

Embeddedness and Empathy:

How the Social Network shapes Adolescents' Social Understanding

### **Abstract**

Based on theories of social-cognitive development, the present study investigated the yet unknown social structure that underlies the concept of empathy in adolescence. A total of 3,159 seventh graders (13.67 years, 56% girls) from 166 school classes participated by providing information on empathy, related psychosocial factors, and friendship patterns. Social network analyses were used to measure a comprehensive representation of adolescents' social environment by covering individual, group, class, and school characteristics. Multilevel models revealed that individual characteristics as well as contextual factors predict adolescents' level of empathy. Findings indicate that empathy is mirrored in the social structure of adolescents supporting the hypothesis that social demands, which continuously grow with the amount of embeddedness, shape their social understanding.

*Keywords:* Empathy, Social integration, Peer relationships, Adolescence, Social network analysis

## Embeddedness and Empathy: How the Social Network shapes Adolescents' Social Understanding

A widely accepted definition of empathy describes it as a capacity that enables us to secondarily experience and understand the feelings of another person (Preston & de Waal, 2002). Findings across numerous studies suggest that the level of empathy as a trait-like construct can be considered a necessary condition for socially competent behavior, because empathy consistently predicts prosocial behavior (Eisenberg, 2000; Miller & Jansen op de Haar, 1997) as well as perspective taking skills (Findlay, Girardi, & Coplan, 2006) and is a negative predictor of aggressive behavior (Hastings, Zahn-Waxler, Robinson, Usher, & Bridges, 2000) as well as bullying (Caravita, Di Blasio, & Salmivalli, 2009).

Different research perspectives have enriched our understanding of empathy. For example, compelling evidence supports the deep evolutionary roots of empathic behavior, because it is observable across different species with cooperative kin relationships (cp. Preston & de Waal, 2002) suggesting its importance for the survival benefit in social life forms (de Waal, 2008). Furthermore, the discovery of mirror neurons (di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992) shed light on the neuroanatomy of empathic skills. The activation of this neural structure explains empathic behavior and, therewith, provides cellular evidence of why individuals are able to experience and understand the feelings of others. However, a social perspective on empathy has rarely been taken into account. This is surprising, because literature implies a strong link between the quality and quantity of social relationships as well as the level of expressed empathy.

### **The Social Dimension of Empathy**

Based on the fundamental need to belong (Baumeister & Leary, 1995), research repeatedly demonstrates the importance of being socially embedded. Especially in adolescence when peer relationships and status are reaching the climax of importance (LaFontana & Cillessen, 2009; Larson & Richards, 1991), a lack of social integration is

detrimental in various ways. This is mainly due to the simple fact that social isolation hurts by activating the same pain-inducing, neurocognitive threat system as physical danger (Eisenberger, Lieberman, & Williams, 2003), but also because less embedded adolescents miss opportunities to advance their social understanding (Parker & Asher, 1987). Social demands, which continuously grow with the amount of embeddedness such as regulating relationships, managing conflicts, supporting peers, or strengthening group cohesion require the improvement of social capabilities.

The assumption that embeddedness shapes the emergence of empathy is in accordance with the perception-action model (Preston & de Waal, 2002), which is based on the idea that perception and action share a common code of representation in the brain. That is, the perception of another person's behavior activates one's own representations for this behavior and these shared representations proceed to motor areas of the brain where "state-matching" responses are executed. Representations are created over many interactions across various situations and these social experiences form a person's ability to secondarily experience and understand the state of another person. That is, social relationships determine the quality and quantity of shared representations and the more shared representations persons possess the more pronounced are their empathic processes.

Experimental studies support the existence of the implied causal direction and revealed a unique causal pathway from social relationships to empathy by demonstrating that social exclusion causes a lack of empathy (DeWall and Baumeister, 2006) and temporarily impairs the capacity for empathic understanding (Twenge, Baumeister, DeWall, Ciarocco, & Bartels, 2007). Based upon these considerations, empathy seems to be shaped through social relationships, but of course empathic skills, in turn, will influence the quality and quantity of social experiences in terms of a bidirectional and mutual reinforcing association.

Several researchers have highlighted the importance of interpersonal relationships, specifically the mother-infant bond, for children's social understanding (Carpendale & Lewis,

2004; Saarni, 1990). We assume that this mechanism carries on beyond childhood, because social interactions remain the motor for constructing the required social knowledge in adolescence. For a better understanding of empathy development during adolescence, it is therefore important to explore the role of social interactions, specifically peer relationships within the school context, i.e. the social environment adolescents spend most of their waking hours.

Unfortunately, the state of research is inferior to the excitement of theoretical debate and evidence concerning the interplay of adolescents' peer relationships and empathy is rare. We are aware of only one study that examined this association (Oberle, Schonert-Reichl, & Thomson, 2009) and two more studies that used empathy-related constructs such as emotional intelligence (Ciarrochi, Chan, & Bajgar, 2001) or empathic accuracy (Gleason, Jenson-Campbell, & Ickes, 2009). All studies found small to moderate associations between empathy and peer relationships, which were restricted to either just some aspects of empathic skills (Ciarrochi et al., 2001; Gleason et al., 2009) or to specific subpopulations (Oberle et al., 2009).

### **A Social Network Perspective on Empathy**

A limitation of previous studies refers to the assessment method and analysis of peer relationships. The common empirical approach relies on considering the number of friends or certain friendship quality indicators such as self-reported social support. However, these data hardly take into account the complex choreography of peer relationships. We believe that a social network perspective is a more efficient tool for generating a comprehensive picture of the fabric of adolescents' social environment. Social network analysis (SNA) provides a unique explanatory framework following the basic idea that social interdependencies matter and that the structure of social interactions explains something about human behavior (Borgatti, Mehra, Brass, & Labianca, 2009). Since it has been known for over 60 years that adolescents' behavior is strongly influenced by the social structure in which they are

embedded (Hollingshead, 1949), applying SNA promises new insights regarding the degree of empathy during that phase of life. We assume that empathy depends in part on individual characteristics and in part on the social structure and constraints of an underlying social network, in which adolescents are embedded and exposed to specific influence processes.

Beyond the improved congruence of theoretical models and empirical representation, this research perspective offers several methodological advantages for understanding the social dimension of empathy: First, matrix algebra and graph theory allow for identifying latent social-psychological entities such as peer groups more objectively. Second, because SNA goes beyond dyadic friendship patterns and considers all relationships including indirect and complementary peer connections within the entire social network system such as a school class (e.g. Gest, Farmer, Cairns, & Xie, 2003), it reaches a higher degree of accuracy and validity. Third, SNA allows separating effects with respect to the analytic level where they occur: (a) the individual level with factors associated with each person; (b) the group level with characteristics of the peer group; and in the school context (c) the class level with measures describing collective network characteristics.

Since schools, classes, peer groups, and individuals are defined as nested structures, the statistical analysis of choice is hierarchical linear modeling (HLM), which allows for flexible modeling of the dynamic processes within and across levels (Raudenbush & Bryk, 2002). This approach allows to simultaneously analyze individual and contextual processes related to empathy as emphasized by Caravita and colleagues (2009) as well as Carpendale and Lewis (2004). Note that HLM takes into account that adolescents on the individual level are not completely independent from one another: Once adolescents are members of a network, they are susceptible to their peers' influence and will adjust their behavior and beliefs to various group or collective norms. Consequently, adolescents within a certain group end up being more similar to each other than adolescents from different groups. In statistical

terms, this phenomenon is known as intraclass correlation, in social psychology it is often dubbed as homophily (McPherson, Smith-Lovin, & Cook, 2001).

In sum, SNA provides a comprehensive representation of the social environment adolescents are embedded in. This analytic perspective, especially in combination with HLM, holds the promise to shed light on the social structure underlying the concept of empathy.

### **Objectives and Hypotheses**

Based on the outlined theoretical background, we hypothesized that adolescents' social connectedness is associated with certain social demands which, in turn, require and shape social capabilities such as empathy. Hence the individual degree of empathy is reflected in the social structure adolescents are embedded in. The present study tested this hypothesis by exploring the interplay of peer relationships and empathy on different social levels covering individual factors, group characteristics, and the overall structure of school classes. Besides the social network parameters, we utilized two psychosocial predictors for this purpose serving as empathy-related control variables in order to estimate the network effects more accurately and to eliminate alternative explanations. These are disruptive behavior and peer acceptance, because they have been found to be uniquely related to empathy (Esturgó-Deu & Sala-Roca, 2010 and Gifford-Smith & Brownell, 2003, respectively) and to specifically characterize and influence the social environment within school classes (Thomas, Bierman, Thompson, & Powers, 2008 and Osterman, 2000, respectively). The following hypotheses were tested:

1. The degree to which adolescents are embedded within the network of their school class is positively related to their individual level of empathy.
2. The level of individual empathy can be predicted by parameters on the peer group- and class level, even after controlling for individual characteristics.

Furthermore, because we hypothesized that the individual level of expressed empathy is mirrored in an underlying social network, we examined the extent to which the association

between embeddedness and empathy covaries with the social structure in which adolescents are embedded. In the HLM context this meant exploring cross-level interactions moderating the slope of the embeddedness-empathy association. We hypothesized:

3. The association between embeddedness and empathy varies in accordance with contextual characteristics on the peer group level in which adolescents are embedded.

## **Method**

### **Sample**

Participants were part of the longitudinal study “Learning Processes, Educational Careers, and Psychosocial Development in Adolescence and Young Adulthood” (BIJU), which had been conducted at the Max Planck Institute for Human Development in Berlin, Germany (cp. Baumert et al., 1996). The sample was drawn from four participating federal states and included all major tracks of the German secondary school system covering the academic track ‘Gymnasium’ (60%), the intermediate track ‘Realschule’ (25%), the least academic track ‘Hauptschule’ (8%), and the comprehensive track ‘Gesamtschule’ (7%).<sup>1</sup> Schools were randomly selected from the official school roster in each state, separate for each school type. Since the study had state approval, the participation rate was very high (above 90%). The main reason for non-participation was school restructuring or recent school merger. Within each school, two classes were selected at random. For the purpose of the study, school classes had to fulfill two inclusion criteria to provide sufficient data: (a) a number of nominating participants of at least 15 and (b) a participation rate higher than 67%. This selection procedure left a total of 166 classes including 3.159 students, with an average class size of 19.03 students ( $SD = 4.11$ ).

The analysis includes survey data collected at the end of seventh grade when social network data were solicited. Participants’ average age was  $M = 13.67$  years ( $SD = .62$ ) with a gender ratio of 56% girls to 44% boys. No data on the ethnical composition were available. Using census data as a proxy, students are predominantly of Caucasian background (80%).



Roughly half of the remaining group is of Turkish descent, the other half comprises of various ethnic backgrounds, mainly of Eastern European origin.

As spatial proximity determines how social networks form in schools, it is worthy to note that in the German school system students up to grade ten spend most of their classes with the same classmates in a designated classroom while teachers rotate between rooms. Although peer relationships between students from different classrooms occur, they are structurally limited regarding the time they can spend together during a regular school day. Therefore, the classroom creates a strong social network, which will be analyzed accordingly using class-specific network analyses.

### **Measures**

Data collection relied on the administration of standardized student questionnaires and was realized during regular class periods under the supervision of trained research assistants. Students had the right to discontinue at any point in time or skip sections of the questionnaire part. In case students chose not to participate, they were asked to work on a worksheet provided by the teacher who was present during the entire data collection phase.

#### **Psychosocial Scales.**

***Empathy.*** Davis's Interpersonal Reactivity Index (IRI; Davis, 1983) reflects the multidimensionality of empathy, specifically its cognitive and emotional component. Because two out of four subscales ('fantasy' and 'personal distress') do not assess empathy in the narrower sense, only the remaining two subscales with seven items each constituted the indicator of empathy: 'perspective taking' (cognitive component, e.g.: "I sometimes try to understand my friends better by imagining how things look from their perspective.") and 'empathic concern' (emotional component, e.g.: "I often have tender, concerned feelings for people less fortunate than me."). Utilizing a four-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*), participants were asked to report the extent to which these

statements apply to them. The mean of both positively correlated subscales represents the total empathy score with a reliability of Cronbach's  $\alpha = .76$ .

***Disruptive behavior.*** The disruptive classroom behavior was measured with the instrument developed by Fend and Prester (1986), which has been repeatedly applied to the context of school classes (e.g. Schnabel, Alfeld, Eccles, Köller, & Baumert, 2002; Trautwein, et al., 2006). On a list of ten items participants indicated how often they engaged in disruptive behavior in school (e.g.: "How often do you annoy your teacher on purpose?") by using a scale ranging from 1 (*never*) to 4 (*often*). This scale had a reliability of Cronbach's  $\alpha = .87$ .

***Peer acceptance.*** A scale introduced by Fend and Prester (1986) measured peer acceptance on four items (e.g.: "I am respected by my peers") using a four-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). The resulting scale displayed a reliability of Cronbach's  $\alpha = .73$ .

**Network Parameters.** The peer nomination procedure for the SNA was based on the affective social relation approach (cp. Borgatti et al., 2009) utilizing the item „Which classmates do you like a lot?“. With the help of a class roster, participants were asked to nominate up to four classmates in this regard.<sup>2</sup> The use of SNA provided us with parameters indicating the individual embeddedness within the network, the group structure, and the collective network characteristic of the entire class. In line with this, three main network parameters were used.

Insert figure 1 about here

***Embeddedness.*** An individual parameter indicates adolescents' social connectedness in class, as illustrated by the size of each node in figure 1. The standard measure in this regard is a persons' degree centrality, which is the number of incoming and outgoing ties in the network (nominations from and to peers). However, this indicator is purely quantitative and does not consider to which people someone is connected. For example, two adolescents with the same number of friends still differ with regard to their amount of embeddedness, if their

friends are not equally connected to others. Therefore, the present study used Bonacich's centrality measure (Bonacich, 1987) based on the following rationale: The more connected my friends are, the more powerful am I. Consequently, this measure of embeddedness not only indicates someone's number of connections, but also the number of connections to which someone is connected. To compare different school classes with varying sizes and network densities, Bonacich's centrality measure was standardized within classes.

**Group Membership.** With the extraction of peer groups each adolescent's specific group membership was identified, as illustrated by the shape of each node in figure 1. Our analytic unit for finding cohesive subgroups was cliques, which are defined as the maximum number of actors who have all possible ties present among each other (Luce & Perry, 1949). This concept of the maximal complete sub-graph is very precise, but it allows for participants to be members of more than one group. As a consequence, the amount of overlapping cliques would not or at best modestly reduce the number of higher clustered network units on the group level. Therefore, we additionally applied the hierarchical clique clustering approach (cp. Everett & Borgatti, 1998) that produces non-overlapping groups, so that each adolescent was assigned to one distinct peer group. Although, this procedure disregards the concept of multi-group membership, it provides us with the information of each adolescent's most intense cohesive subgroup. That is, this form of data reduction assigns adolescents to their intra-individually strongest peer group with the most intense social interactions.

**Centralization.** A collective score indicates each school class's overall centralization. This parameter is the class-specific equivalent of level-1 degree centrality and specifies the variability in participants' number of nominations, as illustrated by the difference in connectedness of all nodes in figure 1. Low centralization represents an equally-powered network, whereas high centralization represents a network with only few (or even just one) central or powerful adolescents.

## **Analyses**

SNA were performed by using the software UCINET in its current version 6.289 (Borgatti, Everett, & Freeman, 2002). We used neither weighted, signed, nor ranked data; however, we symmetrized network data, so that in- and out-degrees were equally treated as an undirected indicator of the overall embeddedness. In the present study, in which participants were allowed to make only a limited number of nominations, missing reciprocity could be due to the missing opportunity of nominating all friends, so that this transformation increases the amount of information by considering out-degree connections as complete relationships. All self nominations were ignored. Participants who nominated, but where not nominated or vice versa were considered in the analyses, but participants who neither nominated nor had been nominated were excluded.

We used HLM7 for multilevel modeling (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2011) to simultaneously consider individual and contextual influences and to adequately account for the existing nested data structure. A four-level random-intercept-random-slope model (L1: adolescents, L2: peer groups, L3: school classes, L4: schools) estimated the outcome variable empathy with the use of predictors covering network parameters (embeddedness and centralization) and psychosocial variables (peer acceptance and disruptive behavior). To control for aggregated equivalents and to compare individual and contextual effects, these predictive parameters were modeled on all levels except for the school level.<sup>3</sup> Control variables were demographics (age and sex), structural network properties (peer group- and class size), and educational variables (school type). Continuous variables were standardized, separately on each level, to facilitate the interpretation of the regression weight on all four levels.

## Results

### General Network Statistics

Based on 10,679 nominations from 3,159 adolescents out of 166 school classes, a total of 1,395 peer groups were extracted. On average, each class consisted of 8.40 peer groups, whose size ranged from 1 to 9 with a mean of  $M = 2.27$  adolescents ( $SD = 1.33$ ). The majority of peer groups in seventh grade were homogeneous with regard to gender: 663 girl peer groups (48%) and 587 boy peer groups (42%). However, a considerable amount of peer groups were gender-mixed (145 peer groups, 10%).

The overall number of peer groups included 381 isolates (12%), which were considered separate “one-person groups”. Although isolates are characterized by identical scores on level 1 and level 2 from a multilevel perspective (a single person constitutes his/her own peer group), a previous study based on a different data set demonstrated the robustness of overall effects despite incomplete nestedness due to isolates (Wölfer, Bull, & Scheithauer, in press). Isolates were found in all but 14 classes with an average number per class of  $M = 2.30$  ( $SD = 1.34$ ). Slightly more boys (53%) than girls (47%) were identified as isolates, their average age ( $M = 13.72$ ,  $SD = .65$ ) was not significantly different from the mean age of non-isolates, and this status was unrelated to the type of school.

The opposite of isolates are the so-called ‘hubs’, i.e. adolescents in the center of a classroom’s social network: 342 persons (11%) were identified to have a degree centrality of more than .30, which means they were connected to at least 30% of all classmates. Whereas the mean age of hubs ( $M = 13.75$ ,  $SD = 0.61$ ) and their occurrence in different school types were nearly identical to isolates as well as to the overall sample, a clear gender difference emerged favoring girls (70%) in this role,  $\chi^2(1) = 27.73$ ,  $p < .001$ .

### Descriptives of Study Variables

Table 1 presents all variables of interest grouped by sex. Gender differences were found on empathy favoring girls and on disruptive behavior dominated by boys. Moreover,

girls were more strongly embedded within the class' network and they reported to be more accepted by their peers than boys. Group comparisons (MANOVA) demonstrated that girls and boys differed significantly on empathy  $F(1, 3157) = 268.21, p < .001$ , embeddedness  $F(1, 3157) = 64.69, p < .001$ , disruptive behavior  $F(1, 3157) = 157.41, p < .001$ , and acceptance  $F(1, 3157) = 30.06, p < .001$ . On the contextual level, gender-mixed peer groups are situated exactly between both unisex peer groups concerning all averaged, group-aggregated psychosocial variables suggesting that gender effects are free of heterogeneity-based, synergistic group processes. These results underscore the need to consider sex as a control variable on the individual level within the multilevel analyses.

Insert table 1 about here

Insert table 2 about here

Table 2 provides the correlation coefficients for all continuous predictors. For both girls and boys the intercorrelations between predictors were small with an absolute value of .18 at most.

### **Multilevel Prediction of Empathy**

For the multilevel prediction of empathy we estimated four-level random-intercept-random-slope models including 3.159 adolescents on level 1, 1.395 peer groups on level 2, 166 school classes on level 3, and 107 schools on level 4. Table 3 reports a sequence of three statistically nested models: Model 1 included random coefficients with no predictors identifying the variance component across levels, Model 2 included all single predictors (main effect model), and Model 3 included two additional cross-level interaction terms.

Insert table 3 about here

In Model 1, the unconditional model, we determined the proportion of variance on the four different levels. The resulting intraclass coefficients (ICC) were 0.03 for the school level, 0.01 for the class level, and 0.14 for the peer group level, respectively. That is, 3% of the variance in empathy is attributable to the school level, 1% to the class level, 14% to the group

level, and the remaining 82% to the individual level. The variance between groups and between schools differed significantly from zero with  $\chi^2(1121) = 1717, p < .001$  and  $\chi^2(106) = 161, p < .001$ , respectively. Although the variance between classes was not found to differ significantly from zero,  $\chi^2(58) = 67, p = .18$ , the consideration of this level is conceptually required, because it reflects our central focus of analyses (i.e. class-specific SNA).

Model 2 confirmed the hypothesized effect of embeddedness, as this parameter significantly predicted adolescents' empathy score. Interestingly, the embeddedness-empathy association exclusively exists on the individual level and missed the level of significance on the contextual levels. Beyond this individual effect, empathy was also reflected in the contextual structure in which adolescents were embedded: Being integrated in classes where adolescents feel on average more accepted by their peers and being integrated in schools from the higher academic track (Gymnasium) was positively related to empathy. All effects were controlled for age, sex, peer group- and class size as well as higher-level equivalents of individual predictors.

Model 3 included two additional cross-level interactions to test under which social circumstances the association varies between embeddedness and empathy. While the 'embeddedness x disruptive behavior' interaction missed the level of significance, the term 'embeddedness x acceptance' was found to have a significantly positive effect, as illustrated in the figures 2 and 3. That is, the association between embeddedness and empathy increases for more accepted peer groups. Deviance differences from Model 2 (without interaction terms) to Model 3 (including interaction terms) indicate no significant fit improvement.

Insert figure 2 about here

Insert figure 3 about here

## **Discussion**

The primary purpose of this study was to uncover the social structure that underlies adolescents' level of empathy by utilizing a more complex social network perspective to

precisely identify individual and contextual characteristics, which were, in turn, included in a multilevel model to further the understanding of empathy in adolescence. The main findings of this study refer to the predictive power of the individual network position for empathy, the incremental power of contextual characteristics, and the robust gender differences in both empathy and embeddedness.

### **Individual Effects**

The present study used SNA to illuminate the social dimension of empathy. We were able to analyze a comprehensive representation of adolescents' school environment and gave particular consideration to the fact that their behavior and attitudes are highly influenced by the social structure in which they are embedded. The peer group they belong to, the classroom this peer group is a part of, and the school this classroom is located in define the social field with its multilayered influences. Utilizing the concept of network centrality proposed by Bonacich (1987), the present study measured the amount of embeddedness by considering the quantity and quality of adolescents' social relationships. This advanced approach to assess and analyze peer relationships helped to overcome validity limitations in previous studies that examined the interplay of peer relationships and empathy.

In accordance with our first hypothesis, results confirm that individual embeddedness is significantly related to the level of empathy, which supports the notion of a social dimension of empathy: The ability to secondarily experience and understand the state of another person is reflected in the intensity of adolescents' social connectedness. Highly integrated adolescents, so-called hubs, possess the social capabilities that are needed to regulate relationships between members of their peer group or even to support the overall social structure of their school class. In contrast, isolates' social position at the fringes of a network offers less opportunity to face social demands and improve their social understanding.



This empirically supported association between social relationships and empathy seems to suggest that adolescents' empathy could be improved by individual-based interventions that aim to increase the social involvement of less integrated students. However, the interplay between peer relationships and empathy goes beyond the individual level.

### **Contextual Effects**

Based on the large sample and in accordance with the social network and multilevel perspective, we were able to simultaneously consider the peer group, the class, and the school context as well as their dynamic interaction as additional determinants of empathy. With this perspective, we corroborate Carpendale and Lewis's (2004) claim that the contextual dimension in the field of empathy needs to be taken into account. This approach is crucial because social structures initially form through social selection processes based on similarities concerning psychological characteristics (McPherson et al., 2001). Moreover, once these homogeneous network structures have emerged, their members are highly susceptible to social influence processes and will continuously adjust their attitudes, beliefs and behavior to various group or collective norms. Therefore, as adolescents are regularly exposed to peers, it is not surprising that empathy is associated with complex group processes beyond the known effects on the individual level.

In accordance with our second hypothesis, adolescents who are part of classes with an atmosphere characterized by acceptance among peers and who attend a school from the higher academic track show significantly higher empathy. Because the ability to secondarily experience and understand others depends on the social demands provided by adolescents' direct and global school environment, it is plausible to assume that adolescents' empathy remains less developed, when conflicts are regulated in a less empathic manner: Classes with a poor class climate define a social environment, where rationale discourse is less dominant as mode of conflict resolution, so that adolescents simply miss opportunities to advance their social understanding. The school type effect is in accordance with prior findings favoring

students from the academic track with regard to their empathic skills (cp. Stanat & Kunter, 2000). These replicated differences might be grounded in both individual abilities, such as higher intelligence of adolescents from the Gymnasium, and structural characteristics, such as the above described environmentally specific ways of conflict regulation as a school culture, which, in turn, results in more opportunities to train empathic behavior. Interestingly, the peer group size and the class size had no effect on empathy. That is, neither the number of close friends within a peer group nor the number of potential friends within a school class influenced the quality of adolescents' social understanding. In this regard, the dominant factors seem to be the overall embeddedness within the network including complementary and indirect peer affiliations as well as the quantity and quality of peer relationships.

For analyzing the complete choreography of social mechanisms that are involved in adolescents' expressed level of empathy, we additionally included cross-level interactions. In general, considering the non-significant fit improvement of Model 3, we are unable to conclude that the association between social relationships and empathy varies in accordance with contextual characteristics on the peer group level; at least given the considered psychosocial scales. However, one cross-level interaction was significant suggesting that the relation between embeddedness and empathy was stronger for more accepted peer groups. That is, accepted and thus integrated peer groups possess high levels of empathy, which supports our theoretical argument to the extent that the social demands shape adolescents' social understanding. Given the lack of overall improved fit, this effect needs to be replicated with a different sample.

### **Gender Differences**

The present study found robust gender differences in both empathy and network embeddedness favoring girls. The first result replicates numerous studies summarized in Eisenberg and Fabes's (1998) seminal meta analysis on this issue. So far, research predominantly offered biological arguments to explain these differences with gender-specific

activities in the right hemisphere (Rueckert & Naybar, 2008) or in the mirror neurons themselves (Cheng, Tzeng, Decety, & Hsieh, 2006). However, referring to the finding that girls have a higher degree of embeddedness, we offer the alternative explanation that it might be the social difference that explains the psychological one. That is, the gender difference in empathy may not exclusively be traced back to neurobiological reasons, but also to a gender-specific social environment. In line with our supported theoretical background, girls have an improved social understanding simply due to their higher social integration and the associated social demands that shape their level of empathy. In this regard, a combination of social network and neurobiological data should be one of the future directions outlined below.

### **Limitations and Future Directions**

The design of this study was cross-sectional in nature and remains speculative with respect to the causal interpretation of underlying age-related mechanisms. Therefore, longitudinal studies are necessary to identify developmental trajectories of empathy and whether change on empathy can be predicted by stable contextual characteristics. As outlined in the introduction, we speculate that those analyses will reveal a bidirectional positive influence, since increased empathy is likely to stabilize a “hub” position, which, in turn, results in more social experiences that foster empathy development.

As hypothesized, empathy seems to be formed through social demands within certain environments and goes hand in hand with specific social responsibilities, such as regulation of group conflicts by strongly integrated adolescents. However, empathy is a necessary but not sufficient condition for socially competent behavior and future research needs to shed light on individual and contextual reasons for why certain strongly integrated adolescents channel their higher social understanding into prosocial behavior (Eisenberg, 2000; Miller & Jansen op de Haar, 1997), while others use their social status to aggressively maintain their own social status (Rodkin, Farmer, Pearl, & Van Acker, 2006).

A final limitation refers to the subjectivity in self-reports on empathy and other psychosocial scales. Critique concerning the missing objectivity is often countered by the argument that a person's perception of the world is more useful and informative in explaining and predicting behavior than measuring the objective world itself. However, the replication with existing objective instruments, such as performance tasks on empathy, or even the joint consideration of subjective and objective measures would provide additional confidence that self-reported empathy measures more than social desirability or other artifacts that questionnaire measures are prone to.

While previous studies have rarely considered the social dimension of empathy, the present research perspective provides valuable insights into the role of the individual network position and the contextual network characteristics for adolescents' expressed level of empathy. Future directions in this field of research refer to: (a) the replication of study results with multiple and preferably objective empathy measures; (b) the detailed examination of gender effects, ideally by combining social network with neurobiological data; (c) the bridge from social understanding to actual prosocial behavior; and especially (d) the longitudinal dynamic of social networks for studying the underlying developmental mechanisms of empathy. We hope that upcoming studies will be able to answer the still open research questions and advance our understanding concerning the biopsychosocial structure and development of empathy in adolescence.

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### Footnotes

<sup>1</sup>Students are selected into these between-school tracks primarily based on their achievement. This strong selectivity creates average achievement differences, especially between the ‘Gymnasium’ and all other major tracks. Because of consequential achievement-related track differences, for example with regard to SES, we created a dichotomous variable (Gymnasium vs. Non-Gymnasium) to control for and test the collective achievement effect on empathy.

<sup>2</sup>Although Parkhurst and Asher (1992) comprehensible argued for an unlimited number of nominations, empirical comparisons of different sociometric assessment methods showed the applicability of the like-most approach as a restricted nomination procedure: Frederickson and Furnham (1998) asked students to complete different sociometric questionnaires including the restricted peer nomination approach, analyzed their concordance, and revealed that the restricted nomination approach does not differ with regard to the elicited informative value.

<sup>3</sup>This exception is due to the class-specific generation of network parameters and psychosocial scales, for which the multilevel comparability of predictors ends on the third level (school classes). The additional consideration of the fourth level is mainly based on structural reasons (data nestedness).

### Tables

Table 1

Descriptives of the Study Variables grouped by Sex

	Boys		Girls		Total	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Empathy	2.67	0.39	2.89	0.37	2.79	0.39
Embeddedness	3.94	2.15	4.58	2.25	4.30	2.23
Disruptive Behavior	2.07	0.68	1.81	0.52	1.92	0.61
Acceptance	2.94	0.72	3.08	0.71	3.02	0.72
Centralization					0.24	0.09

Note. The class level variable centralization cannot be grouped by the individual variable sex. Descriptives of variables are presented before their z-standardization; psychosocial variables ranging from 1 to 4, embeddedness from 0 to 12 and centralization from 0 to 1.

Table 2

Intercorrelations of continuous Predictors

	1	2	3	4
1 Embeddedness	—	-.01	.05	.09
2 Age	-.01	—	.03	-.01
3 Disruptive Behavior	.07	.09	—	-.08
4 Acceptance	.14	-.02	-.18	—

Note. Correlations for girls ( $n = 1.777$ ) above and boys ( $n = 1.382$ ) below the diagonal;

$r > .05 | p < .05$ .

Table 3

## Predicting Empathy

	Model 1	Model 2			Model 3		
		<i>B</i>	<i>p</i>	<i>SE</i>	<i>B</i>	<i>p</i>	<i>SE</i>
Level 1: <i>Adolescents</i>							
Sex <sup>1</sup>		-0.457	***	0.037	-0.458	***	0.037
Age		0.014		0.017	0.014		0.017
Embeddedness		0.064	*	0.033	0.057	*	0.034
Disruptive behavior		-0.132	***	0.025	-0.132	***	0.025
Acceptance		0.019		0.023	0.019		0.023
Level 2: <i>Peer groups</i>							
Group size		0.018		0.019	0.018		0.019
Embeddedness <sup>A</sup>		-0.024		0.035	-0.022		0.035
Disruptive behavior <sup>A</sup>		-0.024		0.031	-0.028		0.031
Acceptance <sup>A</sup>		-0.042		0.030	-0.032		0.030
Embeddedness x Disruptive behavior <sup>A</sup>					-0.011		0.021

Embeddedness x Acceptance <sup>A</sup>			0.037 *	0.022
Level 3: <i>School classes</i>				
Class size		0.027	0.022	0.027
Centralization		0.007	0.020	0.007
Disruptive behavior <sup>A</sup>		0.031	0.025	0.032
Acceptance <sup>A</sup>		0.047 *	0.027	0.045 *
Level 4: <i>Schools</i>				
School type <sup>2</sup>		-0.189 ***	0.049	-0.187 ***
L1 Variance ( <i>E</i> )	0.786	0.764	0.761	
L2 Variance ( <i>R</i> <sub>0</sub> )	0.137	0.064	0.066	
L3 Variance ( <i>U</i> <sub>00</sub> )	0.009	0.009	0.009	
L4 Variance ( <i>V</i> <sub>000</sub> )	0.024	0.008	0.007	
Deviance ( <i>df</i> )	8717 (5)	8398 (19)	8394 (21)	
$\Delta$ Deviance in $\chi^2$ ( <i>df</i> ), <i>p</i>	—	319 (14), <.001	4 (2), = .16	

Note. <sup>A</sup>Aggregated Scores; <sup>1</sup> 0 = girls and 1 = boys; <sup>2</sup> 0 = gymnasium and 1 = non-gymnasium; L1: 3.159 adolescents, L2: 1.395 peer groups, L3:

166 school classes, L4: 107 schools; one-tailed significance, \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

**Figure Captions**

Figure 1. Network of a Sample School Class. Nodes are adolescents and lines are relationships. Adolescents are sized according to their embeddedness and shaped according to their peer-group membership, while blank circles (#9 and #12) represent isolates.

Figure 2. Cross-level Interaction between Empathy (L1) and Embeddedness (L1) by Disruptive Behavior (L2).

Figure 3. Cross-Level Interaction between Empathy (L1) and Embeddedness (L1) by Acceptance (L2).



## Figures

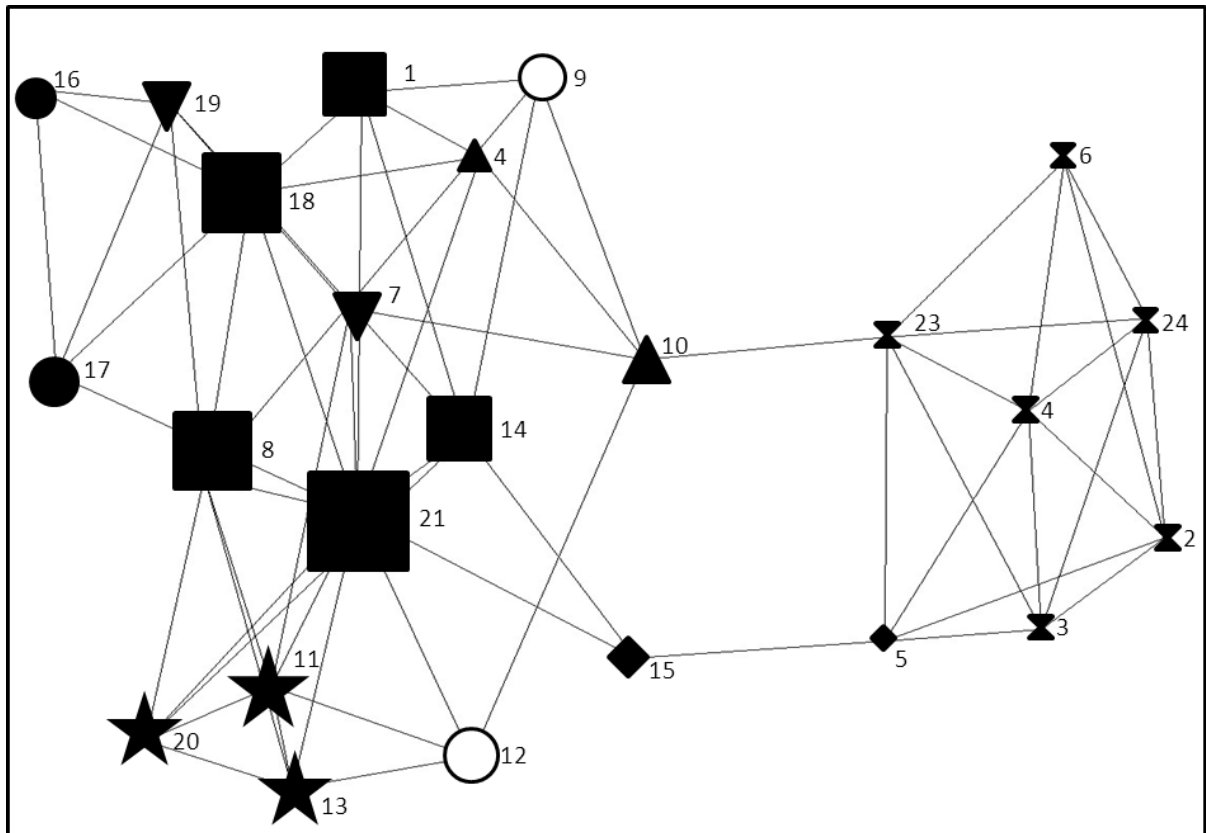


Figure 1

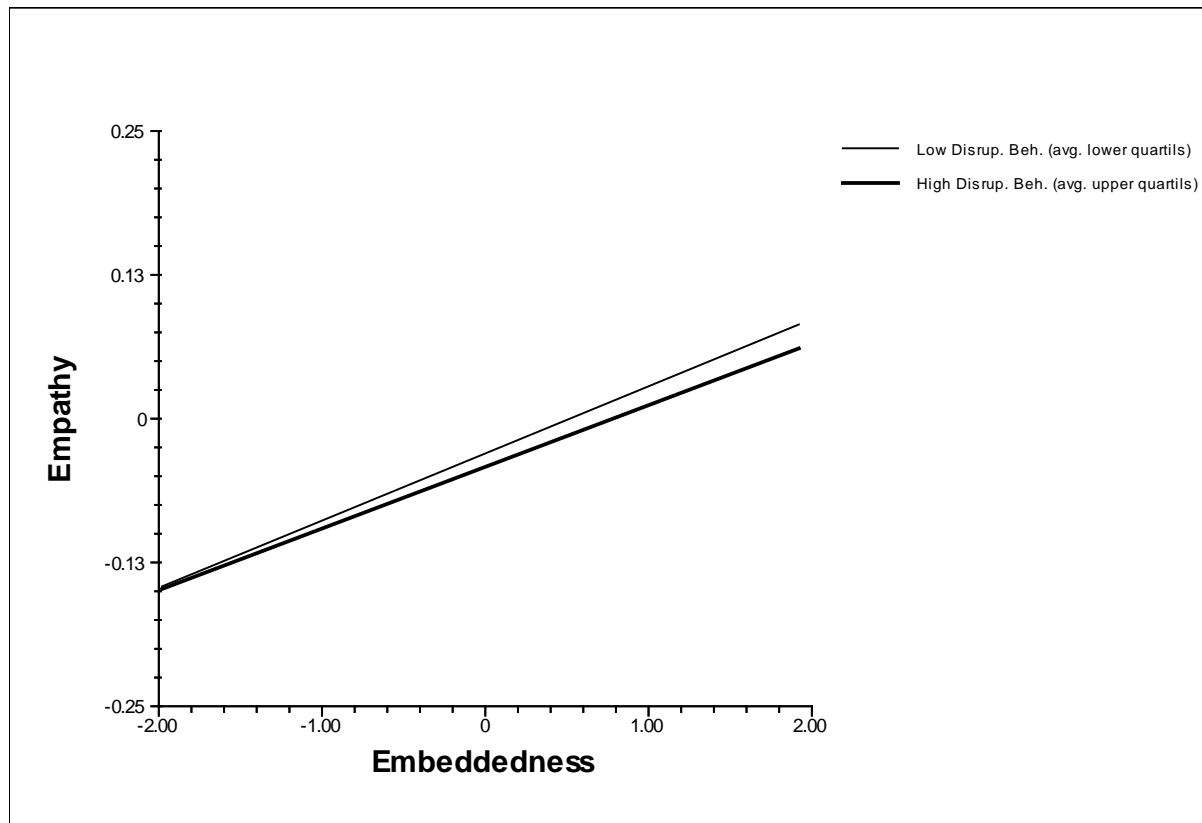


Figure 2

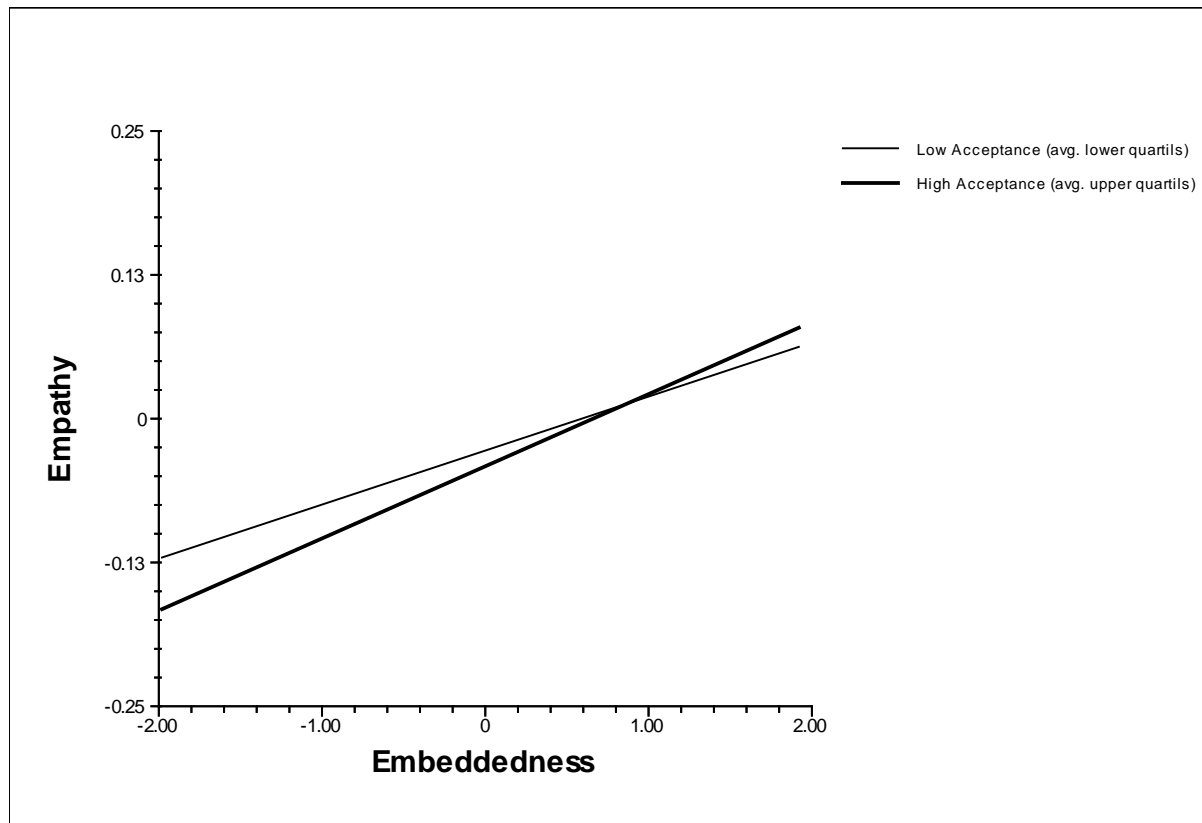


Figure 3