

Social Influence and Bullying Behavior: Intervention-Based Network Dynamics of the fairplayer.manual Bullying Prevention Program

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Bullying is a social phenomenon and although preventive interventions consequently address social mechanisms, evaluations hardly consider the complexity of peer processes. Therefore, the present study analyzes the efficacy of the fairplayer.manual bullying prevention program from a social network perspective. Within a pretest–posttest control group design, longitudinal data were available from 328 middle-school students ($M_{\text{Age}} = 13.7$ years; 51% girls), who provided information on bullying behavior and interaction patterns. The revealed network parameters were utilized to examine the network change (MANCOVA) and the network dynamics (SIENA). Across both forms of analyses, findings revealed the hypothesized intervention-based decrease of bullies' social influence. Hence the present bullying prevention program, as one example of programs that successfully addresses both individual skills and social mechanisms, demonstrates the desired effect of reducing contextual opportunities for the exhibition of bullying behavior. *Aggr. Behav.* 40:309–319, 2014. © 2014 Wiley Periodicals, Inc.

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INTRODUCTION

At some point during adolescence, almost everybody is harassed, teased, or even victimized by peers (Finkelhor, Ormrod, & Turner, 2009; Kochenderfer-Ladd & Ladd, 2001). However, in the form of bullying—which is described as repeated aggressive behavior directed against a person who has difficulty defending him- or herself (cf. Olweus, 1996)—physical and psychological forms of victimization have detrimental consequences. These include poorer academic achievement (Rothman, Head, Klineberg, & Stansfeld, 2010), physical and mental health problems (Arseneault, Bowes, & Shakoor, 2009; Biebl, DiLalla, Davis, Lynch, & Shinn, 2011), as well as suicidal outcomes (Kim & Leventhal, 2008). Hence, bullying is considered to be a major public health problem in youth (American Psychological Association, 2004), which underscores the importance of examining bullying and the efficacy of bullying prevention programs.

Within the last years, research has made much progress in understanding the social characteristics of bullying. The participant role approach (Salmivalli, 1999) opened a new conceptual perspective on the social choreography during bullying episodes, while social network analysis has begun to clarify this behavior empirically with

respect to the social influence processes within school classes (Huitsing, Veenstra, Sainio, & Salmivalli, 2012; Veenstra, Lindenberg, Munniksma, & Dijkstra, 2010). However, this progress has not yet been translated into the applied field of bullying research, as evaluations of preventive interventions tend to neglect the complexity and interdependency of peer network processes involved in bullying among adolescents. This is surprising, because social mechanisms are the focus in most school-based programs (Gest, Osgood, Feinberg, Bierman, & Moody, 2011).

Social Mechanisms Within Bullying Prevention Programs

Effective bullying prevention programs address not only individual social skills, but also social mechanisms within the overall organization and structure of

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relationships (cf. Olweus, 1993; Perkins, Craig, & Perkins, 2011). Even changes on the individual level are driven by context, as they are shown to unfold their complete effects indirectly as a synergistic byproduct within the school class (e.g., Conduct Problems Prevention Research Group, 1999).

The necessity of considering the social dimension within bullying preventions relies on the nature of adolescents' peer relationships: Adolescents are highly susceptible to the influence of their peers (Brechwald & Prinstein, 2011). Once they find their social position, adolescents tend to adjust their behavior, attitudes, and beliefs to various group or collective norms. That is, social influence processes take place in school classes. Especially within the bullying context, these social influence processes are of particular interest: In general, aggressive students frequently occupy a central position in class (Rodkin, Farmer, Pearl, & Van Acker, 2006) and in particular, bullies are by definition characterized by superior social influence (cf. Olweus, 1996). In fact, this imbalance of power represents a necessary condition for the development and maintenance of bullying behavior, as it enables aggressive students to unfold their victimizing impact continuously onto the entire network.

Consequently, successful bullying prevention programs take social mechanisms into account that address the existing social influence processes (Gest et al., 2011). These mechanisms include (a) the modification of attitudes that support prosocial behavior; (b) the change of social norms to the extent that students oppose bullying behavior; and (c) the training of social skills that increase students' resistance to the influence of bullies. Based on the background of these mechanisms and their targeted social influence processes, the present paper evaluates the efficacy of a bullying prevention program.

The Fairplayer.Manual Bullying Prevention Program

In Germany, an established bullying prevention program is fairplayer.manual (Scheithauer & Bull, 2008), which is—as one example of programs that consider the social mechanisms in class—the focus of the present study. The program was found to successfully reduce bullying behavior, given conventional survey data (cf., Bull, Schultze, & Scheithauer, 2009; Scheithauer, Hess, Schultze-Krumbholz, & Bull, 2012).

Based on cognitive-behavioral methods, fairplayer.manual is implemented as a manualized, school-based, preventive intervention targeting middle-school students (see Design Section within the Method part for details concerning the programs' content and its implementation). Comparable with effective bullying prevention programs in elementary school, such as KiVa (e.g., Kärnä et al., 2011), fairplayer.manual contains various operating mechanisms

for addressing the social complexity of bullying that have been outlined above.

First and foremost, the program seeks to raise students' awareness of bullying and to change their attitudes concerning this behavior, which increases their sense of responsibility and encouragement for intervention. This contextual objective is amplified by the introduction of the participant-role approach, which educates students in understanding the existence of different social roles within the bullying process (cf. Salmivalli, 1999) and the possible role-specific contribution in reducing bullying. For example, the program encourages assistants and reinforcers to stop supporting bullies, activates outsiders' sense of social responsibility, and equips (potential) defenders with intervening strategies for helping victims during bullying episodes. For this purpose, role plays allow experiencing the bullying process from different perspectives, stimulating self-reflected behavior, and training alternative prosocial behavioral options while giving students the possibility to experience self-efficacy. Moreover, fairplayer.manual addresses the social norms in class, which facilitates the formation of synergistic group dynamics towards an antibullying atmosphere in class. Finally, utilizing material tailored to the age group of middle-school students, the program aims at increasing social competencies such as empathy, moral reasoning, and perspective taking skills, which consolidates all previous elements of the prevention.

All of these applied social mechanisms are intended to have a consequential effect on the entire network of the school class. While breaking up the rigid framework of a probullying atmosphere in class, we assume the acceptance of bullying behavior and relatedly the popularity of bullies to decrease. This modification is expected to be echoed in a reorganized social structure that is characterized by a reduction of bullies' powerful network position which, in turn, decreases their social influence and therewith their contextual opportunities to express constant and powerful victimizing behavior.

The Value of Social Network Analysis

Many bullying prevention programs such as fairplayer.manual target the social dynamics within the school context, but previous outcome analyses hardly captured peer influence processes or the social network, in which these influence processes occur (Gest et al., 2011). Social network analysis (SNA) structures ties (e.g., social relationships) between nodes (e.g., students) through certain interdependencies (e.g., friendship) and assumes that these interdependencies explain something about the network members (Borgatti, Mehra, Brass, & Labianca, 2009). For the purpose of assessing social influence processes, SNA comes along with psychometric advantages, because

(a) it is based on more objective peer nominations; (b) it reaches beyond individual-based explanations by considering the entire social structure; (c) it precisely specifies complex patterns of relationships; and (d) it captures the operating social influence processes within the illuminated interdependencies of a network. Therefore, this analytic perspective provides unique information characterized by superior psychometric properties such as a greater degree of accuracy and validity in contrast to aggregated individual characteristics.

In accordance with these psychometric advantages, SNA presents a valuable tool for adequately testing social influence processes within the evaluation of bullying prevention programs. More specifically, its application corresponds with the nature of intervention-based social mechanisms: One can consider social influence as a diffusion process within a network, in which attitudes and values spread among individuals across their interrelating ties and, in turn, shape behavioral dynamics. Therefore, the intervention-based modifications of attitudes, values, and behaviors alter social influence processes, which are expected to be echoed within the above described reorganization of a social network.

Objectives and Hypotheses

Based upon the progress of the social perspective in bullying research, the present study aims to test the operating social mechanisms that underlie the efficacy of bullying prevention programs by analyzing the intervention-based network dynamics. This objective centers on the research question: Does the present bullying prevention program modify the social network of the class by reducing the social influence of bullies?

For this purpose, we evaluate the program fairplayer.manual in a pretest–posttest control group design by utilizing SNA, which is the method of choice, because it adequately captures the social influence processes within school classes. The extracted network parameters will be translated into two consecutive statistical procedures, each with a specific analytic focus. We will start to analyze the intervention-based change of bullies versus nonbullies with respect to centrality network parameters. Thereafter, we will examine the extent to which the network dynamics reflect the change in bullying behavior within the intervention period. Both analytic approaches build on the other and outbalance their respective strengths and limitations: While the general group comparison considers a broad variety of different network parameters that provide detailed insights concerning the kind of network modification, the examination of network dynamics in relation to the change of bullying behavior takes full advantage of the data's longitudinal nature in order to shed light on the respective developmental mechanisms.

This unified multi-method framework enables us to analyze our main research question by means of diverse bullying operationalizations (i.e., dichotomous vs. continuous) and statistical designs (i.e., network change vs. network dynamics), which help to determine the robustness of intervention-based network effects and to better understand their underlying social influence processes. The following hypotheses will be tested:

1. At the pretest, bullies are more centrally integrated and possess more social influence than nonbullies, because social status is a necessary contextual condition to express victimizing behavior in a constant and powerful manner.
2. From the pretest to the posttest, bullies in the intervention group lose their central positions within their social network compared to bullies in the control group.
3. Students in the intervention group, who increase their bullying behavior, experience a decrease in their social influence and vice versa.

METHOD

Sample

Two schools from two large German cities voluntarily participated in a program that focused on preventing bullying and promoting social competencies.¹ A total of 18 secondary school classes were split up in five 7th grade, four 8th grade, and nine 9th grade classes. After receiving parental consent from all but 16 students, everyone of the remaining 354 students participated (permission/participation rate 96%). Of these, completed longitudinal data were available from 328 students (dropout rate 7%), which corresponds to an average of 18.22 students per class. The mean age of participants was 13.7 years ($SD = 1.3$) with a gender ratio of 51% girls to 49% boys. No data on the ethnic composition were available, because in Germany it is not acceptable to ask students about their ethnicity. However, the vast majority of German students are Caucasian and those with immigrant background are predominantly of Turkish descent or Eastern European origin.

The middle school in Germany is characterized by a stable class system, where students spend most of their

¹ The intervention as well as the study procedure and all utilized instruments within the evaluation of this research project were inspected and approved in terms of their ethical appropriateness for human subjects testing by the respective review board of the Berlin Senate Department for Education, Science, and Research. All students participated on the basis of informed consent.

time with the same classmates in the same classroom, while teachers alternate between classrooms. Although peer relationships between students from different classrooms occur, they are structurally limited regarding the time students can spend together during a regular school day. Due to the fact that spatial proximity determines how social networks form in schools, the classroom creates a strong social network, which will be analyzed accordingly using class-specific network analyses.

Design

In the sampling procedure, we asked both schools to provide three control group classes, which received the treatment after the posttest. While considering the grade structure, all participating classes were randomly assigned to either the treatment or control condition. Thereafter, the study started with a pretest prior to the implementation of the program, followed by a treatment period in which 209 students from twelve classes attended the program (IG) whereas 119 students from six classes received no treatment (CG), and ended with a posttest conducted 4 months after the pretest. As a result of the successfully conducted randomization, the intervention and control groups resemble each other with regard to their sociodemographic constitution (IG:

$M_{\text{Age}} = 13.9$, $SD = 1.3$, 53% girls; CG: $M_{\text{Age}} = 13.3$, $SD = 1.4$, 46% girls).

Within the intervention group, fairplayer.manual was implemented by psychologists, who received a 2-day training prior to the intervention, in which they were educated to implement the manualized program, as well as supervisions during the intervention in order to exchange experiences and monitor the treatment fidelity of the program. The program consists of 15 weekly 90-minute sessions. Following the global structure of exposing the problem of, providing knowledge about, and training behavioral skills against bullying, each successive session covers a specific aspect of the program (see Table I). For example, in the session addressing social skills, students reflect about social norms, practice considering different perspectives including the importance of empathy, and learn moral reasoning by means of dilemma discussions.

Measures

All measures rely on self- and peer reports assessed in the evaluation questionnaires at pre- and posttest, which were administered by trained personnel during regular class periods.

Bullying behavior. At pre- and posttest, students were asked to report the frequency at which they display

TABLE I. Modules of fairplayer.manual

Module (Length)	Goals	Actions
1. Introduction (90 min)	Students are introduced to the program, its applied methods, and repeating structure as well as the general topic of bullying	<ul style="list-style-type: none"> • Explanation of work methods and procedure • Development of class rules with contract of agreement • Expose the problem of bullying
2. Awareness raising (2 × 90 min)	By addressing the issue of violence and its counterpart, this module aims to sensitize students and change their attitudes with respect to bullying behavior	<ul style="list-style-type: none"> • Provide knowledge about violence and moral courage • Educate students regarding the plurality of bullying • Sensitize students for the consequences of bullying
3. Perception of feelings (90 min)	This module aims to improve students understanding of their own and the perception of their peers' feelings	<ul style="list-style-type: none"> • Practice understanding and reflection of own feelings • Train perception of others' body signals and emotions
4. Participant roles (2 × 90 min)	With the participant-role approach (cf. Salmivalli, 1999), this module seeks to demonstrate the social complexity of bullying	<ul style="list-style-type: none"> • Inform about the social dimension of bullying • Perform guided role plays in order to understand and experience different roles within the bullying process
5. Social dynamics in class (90 min)	By creating synergistic group dynamics, this module aims to modify the social influence processes towards an antibullying atmosphere in class	<ul style="list-style-type: none"> • Enhance students' identification with their class • Address social norms within the class • Improve the overall class atmosphere and cooperation
6. Intervention possibilities (90 min)	This module aims to encourage students for and equip them with possible intervention options in different bullying episodes	<ul style="list-style-type: none"> • Stimulate self-reflected behavior • Practice prosocial behavioral options and possible intervening strategies in respective bullying situations
7. Social-skill training (5 × 90 min)	By training a broad variety of social competencies, this module aims to provide students with the skills to behave in accordance with the programs' objective	<ul style="list-style-type: none"> • Train perspective-taking and empathic skills with the help of guided and supervised role plays • Learn moral reasoning by means of dilemma discussion
8. Diversity (90 min)	This module puts a focus on marginalized groups in order to increase the acceptance of diversity	<ul style="list-style-type: none"> • Become aware of and accept perspectives of others • Learn to respect and appreciate diversity
9. Final reflection (90 min)	The final module seeks to consolidate and help to transfer the acquired knowledge and skills	<ul style="list-style-type: none"> • Repeat, discuss, and reflect the content of the program • Integrate program components in normal school days

bullying behavior on the Revised Bully/Victim Questionnaire (Olweus, 1996). After being provided with a definition of bullying, students rated their bullying behavior on seven items covering verbal, relational, and physical forms of victimization (e.g., “I called another student(s) mean names, made fun of or teased him or her in a hurtful way.” or “I took money or other things from him or her or damaged his or her belongings.”) by using a scale ranging from 1 (*no bullying*) to 5 (*often within a week*).

These data provided two outcomes for bullying behavior. First, a dichotomous variable classified students in bullies and nonbullies. The applied scaling procedure is similar to a checklist (cf., Solberg & Olweus, 2003), in which students were categorized to be a bully, when describing the frequency of their bullying behavior on at least one item with a score of at least 3 (more than once a month). Second, a continuous scale indicated each student's bullying behavior. In order to analyze its corresponding change, we subtracted the pretest- from the posttest-score, so that a negative value represents a decrease in bullying behavior.

Network parameter. At pre- and posttest, students were asked to report an unlimited number of those peers, with whom they prefer spending their time; that is, the generated networks are characterized by the interactional type of network tie (cf. Borgatti et al., 2009). This peer nomination procedure was realized with the help of a class roster. The resulting interaction patterns were used to extract the class-specific networks (see Fig. 1) and determine the social influence of their members by analyzing the four most established individual centrality parameters (cf. Hanneman & Riddle, 2005): indegree, Bonacich's centrality measure, closeness, and betweenness. Each of these parameters reflects a very specific

aspect of students' social influence within their networks as described below.

Indegree. The indegree is a centrality measure, which quantifies a person's number of incoming ties (i.e., received nominations) and therewith reflects someone's social importance (Freeman, 1979). In Figure 1, individuals are sized by their indegree, which indicates that student #13, #8, and #16 are the socially most important network members in this regard.

Bonacich. An alternative approach to determine a person's social influence represents Bonacich's centrality measure, which considers not only someone's number of connections, but also the number of connections to which someone is connected (Bonacich, 1987). Therewith, this parameter rather reflects a person's overall embeddedness within the network. For example, two equally connected network members may still differ with regard to their amount of social influence, when their friends' centrality varies. In Figure 1, student #1 and #23 have five connections each, but student #23, in turn, is connected to more important network members compared to student #1.

Closeness. The closeness parameter is a centrality measure representing the sum of geodesic distance, which is the distance of a person to all other network members and reflects his or her reachability (Freeman, 1979). The additional informative value of this parameter is clearly illustrated in Figure 1: Although they differ substantially with regard to their indegree and Bonacich's centrality scores, student #13 and #15 have comparably high closeness scores.

Betweenness. The final centrality measure is betweenness, which is based on the idea that the more persons depend on someone in contacting other persons, the more power this individual has (Freeman, 1977). This parameter reflects someone's linking role within a network and can be understood as a score that represents the tendency that the network structure changes dramatically or even splits into different components, in case this person is removed from the network. In the sample network of Figure 1, student #4, #15, and #22 are characterized by high betweenness scores.

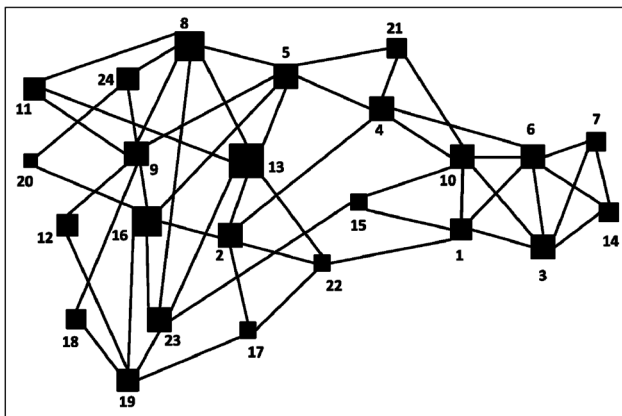


Fig. 1. Network of a sample school class. *Note.* Directionality of ties has been left out for reasons of simplicity.

Statistical Analyses

Utilizing the software UCINET in its current version 6.322 (Borgatti, Everett, & Freeman, 2002), we performed SNA to estimate all centrality parameters. The indegree parameter is based on directional graphs, whereas Bonacich's centrality measure, closeness, and betweenness were symmetrized, which means that incoming ties (received nominations) and outgoing ties (reported nominations) were equally treated as an undirected indicator of the overall degree centrality due

to their better applicability in nondirectional graphs.² In order to compare different school classes of varying sizes and densities, the centrality parameters were standardized within each class.

In the subsequent inferential-statistical analyses, we compared the intervention and control group regarding the extent to which the social influence reflected in the network dynamic varies as a function of bullying status and changing bullying behavior. For this purpose, we started to analyze the intervention-based network modification by utilizing a multivariate analysis of covariance, which contrasts the network change between the intervention group and the control group for bullies and nonbullies, while controlling for all respective initial network parameters. The interaction effect of intervention group and bullying status tests the hypothesis that bullies in the intervention group lose their social influence.

Thereafter, we applied the actor-based Simulation Investigation for Empirical Network Analysis (SIENA, version 3.11; Snijders, Steglich, Schweinberger, & Huisman, 2007) within the StOCNET environment (version 1.8). SIENA is the best developed and most frequently used statistic for longitudinal social network analysis and enables researchers to explain modifications within temporarily succeeding networks. The analytic consideration of different school classes was realized by entering one matrix, in which all class-specific networks were arranged in the diagonal, whereas the remaining between-classroom friendships were coded as structural zeros to indicate that there is no tie possible between classrooms. Within the model we specified selection effects (network dynamics), which capture the extent to which individual characteristics such as attitudes, norms, and behaviors affect the network formation.³ Based on the evaluation function, we estimated individuals' tendency to maintain or create ties in their local network neighborhood. Analogous to the procedure of generalized linear models, this individual change in the network is determined probabilistically with a linear combination

of different network effects. In this respect, we modeled two main types of effects: structural network effects and covariate effects. While structural effects capture endogenous network mechanisms, such as density, covariate effects estimate the network dynamics based on exogenous factors, such as changing bullying behavior. Table II describes and illustrates all parameters that we modeled in SIENA.

RESULTS

General Descriptives

A total of 1,319 nominations were made with a consequential average degree of 4.03 per student. Coincidentally exactly the same number of nominations occurred in both pretest and posttest. Nonetheless, the networks are not static: While 925 ties maintained, 394 new ties have formed and 394 old ties have disappeared from pretest to posttest, indicating the expected flexibility within the networks. Networks at both occasions have a similar overall reciprocity with 423 and 427 dyads at the pretest and posttest, respectively, whereas the remaining one-third of ties was found to be asymmetric. In accordance with the prevalence rates of bullying repeatedly found in the literature (e.g., Scheithauer, Hayer, Petermann, & Jugert, 2006), 13% of students at the pretest met the criteria to be classified as a bully in both the intervention and control group, which amounts to a total of 44 bullies. This quantity decreased to the posttest, while slightly favoring the intervention group (10%) over the control group (11%). Considering the intensity of students' bullying behavior, we revealed the expected marginal mean scores in both groups at the pretest ($M_{IG} = 1.20$, $SD = 0.33$; $M_{CG} = 1.25$, $SD = 0.53$, $P > .05$) with no group differences concerning their overall change towards the posttest ($\Delta M_{IG} = 0.00$, $\Delta M_{CG} = -0.06$, $P > .05$). The corresponding intervention-based network effects for students with high and increasing bullying behavior will be presented in the next and final result section, respectively.

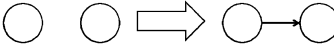
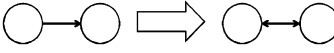
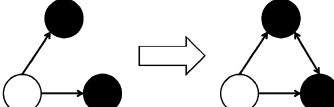
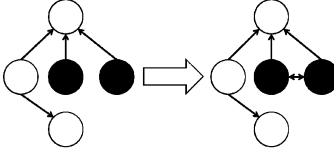
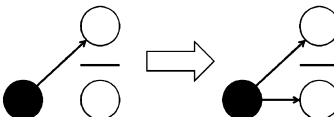
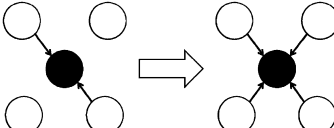
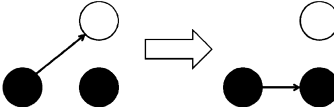
In the upper part of Table III, descriptives of the initial network parameters at the pretest are reported, separately for bullies and nonbullies in the intervention and control group. These group comparisons were examined using a 2×2 (intervention group, bullying status) multivariate analysis of variance. The corresponding group differences for each specific dependent variable are reported in the lower part of Table III.

We found the expected differences with regard to the bullying status: Bullies are characterized by a significantly higher centrality and social influence on all four initial network parameters (Pillai's Trace: $F(4, 321) = 4.00$, $P < .01$), as supported by the respective effect sizes that contrast bullies versus nonbullies across both groups.

²Parameters that go beyond counting the number of incoming ties (e.g., indegree) and consider complex relationship within the complete network (e.g., Bonacich's centrality measure, closeness, or betweenness) are subject to estimation difficulties when this network graph is disconnected. However, symmetrizing data—a common transformation in social network analysis (cf. Wasserman & Faust, 1994)—substantially increases the likelihood of an overall graph connectedness.

³Socialization effects (behavioral dynamics) which, in turn, capture the extent to which the network formation affects individual characteristics were not included, because the tested intervention addresses individual characteristics, which are expected to affect the network indirectly via selection effects. However, the intervention does not target the network itself in the way that it stigmatizes bullies or dictates students their friendship formation, so that socialization effects are implausible, at least given the present pretest–posttest design.

TABLE II. Synopsis of Network Parameters Modeled in SIENA

Network Parameters	Description	Illustration
Structural Network Effects		
Outdegree (Density)	It is helpful to think of the outdegree effect as an intercept reflecting the basic tendency to nominate actors within the network, for which this parameter represents a crucial control variable as well as a helpful reference value in order to interpret the effect of all other network parameter (Veenstra & Steglich, 2012)	
Reciprocity	This parameter represents actor's preference to create reciprocated relations within the network. One needs to control for reciprocity, just as for outdegree, in every SIENA estimation (cf. Snijders et al., 2007).	
Transitive Triplets	This effect represents the network closure by specifying the extent to which unconnected friends of an actor create connections to each other, in accordance with the premise "friends of my friends are my friends"	
Balance	Balance is the second network closure effect we control for, as recommended by Snijders et al. (2007). It displays an actors' preference for connections to others with a similar ego network by considering the congruence of existent and non-existent ties	
Betweenness	This triadic effect expresses an actors' linking role as the tendency to create connections to others which, in turn, are unconnected to each other. It was modeled to increase the comparability between both forms of analyses	
Covariate Effects		
Alter Effects	Alter effects represent the tendency that actors high on this covariate increase their indegrees indicating a preference to form ties based on this effect. In this regard, we included intervention group membership, the change in bullying behavior, and their interaction (previously created cross product). This interaction tests the hypothesis that increased bullying behavior is associated with decreased social influence in the intervention group	
Similarity Effects	Similarity effects (in case of dichotomous variables: same effects) are important controls, which express the tendency of actors to be connected to others with similar (the same) values on this covariate. In this regard, we modeled all covariates but intervention group, because the class-specific implementation of the intervention causes a complete similarity concerning this attribute	

With regard to the subsequent analysis of intervention effects, it is worth noting that neither the group main effect, nor the interaction term $\text{Group} \times \text{Status}$ yielded a significant difference concerning the network parameters at the pretest (Pillai's Trace: $F(4, 321) = .97, P > .05$ and $F(4, 321) = .77, P > .05$, respectively), which underscores the comparability of the intervention and control group as well as of bullies' social role in both groups.

Network Change

Table IV contrasts the descriptive network change between the intervention group and the control group for bullies and nonbullies in its upper part. Group differences

regarding the change on the four network parameters were examined with a 2×2 (intervention group, bullying status) multivariate analysis of covariance, controlling for the initial scores of all respective network parameters. The corresponding group differences for each specific dependent variable are reported in the lower part of Table IV.

As expected, the group main effect reveals that the majority of network scores changed significantly in the intervention group compared to the control group (Pillai's Trace: $F(4, 317) = 15.62, P < .001$). This result suggests that something happened within the network structure of those classes that participated in the intervention program. While the networks did not change

TABLE III. Initial Network Parameters

Group	Status	Indegree	Bonacich	Closeness	Betweenness
Intervention	No Bully ($n = 181$)	21.28 (11.57)	3.82 (2.09)	43.04 (10.42)	5.87 (7.77)
	Bully ($n = 28$)	27.14 (13.41)	4.86 (1.95)	48.32 (12.83)	9.46 (10.41)
Control	No Bully ($n = 103$)	18.64 (10.18)	4.20 (2.39)	42.17 (13.60)	5.38 (7.13)
	Bully ($n = 16$)	26.06 (14.58)	4.75 (2.67)	49.50 (14.57)	6.31 (8.17)
Intervention group ^a $F(1, 324)$		.92	.14	.00	1.90
Bullying status ^b $F(1, 324)$		11.79***	4.52*	9.86***	2.92*
Group \times Status $F(1, 324)$		.16	.43	.26	1.00
ES (Cohen's d)		.52	.39	.48	.30

^aCoded as "0" control group and "1" intervention group;

^bCoded as "0" nonbully and "1" bully; standard deviations are reported in the respective parenthesis; effects sizes contrast bullies versus nonbullies; one-tailed significances.

* $p < .05$.

*** $p < .001$.

TABLE IV. Network Change Scores

Group	Status	Indegree	Bonacich	Closeness	Betweenness
Intervention	No Bully ($n = 181$)	.40 (9.94)	.15 (1.64)	−10.28 (14.61)	−.26 (8.45)
	Bully ($n = 28$)	−3.82 (9.89)	−1.10 (2.09)	−21.25 (18.94)	−6.03 (10.19)
Control	No Bully ($n = 103$)	.57 (7.16)	−.15 (2.16)	−.68 (7.30)	−.63 (6.58)
	Bully ($n = 16$)	−1.37 (10.67)	.68 (1.92)	−1.56 (6.53)	.75 (8.35)
Intervention group ^a $F(1, 320)$		.13	7.34***	54.78***	3.82*
Bullying status ^b $F(1, 320)$		.10	.01	1.99	1.11
Group \times Status $F(1, 320)$		1.14	10.58***	7.44***	6.86***
ES (Cohen's d)		.24	.90	1.39	.73

^aCoded as "0" control group and "1" intervention group;

^bCoded as "0" nonbully and "1" bully; standard deviations are reported in the respective parenthesis; effects are controlled for all respective initial network parameters; effects sizes contrasting bullies in control group versus bullies in intervention group; one-tailed significances.

* $p < .05$.

*** $p < .001$.

as a function of the bullying status itself (Pillai's Trace: $F(4, 317) = .63, P > .05$), the Group \times Status interaction term demonstrates the expected effect: Whereas in the intervention group bullies become socially marginalized in contrast to their classmates, this bully-specific network change does not apply to the control group (Pillai's Trace: $F(4, 317) = 4.33, P < .01$). This intervention outcome was supported by the meaningful effect sizes that contrast bullies in the control group with those in the intervention group.⁴

⁴Following the conventional interpretation, .20 is a small, .50 is a moderate, and .80 is a large effect size (Cohen, 1988). School-based prevention programs are usually characterized by small to moderate effect sizes (cf., Wilson, Gottfredson, & Najaka, 2001), which are, however, still meaningful, because a "small" effect size of .33 implies an intervention-based improvement in the outcome variable by one-third of its standard deviation.

Network Dynamics

Table V reports the SIENA estimation of generated network dynamics based on the above outlined structural network and covariate effects (cf. Table II). This model is characterized by good convergence statistics with t -ratios for deviations close to zero and a low to moderate intercorrelation of estimated parameters. The estimates in the second column of Table V represent log-odds ratios, and after an exponentiation odds ratios, which specify the probabilities of students' network change.

The rate parameter yields a significant network change between pre- and posttest giving students the opportunity to modify their local network neighborhood, which is a necessary precondition for analyzing all following estimates of the network dynamic. The structural network effects reveal a low density of examined networks as well as a tendency of actors to create reciprocity, to form transitive triplets, and to dissolve their linking role. More specifically, the outdegree (density) effect indicates that

TABLE V. Network Evolution (SIENA Estimation)

	Estimate	Standard Error	|t-Value|^a
General Network Change			
Rate Parameter	4.36	0.17	25.65***
Structural Network Effects			
Outdegree (Density)	-0.98	0.15	6.53***
Reciprocity	1.59	0.16	9.94***
Transitive Triplets	0.14	0.02	7.00***
Balance	-11.91	8.54	1.40***
Betweenness	-0.47	0.07	6.71
Covariate Alter Effects			
Intervention group ^b	0.13	0.10	1.30
Bullying change	0.16	0.14	1.14
Group × Change	-0.43	0.18	2.39**
Covariate Similarity Effects			
Bullying change	-1.48	1.15	1.29
Group × Change	1.28	0.86	1.49

^aReported as absolute values;

^bCoded as “0” control group and “1” intervention group; effects are controlled for initial bullying scores, sex, age and their respective covariate similarity effects; one-tailed significances.

** $p < .01$.

*** $p < .001$.

students disfavor the basic tendency to form a new tie to a random network member ($e^{-0.98} = 0.4$). This generally suppressing effect for a network change disappears in case of reciprocity. Its estimate indicates that students are $e^{1.59} = 4.9$ times more likely to form a reciprocated tie, compared to an unreciprocated tie. Moreover, students have a slight preference to form a new tie if it produces transitivity ($e^{0.14} = 1.2$) and disfavor the establishment of a new tie in case of betweenness ($e^{-0.47} = 0.6$).

Although these structural effects primarily serve as control variables within the SIENA estimation, their values suggest the expected network dynamics, which break up rigid structures. In order to explain the change that is reflected in the significant rate parameter and the structural network effects, we consulted the covariate effects. Both main effects, the intervention group and bullying change, did not affect the network dynamics. However, as hypothesized, their interaction demonstrates that students in the intervention group with an increased bullying behavior decreased with regard to their social influence, because they represent an unfavorable option for a new tie ($e^{-0.43} = 0.7$).

DISCUSSION

The present study started to consider the social mechanisms of bullying for examining the efficacy of the fairplayer.manual bullying prevention program. For this purpose, we evaluated the program's objectives concerning the modification of bullies' central position and associated influence processes from a social network

perspective. In this manner, we built on research regarding the social status of bullies and revealed novel insights with respect to the intervention-based network dynamics.

The Social Status of Bullies

Bullying is evidently characterized by diverse social roles (Salmivalli, 1999) and effective interventions are designed to operate differently for bullies, assistants, or reinforcers (e.g., Kärnä et al., 2011). Hence, different social roles within the bullying process call for different analytic attention. The obviously most crucial role and the focus of the present study is the one of bullies. This role is of particular interest due to bullies' prominent social status in class: In accordance with the existing literature (e.g., Rodkin et al., 2006), our networks at the pretest revealed the expected patterns favoring bullies on all utilized parameters concerning their network position. This finding clearly supports our first hypothesis and demonstrates bullies' superior centrality and social influence, which they need for effectively expressing aggressive behavior and continuously victimizing weaker peers.

Without any interventions, bullying seems to present an antisocial but effective strategy for students to raise or maintain their position in the social hierarchy of a school class. Nonetheless, a program-based stigmatization or even purposeful isolation of bullies is certainly the wrong way. Literature suggests that some bullies, in turn, have a victimization background that explains their current behavior (Ma, 2001). Therefore, the challenge is rather to activate all students within a universal preventive intervention, in which the existing social mechanisms are targeted resulting in a modified social structure that prevents bullies from exhibiting their victimizing behavior.

Intervention-Based Network Dynamics

SNA has reached a point of analytic refinement, which makes it a valuable tool for testing these intended intervention effects. Recent conceptual, empirical, and technical advancements in the field of SNA equip researchers with the potential to further the understanding of the addressed social influence processes involved in preventive bullying programs.

The applied social network approach revealed uniquely informative parameters, which were related to two bullying outcomes in two consecutive inference statistics: First we examined the network change on diverse parameters as a function of bullying status and intervention-group membership by utilizing a multivariate analysis of covariance controlling for initial networks. Thereafter, we estimated the intervention-based network dynamics in SIENA based on the change in bullying

behavior while controlling for structural network effects. In accordance with our hypotheses, bullies in the intervention group lose their powerful position in contrast to those of the control group and students in the intervention group, who increase their bullying behavior, experience a decrease in their social influence compared to the control group. Hence across both forms of analyses, these complementary findings provide evidence for the desired intervention effect of reducing contextual opportunities for the exhibition of bullying behavior.

Interestingly, with the exception of indegree, the network change effects applied to all parameters including Bonacich's centrality measure, closeness, and betweenness. More specifically, after conducting the intervention, bullies have significantly fewer important connections (Bonacich's centrality measure), are significantly less centrally embedded (closeness), and have a significantly decreased linking function (betweenness) within the network of their school class. However, although the absolute number of connections (indegree) tends to decrease for bullies in the intervention group, this network change missed the level of statistical significance. That is, bullies do not become isolated from the rest of their school class and roughly maintain the quantity of their peer relationships, while precise network parameters that went beyond the consideration of students number of friends, clearly indicate an intervention-based reduction of bullies' social influence. This corresponds with the programs objectives, which aims to improve students' social skills and to target their attitudes towards and norms about bullying. If bullies had become isolated from their class, the programs' success would be questionable, because social isolation or relational aggression is considered also to be a form of bullying behavior (Olweus, 1993, 1996). However, as intended by the program, the intervention-based network development does not bully the bully, but is rather characterized by a qualitative loss of their previous influential position, which narrows opportunities to express powerful and continuous victimizing behavior.

Limitations and Future Research Directions

The study is longitudinal in nature and the development of both constructs, social networks and bullying behavior, is adequately reflected in their respective measurements, but the present pretest–posttest design is restricted to two measurement points only. Although SNA presents a sophisticated form of analyzing data, each network merely pictures a snap-shot of a current social system. Especially in SIENA, multiple waves can be considered comfortably and have the potential to increase the explanatory power. Therefore, ongoing studies should seek to incorporate more measurement points for testing the long-term effects of programs or for

conducting a process evaluation including many succeeding waves, which allows a detailed examination of the modifying social mechanisms during the intervention period. From a social network perspective, another valuable direction for future research is the investigation of social mechanisms across varying social settings. More specifically, we encourage researchers to analyze intervention-based network dynamics in other school structures in order to replicate the present findings and to determine contextual factors that, in turn, affect the efficacy of bullying prevention programs.

While SNA takes information from all students into account, bullying behavior was assessed by means of self-reports. For this reason, the data on this central outcome variable may lack objectivity, because of phenomena such as the tendency of social desirability. Although Espelage and Swearer (2003) emphasized that students' introspective perception presents a useful and necessary predictor for measuring their actual bullying behavior, the consideration of multiple measures will certainly enrich this field of research. In particular, the empirical and analytic integration of external information provided by teachers or peers concerning students' bullying behavior should be realized in future studies that examine the intervention-based network dynamics of bullying prevention programs.

After we started to evaluate bullying prevention programs concerning their social mechanisms, future studies need to provide details on how and by whom they operate. Group processes, in particular in- and outgroup effects, were found to further our understanding of bullying behavior (Huitsing & Veenstra, 2012). Hence additional subgroup information on who bullies whom, and especially the extent to which these dynamics change within the course of an intervention, should be taken into account for advancing this line of research.

Beyond demonstrating the applicability of SNA for examining social mechanisms within bullying prevention programs, the present findings evidently demonstrate the efficacy of the implemented program fairplayer.manual in reducing bullying among middle-school students. We hope that further efforts in the field of bullying prevention will benefit from the presented information concerning the background, structure, operating mechanisms, and efficacy of this bullying prevention program in Germany.

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