

Developmental Dynamics of Intergroup Contact and Intergroup Attitudes: Long-Term Effects in Adolescence and Early Adulthood

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Intergroup contact represents a powerful way to improve intergroup attitudes and to overcome prejudice and discrimination. However, long-term effects of intergroup contact that consider social network dynamics have rarely been studied at a young age. Study 1 validated an optimized social network approach to investigate intergroup contact ($N = 6,457$; $M_{\text{age}} = 14.91$ years). Study 2 explored the developmental trajectories of intergroup contact by applying this validated network approach in a cross-sequential design (four-cohort–four-wave; $N = 3,815$; 13–26 years). Accelerated growth curve models showed that contact predicts the development of attitudes in adolescence, whereas acquired attitudes buffer against decreasing contact in adulthood. Findings highlight the potential of social network analysis and the developmental importance of early intergroup contact experiences.

A major challenge of contemporary societies, which may become more diverse on the one hand (Hooghe, Reeskens, Stolle, & Trappers, 2009) but increasingly (re)segregated on the other hand (Nightingale, 2012), is the potential risk for prejudice, discrimination, or social exclusion of certain groups (e.g., immigrants, ethnic minorities). Intergroup contact represents one approach that helps to improve intergroup relations and, therewith, to overcome prejudice and discrimination. Based on the seminal contact hypothesis (Allport, 1954), six decades of research have produced compelling evidence that direct outgroup contact (i.e., positive face to face encounters) successfully reduces prejudice, especially in the form of intergroup friendship (Davies, Tropp, Aron, Pettigrew, & Wright, 2011; Pettigrew & Tropp, 2006). Moreover, even the indirect experience of intergroup contact, for example, in the form of extended contact (i.e., the amount of outgroup contact that someone's ingroup friends have; Wright, Aron, McLaughlin-Volpe, & Ropp, 1997), can improve intergroup relations (Vezzali, Hewstone, Capozza, Giovannini, & Wölfer, 2014). Extended contact is typically less powerful than

direct contact, but has special value as an effective means to improve intergroup relations in settings where opportunities for direct contact are lacking (Dovidio, Eller, & Hewstone, 2011). Moreover, from a developmental point of view, extended contact may be considered a platform for the formation of direct contact by promoting positive outgroup expectancies and favorable norms that prepare individuals for future direct contact experiences (Gomez, Tropp, & Fernandez, 2011; Schofield, Hausmann, Ye, & Woods, 2010) and, therefore, reveals stronger long-term than short-term effects (see Christ et al., 2010). Hence, the simultaneous consideration of both direct and extended contact acknowledges the contextual and developmental aspects of individuals' complex social fabric.

Although important progress has been made in this area, our understanding of intergroup contact can be improved in two respects: First, much of the existing work in this field relies primarily on self-reported contact and thus neglects the complexity of social networks, which can be captured with social network analysis (SNA) that structures relationships among network members and hence provides valuable insights into their intra- and intergroup relations. Second, although the last 10 years have seen an increase in longitudinal

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studies (e.g., Feddes, Noack, & Rutland, 2009), research on long-term intergroup contact covering a broad developmental period across multiple waves and many years is still rare. Therefore, the present article aims to gain a better understanding of intergroup contact effects by considering (a) underlying social network processes and (b) long-term developmental dynamics.

Developmental Importance of Early Intergroup Relations

Studying intergroup relations in the context of network and developmental dynamics is an important research perspective in general, but is especially relevant at a young age. On the one hand, important social-cognitive changes happen in adolescence, which affect the development of intergroup attitudes. These changes include, for example, an increasing understanding of group norms (Abrams & Rutland, 2008), developing moral beliefs (Rutland, Killen, & Abrams, 2010), and—a key developmental task—the formation of adolescents' identity (Erikson, 1963), which also involves the manifestation of an ethnic identity and ethnic self (French, Seidman, Allen, & Aber, 2006). Although social-cognitive facets continue to change in adulthood, many of them become manifested in adolescence and, once acquired, change to a lesser extent thereafter. For example, after individuals have developed an (ethnic) identity, they have a relatively stable understanding of their (ethnic) self over the life course (French et al., 2006).

On the other hand, peer relationships reach the climax of importance in adolescence and socialize (intergroup) attitudes and behaviors (Brechwald & Prinstein, 2011; Henry, Schoeny, Deptula, & Slavick, 2007; Wölfer, Bull, & Scheithauer, 2012). The relevance of peer relationships in adolescence is thought to increase the salience of social norms, which in turn can affect intergroup bias via a self-presentation process (Rutland et al., 2010). Adolescents thus adjust their attitudes, beliefs, and behavior depending on group-specific conventions and expectations. And although peers and the social contexts remain important in adulthood, their influence decreases (LaFontana & Cillessen, 2009).

In sum, literature from developmental science suggests that intergroup contact experiences at a young age are particularly effective for acquiring favorable intergroup attitudes. Specific cognitive and psychosocial dynamics (e.g., moral development, identity formation, importance of peers, better understanding, and higher salience of social norms) seem to increase adolescents' sensitivity to

intergroup contact experiences, which in turn shape their intergroup attitudes and thus their future levels of prejudice and discrimination. This developmental importance of early intergroup relations makes adolescence an important period of investigation. However, social network and long-term developmental effects have rarely been studied at this age and little is known about the formation of intergroup attitudes in adolescence and its long-term development into adulthood, while considering the ethnically diverse, naturalistic network environment to which adolescents are exposed.

Research Objectives

Study 1 validates a network approach to investigate intergroup relations using a large-scale international data set that assessed psychosocial and sociometric information in ethnically mixed schools. Study 2 explores the developmental mechanisms of intergroup contact by applying the previously validated social network operationalization in a large, longitudinal data set that covers a long developmental period from early adolescence to early adulthood. To test whether the expected age difference of contact effects between adolescence and adulthood is based on the theorized developmental processes or on different contact opportunities, Study 2 additionally tests the moderating role of diversity for contact effects.

In both studies, we operationalize intergroup contact as the quantity of intergroup friendships, because it represents a particularly optimal type of contact (Allport, 1954; Davies et al., 2011; Pettigrew, 1998). Whereas Study 1 assessed intergroup relations in the majority group (i.e., participants who were born and have parents who were born in the survey country) and the minority group, Study 2 concentrated on the majority only. For the sake of comparability, we will hence focus on the majority across both studies, but—due to plausible differences between minority and majority members (e.g., Tropp & Pettigrew, 2005)—additionally estimate effects for the immigrant minority group utilizing the available data in Study 1.

Study 1: The Potential of Social Networks

A large body of research has improved our understanding of intergroup contact from various empirical perspectives including survey-based self-reports (Pettigrew, 1997), laboratory experiments (Thompson, 1993), observational studies (Jarrott & Smith,

2011), behavioral measures (McKeown, Cairns, Stringer, & Rae, 2012), neurophysiological investigations (Phelps et al., 2000), and meta-analytic reviews (Pettigrew & Tropp, 2006). However, SNA has been almost completely neglected in contact research (for an exception, see Munniksma, Stark, Verkuyten, Flache, & Veenstra, 2013), which is surprising, because it captures the complex mechanisms that underlie intra- and intergroup relations.

As illustrated in Figure 1, SNA structures relationships between network members and analyzes the extent to which this structure explains something about the network members (Borgatti, Mehra, Brass, & Labianca, 2009). SNA represents a valuable approach, particularly in the realm of contact research, because it considers (a) more comprehensive and more accurate peer nominations, (b) direct and indirect relationships within the naturally existing social structure in a given network boundary (e.g., school classrooms), and (c) individual and contextual characteristics that enrich person-based explanations (for more details and a general introduction to SNA and its application to contact research, see Wölfer, Faber, & Hewstone, 2015). Along these lines, SNA allows a more precise assessment of intergroup relations, which facilitates, in particular, the investigation of indirect intergroup contact such as extended contact (Wright et al., 1997). We contend that individuals are able to accurately report their direct contact, but they are likely to have difficulty in reporting completely accurate information concerning their extended contact given its complex two-step nature (i.e., the outgroup contact experienced by one's ingroup friends). That is,

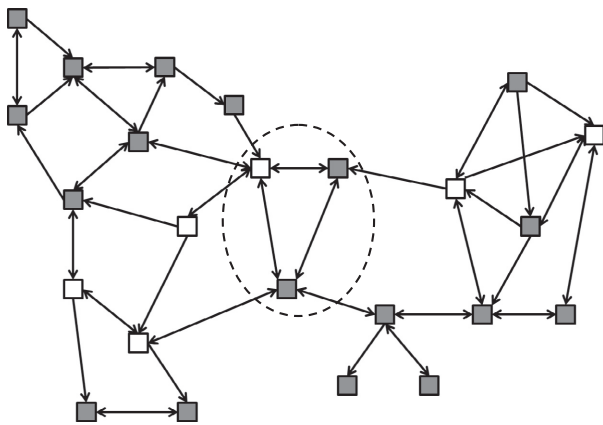


Figure 1. Example social network of a school class.
Note. Nodes represent students, colored by group membership (gray: majority; white: minority), and lines represent relationships (double arrows denote mutual relationships); the dashed circle represents a transitive triplet.

we do not hypothesize that individuals lack the knowledge about their extended friends, but that they might lack the ability to accurately recall it and report the full complexity of extended contact experiences when responding to a questionnaire item. This task might be particularly challenging for children and adolescents whose social-cognitive skills are still developing. In contrast, SNA allows an accurate assessment of individuals' network connections, and hence advances the assessment of intergroup contact.

A pioneering study sought to exploit the potential of SNA for examining extended contact in school classes (Munniksma et al., 2013). Unfortunately, in small networks such as a school class, contact researchers are faced with overlapping or limited information due to the phenomenon of transitivity, which describes a well-supported tendency in networks for the friends of my friends to also be my friends. For example, the transitive triplet within the dashed circle of Figure 1 contains two majority students, who have both direct contact and extended contact—via the other ingroup member—to the minority student. As a result, direct contact and extended contact are strongly intercorrelated and likely to produce multicollinearity. Alternatively, if researchers exclude all of these transitive triplets, very little extended contact information remains, which can lead to problems in replicating extended contact effects found in previous studies (Munniksma et al., 2013).

A more optimal approach, we argue, is to decompose the complex two-step concept of extended contact into two separate analytical procedures: (a) the accurate identification of individuals' reciprocally connected ingroup friends within the social network and (b) the assessment of their intergroup contact. In the second step, it is crucial to capture the general intergroup contact within a wider context (i.e., beyond the local network environment of individuals' directly available contact options) to avoid the problem of transitivity in small networks.

Hence, Study 1 examines the effect of direct and indirect intergroup contact on intergroup attitudes by considering individuals' self-reported outgroup contact (i.e., direct contact) and the self-reported outgroup contact of their ingroup friends that were identified via SNA (i.e., extended contact). We validated this optimized network operationalization of intergroup contact by a large-scale international data set including multiple ethnically diverse networks of adolescents (i.e., school classes).

Method

Sample

Participants were part of the Children of Immigrants Longitudinal Survey in Four European Countries (Kalter et al., 2013), of which we used the completed first wave of this ongoing international collaboration between England, Germany, the Netherlands, and Sweden. From these four countries, England had to be excluded due to a technical problem during the assessment of the social network data (i.e., inconsistent definition of the network boundary by the survey research company). The numerical composition of the main immigrant minority groups is balanced within and between each participating country, although the specific groups tend to vary across countries (Germany: Turks = 2%, Poles = 1%, and Italians = 1% [Statistisches Bundesamt, 2014]; the Netherlands: Turks = 2%, Moroccans = 2%, and Indonesians = 2% [Statistics Netherlands, 2014]; Sweden: Iraqis = 1%, Poles = 1%, and Iranians = 1% [Statistics Sweden]).

The target population of 14-year-old children was recruited within a school-based stratified sample selection that considered different strata of immigrant proportions. Participation rate was high (school participation = 84%, class participation within participating schools = 99%, and student participation rate within participating classes = 85%). Classes with fewer than 15 (11%) students were excluded to conduct meaningful analyses in considerably large networks. This exclusion criterion left a total of 7,970 majority students from 595 ethnically mixed school classes along with 5,018 immigrant minority student classmates, from Turkey (7%), Morocco (2%), Iraq (2%), Serbia (2%), Bosnia and Herzegovina (1%), Poland (1%), Suriname (1%), Russia (1%), and a variety of other countries (each < 1% of the current sample). Of these majority students, completed data were available from 81%. Missing data analyses revealed that students with incomplete data differ marginally at best from the rest regarding gender (51% vs. 50% girls; $d = .01$) and age (14.87 years vs. 14.91 years; $d = .08$), so that attrition can be considered unsystematic. The final sample size comprises 6,457 majority students ($M_{\text{age}} = 14.91$ years; 50% girls) from 590 classes.

Measures

Data were collected in the school year 2010–2011 with a questionnaire that assessed migration-specific characteristics, core dimensions of integration,

sociometric data, and school achievement, from which we analyzed the measures described below.

Intergroup attitudes. The outcome variable was assessed with the feeling thermometer, which demonstrates satisfactory psychometric properties across different age groups and nationalities (cf. Lollot et al., 2014). On a thermometer that runs from 0 to 100 degrees with “warmer” scores indicating more favorable attitudes, participants evaluated the largest minority groups within each respective country. To provide a more reliable measure of general intergroup attitudes, comparable across countries, we averaged attitude scores across multiple immigrant minority groups. Exploratory factor analysis revealed a one-factor solution for all minority attitude scores in each country, supported by satisfactory Cronbach’s α ranging between .84 and .97.

Direct contact. Participants reported for each of the main country-specific minority groups how many outgroup friends they had in general, within and beyond the school context (“Thinking now about all of your friends. How many of them have a [. . .] background?”; from 1 = none of or very few to 5 = almost all or all). To provide a more reliable measure of general direct contact, comparable across countries, we averaged contact scores across multiple immigrant minority groups. EFA revealed a one-factor solution for all minority contact scores in each country, supported by satisfactory Cronbach’s α ranging between .64 and .78.

Extended contact. We assessed our optimized network operationalization of extended contact using the following procedure: (a) We elicited social networks in each class based on a peer nomination procedure that asked each student to nominate up to five classmates: “Who are your best friends in class?” (see Figure 1); (b) we looked at each student’s direct connections within the network; (c) based on the immigrant status, we determined each students’ direct ingroup connections (i.e., connections between same-color boxes in Figure 1); (d) from these direct ingroup connections, we selected all reciprocal relationships in order to capture students’ ingroup friends (i.e., double-arrowed connection between same-color boxes; e.g., the two gray boxes in the dashed circle of Figure 1); and (e) in the final step, we averaged the self-reported direct contact of these ingroup friends, which was measured with separate survey items (described above). This analytic strategy thus yields a precise measure of each participant’s extended contact, because it separates the two analytic steps of extended contact. That is, we did not ask participants to estimate the outgroup contact of their

ingroup friends but objectively identified these ingroup friends with social network data and, in a subsequent step, assessed their outgroup contact directly.

Control variables. Relevant control variables include sex, age, and number of ingroup friends on the individual level, as well as diversity (i.e., immigrant proportion in class), density (i.e., overall network connectedness), reciprocity (i.e., amount of bidirectional relationships), and class size on the contextual level. Although age and sex represent important sociodemographic control variables, the remaining variables are important controls in the context of the present study, because their score determines the opportunity for intergroup contact. More specifically, density represents the potential for general contact experiences, diversity represents the potential for direct intergroup contact experiences, the number of ingroup friends represents the potential of agents for extended contact experiences, and reciprocity represents the potential for mutually connected (intergroup) friendships.

Statistical Analysis

We used multilevel modeling (Raudenbush & Bryk, 2002) to adequately consider the nested data structure. A two-level random-intercept model with students on Level 1 and school classes on Level 2 predicted majority students' attitudes toward the minority from the extent of direct and extended contact, while controlling for diversity, sex, age, ingroup friends, and contextual network characteristics. All continuous variables were *z* standardized to facilitate the interpretation of regression coefficients.

Results and Discussion

SNA was based on a total of 37,622 nominations (per class: $M = 63.77$, $SD = 20.46$). Majority students made 23,614 friendship nominations, of which 16,251 were reciprocated, comprising 11,910 reciprocal ingroup friendships and 3,380 reciprocal outgroup friendships. The revealed ethnic homophily within the social networks (i.e., the preference for forming ingroup friendships) was supported by participants' self-reports: The means of individual study variables revealed low levels of intergroup contact (direct contact: $M = 1.65$, $SD = 0.92$; extended contact: $M = 1.39$, $SD = 0.90$) and mildly favorable intergroup attitudes ($M = 56.43$, $SD = 23.25$). The intercorrelation of self-reported direct contact and the network-enriched measure of extended contact was only low to moderate,

$r(6,455) = .20$, $p < .001$, indicating that the different contact variables measured distinct facets of intergroup relations. This result provides support for the divergent validity of our new extended contact measure as it does not overlap substantially with similar but distinct constructs.

Table 1 summarizes multilevel models that estimated adolescents' intergroup attitudes. The unconditional model determined the variance proportion of the outcome variable across the two levels with a resulting intraclass coefficient of .13, indicating that 13% of the variance in intergroup attitudes is attributable to the class level, which differs significantly from zero, $\chi^2(589) = 1,505$, $p < .001$. The main model revealed significant beta weights for direct contact and for the new extended contact parameter, while controlling for sex, age, number of ingroup friends, diversity, class size, and collective network parameters. It should be noted that this main model can be replicated for the immigrant minority group ($n = 4,465$ students with completed data). Their respective intergroup attitudes toward the majority are similarly predicted by the amount of direct and extended contact toward the majority ($B = 7.51$, $SE = .47$, $p < .001$; $B = 1.39$, $SE = .44$, $p < .01$, respectively), while controlling for the same variables.

To summarize, our first study tested the potentially powerful but underused social network approach for studying intergroup relations, which

Table 1
Multilevel Prediction of Intergroup Attitudes (Study 1)

	Unconditional model			Main model		
	<i>B</i>	<i>p</i>	<i>SE</i>	<i>B</i>	<i>p</i>	<i>SE</i>
Level 1: Students						
Direct contact				4.58	***	.34
Extended contact				0.95	**	.36
Number of ingroup friends				-0.18		.33
Level 2: School classes						
Class size				-0.38		.50
Diversity				-0.72		.43
L1 variance (<i>R</i>)	476			460		
L2 variance (<i>U</i> ₀)	70			41		
Deviance (<i>df</i>)	58,660 (3)			58,285 (12)		
Δ Deviance in χ^2 (<i>df</i>), <i>p</i>	—			376 (9), < .001		

Note. L1: 6,457 students, L2: 590 school classes. Models are controlled for sex, age, and collective network parameters; beta weights indicate the change in students' intergroup attitudes in points on the feeling thermometer, if the corresponding predictor increases by 1 *SD*; full information maximum likelihood estimation. ** $p < .01$. *** $p < .001$.

is—due to the importance of peer relationships—specifically relevant for contact research in adolescence. Results validated the optimized network operationalization of intergroup contact, which has the potential to advance the investigation of intergroup contact and its developmental dynamics.

Study 2: Long-Term Developmental Dynamics of Intergroup Contact

Studying intergroup contact from a longitudinal perspective is of vital importance, because the extent to which intergroup contact affects intergroup relations explicitly describes a longitudinal process. That is, intergroup contact does not reduce prejudice instantly, but—as highlighted by Pettigrew's (1998) reformulated contact theory—operates via underlying processes (i.e., learning about the outgroup, changing behavior, generating affective ties, reappraising the ingroup) that stimulate attitude change over time. Moreover, longitudinal research allows us to analyze the direction of developmental processes by considering both pathways: from contact to attitudes and, vice versa, from attitudes to contact. Building on previous research that indicates bidirectional short-term effects between intergroup contact and intergroup attitudes (Binder et al., 2009), a long-term perspective can provide valuable insights regarding their complex developmental dynamics over a broad period of time. Finally, a longitudinal perspective enables us to examine the change in intergroup contact effects over time to identify developmental periods in which intergroup experiences are particularly effective. This is important, because a better understanding of the developmental trajectories of contact effects may provide valuable knowledge that can optimize the effect and age appropriateness of contact interventions.

Recent literature highlights the importance of early intergroup contact experiences for the reduction of prejudice (Raabe & Beelmann, 2011; Rutland et al., 2010). Fundamentally important cognitive and psychosocial changes in adolescence, such as the development of social-cognitive skills and moral beliefs (Rutland et al., 2010), a better understanding of group norms (Abrams & Rutland, 2008), the formation of an ethnic self and identity (French et al., 2006), the increasing relevance of peers (Brechtwald & Prinstein, 2011), and their importance for socializing attitudes (Henry et al., 2007), shape intergroup attitudes and suggest that adolescence represents a particularly important developmental period for the experience of intergroup contact.

Longitudinal research investigating the effects of intergroup contact has increased over the last 10 years. However, especially at a young age, long-term intergroup contact research covering a broad developmental period across multiple waves and many years is rare. As summarized in Appendix S1, the current state of research reveals a total of 44 longitudinal contact studies in 41 articles, but only a select few of these studies examined contact effects (a) across more than two waves, (b) over more than 2 years, or (c) in childhood or adolescence, although no study meets all of these criteria. Moreover, only very few studies considered both direct and extended contact, although only one study used a social network approach to measure intergroup contact (Munniksma et al., 2013).

Therefore, in Study 2 we explored the long-term developmental dynamics of intergroup contact from early adolescence (13 years) to adulthood (26 years), while applying the previously validated social network approach that simultaneously considers direct and extended contact. For this purpose, we utilize a four-wave (1–2 year time lag) cross-sequential design covering four cohorts in an ethnically diverse social network of an entire community. This unique data set has the potential to advance our understanding of the development of prejudice by providing comprehensive data over a long period of time that allows us to unravel age effects from cohort and period effects and, thereby, improve the developmental comparison of intergroup contact mechanisms between adolescence and adulthood.

Method

Sample

Participants comprised four cohorts (13-, 16-, 20-, and 22-year olds) from a mid-sized Swedish city that is nationally representative regarding population density, income level, and unemployment (Statistics Sweden, 2014). The percentage of minority participants who were themselves born outside of Scandinavia or who had parents born outside of Scandinavia in the current sample is similar to that of the Swedish national average (8%). Data were collected in schools for the first two cohorts. For the first cohort, 13-year-olds were asked to participate by targeting all seventh graders of the comprehensive school system ($n = 1,221$, participation rate = 95%). For the second cohort, 16-year-olds were targeted at the three schools in the city ($n = 1,207$, participation rate = 83%). The first two

cohorts filled out questionnaires annually on four occasions (September 2010, 2011, 2012, and 2013). In the third and fourth cohorts, a randomized sample of 1,000 individuals each within the entire community was targeted (third cohort: $n = 598$, participation rate = 61%; fourth cohort: $n = 601$, participation rate = 61%). The third and fourth cohorts filled out questionnaires on three occasions with a 2-year interval (2010, 2012, and 2014).

We additionally included nominated friends as participants in this study. Every participant was asked to write down the names of (a) three most important friends, and (b) up to 10 general friends. For Cohort 1 and Cohort 2, nominations were restricted to in-school friendships, so that nominated friends themselves participated in the project. For Cohorts 3 and 4, up to three of the most important friends on list (a) were sent a questionnaire with information about the study. The participation rates of these nominated friends were 79% for Cohort 3 ($n = 232$) and 82% for Cohort 4 ($n = 267$). The vast majority of the friends' friends already participated (between 86% and 92% of the nominated friends' friends across measurements). These participating nominated friends and nominated friends' friends did not differ significantly ($p > .10$) in gender, age, or ethnicity from the nominated friends and nominated friends' friends who did not participate, or from the target participants in Cohorts 1–4. The friends ($n = 499$) were added to the original sample of 3,627 participants, creating a total sample of 4,126 participants. This total sample included an analytic sample of 3,815 majority participants (1,896 girls, 1,919 boys; $M_{\text{age}} = 17.26$) from ethnically mixed schools or communities with a total of 311 immigrant minority group members, from Bosnia and Herzegovina (3%), Somalia (2%), Iraq (2%), Kurdistan (2%), Turkey (2%), Lebanon (2%), Vietnam (2%), Kosovo (1%), Syria (1%), Iran (1%), and a variety of other countries (each < 1% of the current sample). Participants who participated at all times (92%) and those who did not were not significantly ($p > 10\%$) different from each other on any of the Wave 1 variables. Missing data on each of the variables within each time point (< 7%) were estimated using full information maximum likelihood.

Instruments

Intergroup attitudes. Majority students' intergroup attitudes were measured with the Tolerance scale of the Prejudice and Tolerance Questionnaire, which has been shown to have a high congruent,

discriminant, and predictive validity (Van Zalk, Van Zalk, Kerr, & Stattin, 2013). Participants were asked to rate four items pertaining to tolerant attitudes toward immigrants (e.g., "Immigrants and nonimmigrants should have equal rights") on a 4-point Likert scale (1 = *don't agree at all* to 4 = *agree completely*). Cronbach's alphas ranged between .92 and .94.

Direct contact. We measured direct contact by means of participants' friendship nominations and their independent reports on ethnicity. Although our analytic sample consisted of majority members only, we used all available information in the entire sample to establish whether each of a majority member's nominated friends belonged to an immigrant minority group.

Extended contact. Consistent with the previously validated social network approach, this parameter was measured by (a) identifying participants' reciprocally connected ingroup friends within their social network and (b) determining these ingroup friends' general intergroup contact within a wider context (i.e., beyond participants' local network environment) to avoid the problem of transitivity in small networks. The second step was realized with the applied sampling technique, where participants' friends nominated, in turn, their friends within the entire school or community.

Diversity. Diversity was examined by calculating the proportion of minority members per school at each measurement, which ranged between 5% and 79%. Diversity was only available for cohorts measured in school (i.e., Cohorts 1 and 2).

Statistical Analysis

We examined the development of intergroup attitudes, direct contact, and extended contact with accelerated longitudinal growth modeling (ALGM). We used multivariate ALGM in a cross-lagged design to be able to compare longitudinal effects of contact on attitudes to longitudinal effects of attitudes on contact using standardized estimates. A major advantage of ALGM is the utilization of latent variables to estimate the starting levels (intercepts) and changes (slopes) in variables, thereby attenuating effects for measurement error in the latent constructs and obtaining more reliable estimates for the effects between the constructs (Little, Preacher, Selig, & Card, 2007). To compare developmental trajectories in intergroup contact and attitudes between adolescents and adults, we estimated intercepts and slopes separately for the two younger (13 and 16 years at Wave 1,

respectively) and the two older cohorts (20 and 22 years at Wave 1, respectively). In the accelerated design, participants' age was used as an indicator of time of measurement. As there were four age cohorts, we used a multiple group analysis with each group representing a cohort (cf. Little et al., 2007).

Results and Discussion

Developmental Trajectories

Appendix S2 provides means of and correlations between all study variables. We used ALGM to estimate the developmental trajectories of these three variables from age 13 (starting age of youngest cohort) to age 26 (end age of oldest cohort). As recommended by Little et al. (2007), we started with constraints between each cohort in all parameters, and tested differences between cohorts by unconstraining parameters one by one across the four cohorts. None of the multiple group differences were significant ($\Delta\chi^2 < 2.319$, $\Delta df = 3$, $p > .10$), indicating no cohort effects on the developmental trajectories. We therefore left constraints between the cohorts in all final models. When trying to estimate the slope of intergroup attitudes in the older cohorts, the variance of the slope became

negative and close to zero ($v = -.0002$) and was, therefore, fixed to 0 (Kline, 2005). All other slopes were significant (vs range between .004 and .123, $p < .001$), showing that individuals differed in their changes in intergroup attitudes, direct contact, and extended contact. The model fit indices of this final model were excellent ($\chi^2 = 15.982$, $df = 19$; $p = .05$; TLI $> .99$; comparative fit index = .999; root mean square error of approximation [RMSEA] = .001; RMSEA 90% CI = [.000, .001]). Findings show that, on average, intergroup attitudes became more positive over time ($M = 0.014$ in adolescence, $M = 0.021$ in early adulthood, $p < .001$). In contrast, we found a decrease in both direct contact ($M = -0.046$ in adolescence, $M = -0.049$ in early adulthood, $p < .001$) and extended contact ($M = -0.263$ in adolescence, $M = -0.254$ in early adulthood, $p < .001$), which is consistent with the phenomenon of ethnic homophily (cf. McPherson, Smith-Lovin, & Cook, 2001).

Long-Term Dynamics of Intergroup Contact

Appendix S3 shows all associations and effects between the developmental trajectories of intergroup attitudes, direct contact, and extended contact. A graphical representation of the relevant effects is shown in Figure 2. Correlations between

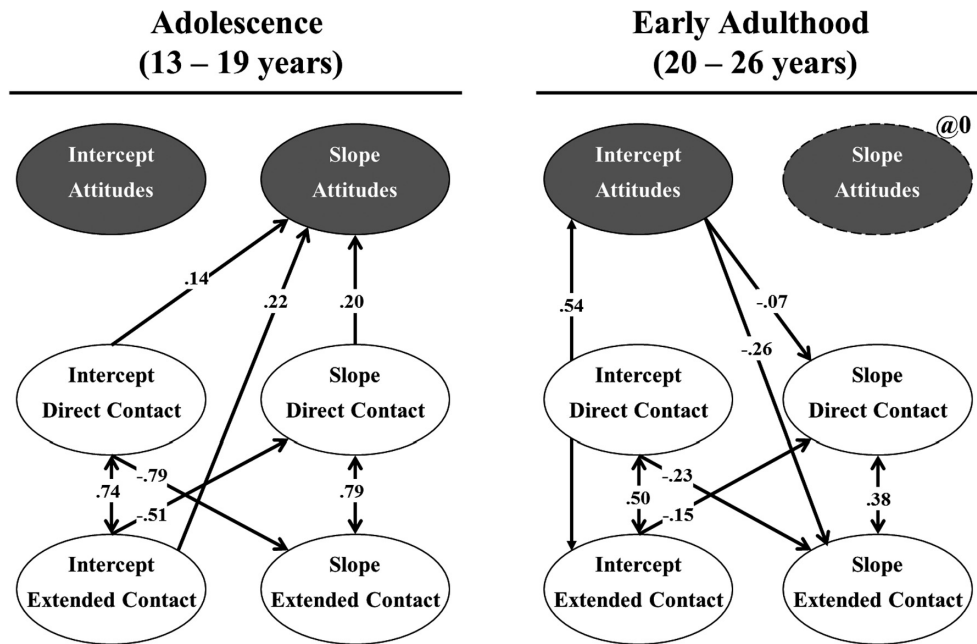


Figure 2. Accelerated growth curve model (Study 2). Note. Developmental trajectories were estimated separately for adolescence (ages 13–19) and for young adulthood (ages 20–26) in one single model. Double-headed arrows represent correlations, single-headed arrows represent standardized regression coefficients, @0 indicates the nonexisting variance of this latent variable. Only findings concerning hypothesized associations and effects are shown (for all effects see Appendix S3). All effects shown are statistically significant ($p < .05$) and are estimated standardized regression weights.

intercepts represent how starting levels of different constructs were associated. Correlations between slopes represent how changes in each construct co-occurred with changes in another construct. Effects of intercepts on slopes represent how the starting level of a construct predicted changes in a construct. All effects in Figure 2 can be interpreted as the change in the outcome variable (indicated by incoming arrows), if the respective predictor (indicated by outgoing arrows) increases by 1 *SD*.

Interestingly, the growth curve models suggest differential developmental processes. Findings show that direct and extended contact both predicted a positive development of intergroup attitudes in adolescence, while we revealed no difference between the long-term effect of direct and extended contact ($\Delta\beta = .008$, $p = .12$). However, given the lack of variance in the development of intergroup attitudes, neither direct nor extended contact predicted the development of attitudes in early adulthood. Thus, besides significant zero-order correlations between contact and later attitudes in the older cohorts (see Appendix S2), our results showed that intergroup contact was associated with the long-term development of intergroup attitudes only for the younger cohorts. Moreover, whereas the initial level of intergroup attitudes was unrelated to changes in intergroup contact in adolescence, it predicted significant changes in direct and extended contact in early adulthood. Given the negative slopes of direct and extended contact, the negative effects of attitudes on these slopes indicate that more positive starting levels of attitudes predicted a smaller decrease in the amount of direct and extended contact. These findings indicate that acquired positive intergroup attitudes buffer against a decline of direct and extended contact in adulthood. Finally, our growth curve models suggest that extended and direct contact bidirectionally enhance each other: Throughout age, the intercept of direct contact predicted a slower decline of extended contact, and vice versa.

Additional analyses show that extended contact influences the development of intergroup attitudes via direct contact in adolescence ($b = .212$, $SE = .021$, $p < .001$), while there is no significant indirect effect from direct contact on intergroup attitudes via extended contact ($b = .021$, $SE = .057$, $p > .10$). This highlights the developmental importance of extended contact as a preparatory platform for direct contact and subsequent favorable intergroup attitudes.

Moderating Role of Diversity

In addition, we examined whether diversity moderates intergroup contact effects in order to explore whether the revealed age-related difference in contact effects is—in contrast to the hypothesized developmental mechanisms—of structural nature due to the decreasing contact opportunities from adolescence to adulthood. Both interactions (Diversity \times Direct Contact and Diversity \times Extended Contact) were significant and negative, demonstrating that intergroup contact effects are stronger in less diverse settings (see Appendix S4, for the respective interaction plots). This finding suggests that weaker contact effects in adulthood are not due to structural reasons, such as fewer contact opportunities, given that this factor increases contact effects as demonstrated by the negative interaction effects between diversity and contact. The age-related difference in contact effects appears, rather, to be due to developmental processes of previously stabilized intergroup attitudes in adolescence.

General Discussion

The purpose of this article was to examine long-term intergroup contact effects, while considering their underlying social network mechanisms in order to further our understanding of the developmental processes involved in intergroup contact and its beneficial effects on intergroup attitudes. The main findings refer to the potential of SNA for contact research and the particularly powerful contact effects in adolescence that help reduce prejudice, discrimination, and social exclusion.

The Potential of SNA for Contact Research

To address adequately the contextual and developmental aspects of individuals' intergroup contact, it is essential to study both direct and extended contact (Vezzali et al., 2014). With the help of SNA, contact researchers can study both types of contact precisely, in particular extended contact. Our optimized network operationalization of intergroup contact decomposes the assessment of extended contact into two separate steps that (a) accurately identify individuals' ingroup friends within the social network and (b) capture these friends' general outgroup contact within a wider context, either via self-reports (Study 1) or via their network connections that reach beyond participants' local network environment (Study 2). Findings across both

studies validated this procedure: While Study 1 yielded the expected effect of extended contact on intergroup attitudes, Study 2 replicated this association across almost every wave in every cohort (see Appendix S2). Thus, this more accurate assessment of extended contact advances the investigation of intergroup contact and helps to provide a better understanding of individuals' intergroup attitudes.

Moreover, the application of social network data also allowed a more objective measurement of intergroup friendship by identifying reciprocally connected network members. Given the restricted nomination technique in both studies, in which participants were asked to report a limited number of nominations (i.e., the most important friends), the social network approach allowed us to capture close friendships and provides contact researchers with an alternative way to measure the strength or intimacy of intergroup contact.

The Importance of Adolescence for Contact Effects

Utilizing a unique four-cohort-four-wave data set covering a developmental period of 14 years, Study 2 examined the development of intergroup attitudes by applying the previously validated social network operationalization. Consistent with prior work (e.g., Rutland et al., 2010), our findings support the developmental importance of early intergroup relations. While intergroup contact drives adolescents' development of intergroup attitudes, contact develops independently of attitudes. In early adulthood, this pattern reverses in that current attitudes affect the development of contact, but attitudes seem unaffected by contact. It is important to note that, in accordance with the existing literature, the basic longitudinal relationships between intergroup contact and future intergroup attitudes tend to reveal significant associations across all cohorts (see Appendix S2). However, once we consider the complex developmental dynamics and estimate the long-term change in intergroup attitudes, intergroup contact appears to become less effective with age due to the increasing stability of intergroup attitudes.

Further analyses suggest that these weaker contact effects in early adults are not due to a decrease in contact opportunities from adolescence to adulthood. In fact, we found stronger intergroup contact effects in less diverse settings with fewer contact opportunities. This finding is in accordance with previous research indicating that individuals benefit most from contact situations if they lack contact opportunities, either because of

spatial segregation (Christ et al., 2010) or because of more prejudiced (or less positive) attitudes (Dhont & Van Hiel, 2009). Hence, our study suggests that the revealed age difference in contact effects is attributable to developmental processes, due to previously stabilized intergroup attitudes in adolescence.

These findings indicate that adolescence seems to be a period in which intergroup experiences are particularly effective for the development of favorable intergroup attitudes. The present study thus supports the existing literature on general attitude change. Consistent with the "impressionable years hypothesis" (cf. Krosnick & Alwin, 1989), core attitudes seem to be more malleable at a young age, when they crystallize during a period of mental plasticity, and then tend to remain relatively stable in adulthood. Moreover, our analyses suggest that early contact experiences may not only be more effective, but—once they have improved attitudes at a young age—also increase the likelihood of future intergroup contact in early adulthood. These mutually reinforcing effects replicate previous research on bidirectional effects between contact and attitudes (Binder et al., 2009) and underscore the need for early contact interventions at a young age. The experience of intergroup contact within the social network of adolescents—while they develop important social cognitions and an ethnic identity—appears crucial in order to develop favorable intergroup attitudes.

Limitations and Future Research Directions

Despite the novel empirical findings concerning a broad period from early adolescence to early adulthood, our data cannot provide insights into the development of intergroup contact and attitudes in childhood. However, it is plausible to assume that intergroup contact experiences are similar or even more important in younger age groups than those considered here (see Bigler, Jones, & Loblinger, 1997; Raabe & Beelmann, 2011). More longitudinal research on contact effects in childhood and adolescence will provide important knowledge to further our understanding of the respective developmental trajectories. The general conclusion, however, will remain the same, we expect: Early contact experiences matter.

Another limitation concerns the investigation of the majority's attitudes toward minority groups in general while neglecting different immigrant subgroups. This was, unfortunately, necessary given the cross-country analyses of the international data

set in Study 1 and the general intergroup attitude instrument in Study 2. Future research that distinguishes between different minority groups might provide valuable additional insights regarding the development of intergroup attitudes. Relatedly, the longitudinal findings of Study 2 were restricted to the nonimmigrant majority and the development of their attitudes toward the immigrant minority. When studying the developmental dynamics of intergroup contact and intergroup attitudes, future research should also include minority respondents in order to gain a better understanding of the mutually dependent and coevolving development of intergroup attitudes among majority and minority members.

Furthermore, the present study operationalized intergroup contact as intergroup friendship. Based on Allport (1954), intergroup friendship represents an optimal form of intergroup contact and is an established concept in this field of research (e.g., Feddes et al., 2009). It is, however, important to acknowledge that the underlying mechanisms and consequential effects of intergroup friendship and more general forms of intergroup contact may differ (see Pettigrew & Tropp, 2006), so that it will be of value to replicate the revealed developmental dynamics with measures that capture less intimate forms of contact. Relatedly, Studies 1 and 2 applied different instruments for the assessment of direct contact. It is, however, unlikely that this difference affected the results and their interpretation given that both instruments measured the same narrowly defined concept, the quantity of intergroup friendships, either with the help of self-reports that asked participants to quantify the amount of intergroup friendships (Study 1) or with network nominations that asked them to provide a list of friends that was analyzed regarding their ethnic composition (Study 2). In fact, this aspect even enhances our ability to generalize findings across different friendship measures.

A final limitation regards the missing consideration of negative contact experiences; a type of contact, which has received surprisingly little attention in this field of research so far. We believe that this additional perspective would be highly informative, because (a) most individuals experience both positive and negative contact and (b) negative contact was found to have a stronger effect on the development of prejudice (Barlow et al., 2012). Given the existence of both positive and negative “ties” in social networks (see Wölfer et al., 2015), the network level again would be optimal for such research.

To conclude, the reported research demonstrates that intergroup contact research, which takes into account both underlying social network processes and long-term dynamics, can further our understanding of the developmental mechanisms involved. Especially at a young age, intergroup contact represents a powerful way to improve intergroup attitudes and to overcome prejudice and discrimination, which, in turn, can buffer against a decline of intergroup contact in adulthood.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Appendix S1. Literature Research on Longitudinal Contact Studies (as of October 2014)

Appendix S2. Means, Standard Deviations, and Correlations of All Variables (Study 2)

Appendix S3. Results From Accelerated Longitudinal Growth Model (Study 2)

Appendix S4. Interaction Effects for Study 2