptions of others' behavior affect peer relationships and the pursuing of social goals. This study is aligned

with recent research focused on how adolescents' perceptions of peer behavior affect their own peer relationships. This research has examined the effects of dyadic perceptions of disdain and respect on disliking and gossiping relationships (Kisfalusi et al., 2019; Pál et al., 2016) and the effects of victimization and aggression on friendships and disliking (Palacios et al., 2019; Rambaran et al., 2020). Our study extends this literature by examining the extent to which the dyadic and reputational perceptions of peers' prosociality, aggression, and popularity affect the formation and maintenance of friendship networks.

4.1 | Limitations and directions for further research

By disentangling the effects of dyadic and reputational perceptions of prosociality, aggression, and popularity on friendship selection, our findings contribute to research on peer relations. We used sample data from Chilean students in fourth, fifth, and sixth grade who were observed twice during one academic year. The analyses were conducted using an actor-based simulation approach, where individual decisions to change across time points were predicted by network properties, dyadic, reputational, and individual attributes. Models were estimated independently for each classroom and then summarized using a meta-analytic technique. Despite these strengths, we also have to acknowledge some limitations. First, our measures of dyadic perceptions referred to who is perceived as prosocial or aggressive in general, but not necessarily prosocial or aggressive to the respondent. We expect that information on adolescent's perceptions of each classmate's behavior (e.g., who helps you when you have a problem?; who is aggressive to you?) would be a more direct way to evaluate dyadic perceptions in further research. A recent study indicated that such a direct measure of prosocial relations ("who helps you with problems like homework, or when you are feeling down") is positively associated with friendship initiation and maintenance (Van Rijsewijk et al., 2019).

Second, this study relied on one item each to measure prosociality, aggression, and popularity. This limits the reliability of the sociometric scores, particularly for the behavioral constructs (Marks et al., 2013). Future studies might include two or more items to measure each of these constructs. Third, we examined the impacts of prosociality, aggression, and popularity on friendships separately. Future studies might include interaction effects to explore when students exhibit two or more of these features simultaneously (e.g., Are children more likely to befriend peers with a reputation for popularity if they are also prosocial, but not if they are aggressive?). Similarly, we assumed that perceptions of prosociality, aggression, and popularity were exogenous. However, there is evidence that friendships predict status (Hashimi & Schaefer, 2018; Labun et al., 2016) or prosociality (Van Rijsewijk et al., 2016, 2019).

Therefore, bidirectional associations should be included in future study designs. Finally, we did not include a measure of peer norms, which reflect the expected and accepted behavior of a social group (Veenstra et al., 2018). Because the display of aggressive and prosocial behaviors might depend on conformity to the peer context (Laninga-Wijnen et al., 2017; Wentzel et al., 2007), researchers may wish to consider the role of social norms.

5 | CONCLUSION

During adolescence, affection and status emerge as two significant goals. Early adolescents become aware of what they think is instrumental in (or impedes) the achievement of these goals. As a result, they focus on cues and information that help them predict the usefulness of peer features for the realization of their goals. Adolescents' individual characteristics would affect the formation and maintenance of peer relationships, such as friendships (Bagwell & Schmidt, 2011). In this article, we examined the extent to which early adolescents' dyadic and reputational perceptions of their peers' prosociality, aggression, and popularity affected friendship networks. Friendships were driven by the dyadic perceptions of peers' aggression and by the reputational perceptions of peers' prosociality. For popularity, the effect of dyadic perception disappeared when including the reputational perception. Overall, these results suggest that peer characteristics play different roles in friendship formation depending on how they are perceived. Our study highlights the importance of disentangling dyadic and reputational perceptions of peer attributes. Future research can

refine this distinction by, for example, examining scenarios in which the dyadic and reputational perceptions of an individual coincide or not, and their effects on positive (e.g., friendship, liking) and negative relationships (e.g., disliking).

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ETHICAL APPROVAL

All instruments and procedures were approved by the Institutional Ethics Review Board of the sponsoring university and were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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