

## Online Appendix A

### Meta-Analysis of Similar Classrooms

In the robustness check, we tested whether violating the assumption of the multi-group option, that all parameters are the same for all classes (Ripley, Snijders, Boda, Vörös, & Preciado, 2019), affected the results. We applied a combined approach in which we first analyzed a small set of similar classrooms (with respect to ethnic composition and academic track) using multi-group analysis and then we combined the results in a meta-analysis. We generated the multi-group objects by grouping classes of the same school together. One school consisted of enough classrooms to split them further up according to the educational track of each class, resulting in 12 multi-group objects in total, each consisting of three to five similar classrooms. One small school consisted of only 2 classrooms. Keeping this school as a separate group may have led to disproportional influence of these classrooms on the results in the meta-analysis. Therefore, we merged the two classrooms of this school with classrooms from schools with similar ethnic composition, which resulted in the final 11 groups of classrooms.

We used score-type test for time-heterogeneity to check whether the parameters were the same for all classrooms in a group (Lospinoso, Schweinberger, Snijders, & Ripley, 2011). Results suggested that the estimates of five classrooms were not compatible with the other classes in the same group and also not with any other group. These five classes we thus excluded and they were also excluded from the main analysis. Furthermore, results showed that parameters of some effects for six classrooms in two other schools were incompatible. It was possible to keep these classes in the sample by re-grouping them based on the compatibility of the parameters instead of their belonging to the same school, resulting in 11 multiple group objects based on 41 classrooms. Because we excluded five classrooms, the multi-group analysis was repeated. This analysis showed that four classrooms were also

incompatible with other classrooms and were, thus, excluded. Additional score-type analysis showed that five classrooms were not possible to include into the final meta-analysis due to incompatibility with other classrooms. These classrooms were excluded only in the final meta-analysis, not in the main multi-group analysis. Schools that contained less than two classrooms after exclusion of classrooms were merged with schools with the similar educational level and with the similar ethnic composition.

This way, we created 8 multiple group objects based on 32 classrooms (see Table A1), in which we first estimated the models separately and then combined the results in a meta-analysis (see Table A2). To account for significant differences between the parameters of some effects within each multiple group object, we added dummy variables for the respective classroom and the interaction between the classroom and the parameter (Ripley et al., 2019).

The high complexity of our analyses makes it impossible to include a main effect of social influence and an interaction with social influence in the same model. Collinearity between the main effect and the interaction likely leads to nonconvergence of the model when using small classroom networks. Therefore, we fixed the main influence effect, i.e. the average similarity effect, according to the results from the multi-group analysis (for a similar approach, see Geven, Weesie, & van Tubergen, 2013).

P-values of the meta-analysis were estimated by Fisher combination of one-sided tests (Ripley et al., 2019) since this approach does not require that estimated and standard errors are uncorrelated. Right-sided tests refer to the effect being positive, while left-sided tests estimate whether there is a negative parameter. Following the recommendation of Ripley and colleagues (2019), we used an alpha level of .025 since we test the same effect twice.

**Literature**

- Geven, S., Weesie, J., & van Tubergen, F. (2013). The influence of friends on adolescents' behavior problems at school: The role of ego, alter and dyadic characteristics. *Social Networks*, 35(4), 583–592. <https://doi.org/10.1016/j.socnet.2013.08.002>
- Lospinoso, J. A., Schweinberger, M., Snijders, T. A. B., & Ripley, R. M. (2011). Assessing and accounting for time heterogeneity in stochastic actor oriented models. *Advances in Data Analysis and Classification*, 5(2), 147–176. <https://doi.org/10.1007/s11634-010-0076-1>
- Ripley, R. M., Snijders, T. A. B., Boda, Z., Vörös, A., & Preciado, P. (2019). Manual for RSiena (Version April 9, 2019). Retrieved from <https://www.cran.r-project.org/web/packages/RSiena/>

## Intergroup Attitudes in Social Networks

Table A1

Description of 8 Multi-Group Objects Included in the Meta-Analysis

Multi-group object	Number of classes	Educational level	Number of schools	Percentage of adolescents without immigrant background in the school/schools
1.	4	VMBO or VMBO/HAVO	1	58.42%
2.	3	HAVO	1	86.29%
3.	5	VWO/Gymnasium	1	86.29%
4.	4	VMBO/HAVO	1	55.32%
5.	4	VMBO	2	78.26% and 73.33%
6.	4	HAVO/VWO	1	88.60%
7.	5	VMBO	2	47.92% and 78.26%
8.	3	VMBO or HAVO	2	72.97% and 79.31%

*Note.* Academic level increasingly (from lowest to highest): vmbo, vmbo/havo, havo, havo/vwo, vwo

Table A2

*Meta-Analysis of 11 Multi-Group Analyses of Network and Attitudes Change Presenting the Baseline Model (Model 1) and Models that Involve Interactions between Average Similarity and Potential Determinants of Social Influence: Sociometric Popularity (Model 2), Prestige Popularity (Model 3), Being a Clique Leader (Model 4), or Spending Time with Friends (Model 5) (N = 726)*

	Model 1			Model 2			Model 3			Model 4			Model 5		
	Estimate	SE	N	Estimate	SE	N	Estimate	SE	N	Estimate	SE	N	Estimate	SE	N
<i>Network Function</i>															
(Density)	-2.70 <sup>LS***</sup>	.54	8	-3.18 <sup>LS***</sup>	.62	6	-2.69 <sup>LS***</sup>	.51	8	-2.94 <sup>LS***</sup>	.54	7	-2.85 <sup>LS***</sup>	.60	6
Reciprocity	1.14 <sup>RS***</sup>	.12	8	1.17 <sup>RS***</sup>	.17	7	1.16 <sup>RS***</sup>	.12	8	1.17 <sup>RS***</sup>	.16	8	1.13 <sup>RS***</sup>	.12	7
Jaccard similarity for outgoing ties effect	4.53 <sup>RS***</sup>	.82	3	4.39 <sup>RS***</sup>	.79	3	4.59 <sup>RS***</sup>	.89	4	4.42 <sup>***</sup>	.77	2	4.52 <sup>RS***</sup>	.78	3
In-Structural Equivalence	.49 <sup>RS***</sup>	.06	3	.47 <sup>RS***</sup>	.06	3	.49 <sup>RS***</sup>	.06	3	.45 <sup>RS***</sup>	.06	3	.59 <sup>RS***</sup>	.14	3
Transitive Reciprocity Triplets	-1.77 <sup>LS**</sup>	.43	2	-1.18 <sup>LS**</sup>	.39	2	-1.01 <sup>LS*</sup>	.43	2	-1.14 <sup>LS**</sup>	.38	2	-.82 <sup>LS***</sup>	.26	2
Transitive Reciprocity Triplets 2	1.27 <sup>RS***</sup>	-	1	1.27 <sup>RS***</sup>	-	1	.91 <sup>RS***</sup>	-	1	1.18 <sup>RS***</sup>	-	1	.76 <sup>RS**</sup>	.	1
Indegree Activity	-.01	.33	3	.01	.32	2	-.11	.19	3	.11	.26	3	-.27	.19	2
Outdegree Activity	.10 <sup>RS***</sup>	.02	3	.10 <sup>RS***</sup>	.01	3	.11 <sup>RS***</sup>	.01	3	.09 <sup>RS***</sup>	.01	3	.12 <sup>RS***</sup>	.02	3
Gender homophily	.64 <sup>RS***</sup>	.16	6	.68 <sup>RS***</sup>	.24	5	.75 <sup>RS***</sup>	.25	6	.58 <sup>RS***</sup>	.25	6	.56 <sup>RS***</sup>	.14	5

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Ego gender	.31	.29	6	.43 <sup>RS*</sup>	.29	5	.33 <sup>RS*</sup>	.25	6	.38	.27	6	.38 <sup>RS*</sup>	.31	5
Alter gender	-.40 <sup>LS**</sup>	.17	5	-.29 <sup>LS*</sup>	.15	5	-.21	.14	5	-.31 <sup>LS*</sup>	.16	6	-.20	.14	5
Ethnic homophily	.01	.18	7	-.05	.19	7	-.03	.17	7	-.04	.18	6	-.02	.18	6
Attitude homophily	.12	.57	7	.36	.41	6	.04	.52	7	-.00	.38	7	.15	.17	3
Ego attitude	-.05	.06	7												
Alter attitude	.03	.05	7												
Potential determinant of social influence homophily <sup>a</sup>				.23	.32	7	.93 <sup>RS***</sup>	.30	8	.09	.08	8	.64 <sup>**</sup>	.50	7
Ego Potential determinant of social influence <sup>a</sup>				-.02	.04	7	.03	.03	8	.25	.11	8	-.01	.04	7
Alter Potential determinant of social influence <sup>a</sup>							.09 <sup>RS***</sup>	.03	8	.37 <sup>***</sup>	.10	8	.23 <sup>RS***</sup>	.06	8
<i>Behavioral Function</i>															
Attitude Linear Shape	-.08 <sup>LS*</sup>	.04	8	-.06	.05	8	-.08 <sup>LS*</sup>	.05	8	-.06	.05	7	.01	.12	
Attitude Quadratic Shape	.01	.03	8	-.01	.04	8	.00	.03	8	.02	.03	7	-.02	.03	
Average Similarity	4.96		F	-.82		F	4.93		F	5.33		F	5.33		F
Ethnicity	.10	.16	3	.06	.20	3	.11	.18	3	.20	.19	2	.10	.12	

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Moroccan/Turk												
Alters' Average Potential determinant of social influence <sup>a</sup>	-0.01	.02	8	-0.01	.02	8	.04	.12	7	-0.13	.27	8
Average Similarity x Potential determinant of social influence <sup>a</sup>	.93 <sup>RS***</sup>	.20	8	-0.05	.21	8	-1.19	3.36	5	-1.69	.83	7

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*Note.* Meta-analyses of 8 stochastic actor-oriented multi-group analyses. If the standard error of an effect was higher than 10 in a given group, the estimate was not included in the meta-analysis (Ripley et al., 2018). Column N indicates the number of groups in which the standard error for a specific effect did not cross 10.

Ego and Alter attitude effects were removed after Model 1 because they were insignificant.

<sup>a</sup>Potential determinant of social influence represents sociometric popularity in Model 2, prestige popularity in Model 3, being a clique leader in Model 4, and spending time with friends in Model 5. In Model 5, we tested the interaction between spending time with classmates (dyadic covariate) and average similarity what enabled us to evaluate whether friends with whom adolescents spent time are particularly influential. In the network function, we used the number of classmates with whom adolescent spent a lot of time instead of a dyadic covariate. Average similarity was fixed to the value from multi-group analysis.

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .025$

## Online Appendix B

Table B1

Description and mathematical representation of effects included in models

	Mathematical formula	Description
<i>Network Function</i>		
<b>Baseline Model</b>		
Outdegree (density)	$\sum_j x_{ij}$	Overall tendency to create friendship ties
Reciprocity	$\sum_j x_{ij} x_{ji}$	Tendency to reciprocate friendship ties
Transitive reciprocated triplets effect	$\sum_{j,h} x_{ij} x_{ji} x_{ih} x_{hj}$	Tendency to have reciprocated friendship ties to friends' friends
Transitive reciprocated triplets effect type 2	$\sum_{j,h} x_{ij} x_{ih} x_{hj} x_{jh}$	Tendency to have reciprocated friendship ties to friends' friends in different order
Indegree popularity effect	$\sum_j x_{ij} (\sum_{h \neq i} x_{hj} + 1)$	Tendency of adolescents who have already many friendship nominations to receive even more nominations in the next wave
Indegree activity effect	$x_{i+} x_{+i}$	Tendency of adolescents who have many friendship nominations to create friendship ties in the next wave
Outdegree activity effect	$x_{1+}^2$	Tendency of adolescents who nominate a lot of friends to create even more friendship ties



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Structural equivalence effect with respect to incoming ties

$$\sum x_{ij}d_{ij}$$

in the next wave

Similarity between the friendship nominations that adolescents received and friendship nominations that adolescent's friends received  
Jaccard similarity with respect to outgoing ties

Jaccard similarity for outgoing ties effect

$$\frac{\sum_h x_{ih}x_{jh}}{x_{i+} + x_{j+} - \sum_h x_{ih}x_{jh}}$$

Same gender effect

$$\sum_j x_{ij} G\{v_i = x_j\}$$

A preference for friends with the same gender

Same ethnicity effect

$$\sum_j x_{ij} E\{v_i = x_j\}$$

A preference for friends with the same ethnicity

Attitude homophily effect

$$\sum_j x_{ij} (sim_{ij}^v - \widehat{sim}^v)$$

A preference to select friends with similar intergroup attitudes

Ego gender effect

$$v_i x_{i+}$$

A tendency of girls to create more friendship ties than boys

Ego attitude effect

$$v_i x_{i+}$$

A tendency of adolescents with positive intergroup attitudes to create more friendship ties than adolescents with negative intergroup attitudes

Alter gender effect

$$\sum_j x_{ij}v_j$$

A tendency of girls to receive more friendship ties than boys

Alter attitude effect

$$\sum_j x_{ij}v_j$$

A tendency of adolescents with positive intergroup attitudes to receive more friendship

ties than adolescents with negative intergroup attitudes

**Models that included potential determinant of influence**

Potential determinant of influence homophily effect

$$\sum_j x_{ij} (sim_{ij}^a - \widehat{sim}^v)$$

A preference to select friends with similar value of the potential determinant of influence

Ego potential determinant of influence effect

$$v_i x_{i+}$$

A tendency of adolescents with higher value of potential determinant of influence to create more friendship ties than adolescents with lower value of potential determinant of influence

Alter potential determinant of influence effect

$$\sum_j x_{ij} v_j$$

A tendency of adolescents with higher value of potential determinant of influence to receive more friendship ties than adolescents with lower value of potential determinant of influence

*Behavioral Function*

**Baseline Model**

Linear shape effect

$$z_i$$

Potential trends in the data toward lower or higher values on the dependent variable (intergroup attitudes)

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Quadratic shape effect	$z_i^2$	The tendency of adolescents with very positive or very negative attitudes to develop even more extreme attitudes
Ethnicity Moroccan/Turk	$z_i v_i$	Differences in attitude change between Turks/Moroccans and other adolescents
Average similarity effect	$x_{i+}^{-1} \sum_j x_{ij} (sim_{ij}^z - \widehat{sim}^z)$	Tendency to adopt intergroup attitudes of friends
<b>Models that included potential determinant of influence</b>		
Potential determinant of influence alters' average	$z_i \check{v}_i$	Effect of friends' average value on the potential determinant of influence on attitude change
Being Moroccan/Turk alters' average	$z_i \check{v}_i$	Effect of friends' average value on being Moroccan/Turk on attitude change
Time spent with friends alters' average	$z_i \check{w}_i$	Effect of friends' average value of spending time with friends on attitude change
Average similarity effect x Potential determinant of influence alters' average	Interaction between: 1) $x_{i+}^{-1} \sum_j x_{ij} (sim_{ij}^z - \widehat{sim}^z)$ 2) $z_i \check{v}_i$	Manually created interaction between average similarity effect and alters' average of prestige popularity or being a clique leader
Average similarity effect x Sociometric popularity alters' average	$x_{i+}^{-1} \sum_j x_{ij} x_{+j} (sim_{ij}^z - \widehat{sim}^z)$	Average similarity multiplied by friends' sociometric popularity. This effect was

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predefined in RSiena (effect is called avSimPopAlt).

Average similarity effect x Dyadic covariate

$$\sum_j x_{ij} w_{ij} (sim_{ij}^z - \widehat{sim}^z) / (\sum_j x_{ij})$$

Average similarity weighted by dyadic covariate (e.g., time spent with friends, same ethnicity).

Alter's average of dyadic covariate

$$s_{i75}^{beh} = z_i \tilde{w}_i$$

Effect of an average of dyadic covariate (e.g., same ethnicity) on attitudes

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## Online Appendix C

### Goodness of Fit

We conducted goodness-of-fit tests to see whether our baseline model fitted the data with respect to network changes. For this purpose, we evaluated model fit with auxiliary statistics (Lospinoso, 2012): outdegree distribution (Figure C1), indegree distribution (Figure C2), behavior distribution (Figure C3), geodesic distribution (Figure C4), and the triad census (Figure C5). The goodness of fit statistics compared observed changes in the network and the simulated changes according to our model. Figures C1-C5 suggest that our model captured network changes reasonably well. The insignificant p-values for most auxiliary statistics indicated that our model fit the data (outdegree distribution  $p = .055$ ; indegree distribution  $p = .056$ ; geodesic distribution  $p = .139$ ; triad census  $p = .057$ ). The p-value for the behavior distribution was below the .05 threshold ( $p = .011$ ). We do not consider this a reason for concern given the large sample size and the fact that the divergence from the 95% confidence bands in Figure C3 was very minor.

### Literature

Lospinoso, J. A. (2012). *Statistical models for social network dynamics* (Ph.D.). University of Oxford. Retrieved from <http://ora.ox.ac.uk/objects/uuid:d5ed9b9c-020c-4379-a5f2-cf96439ca37c>

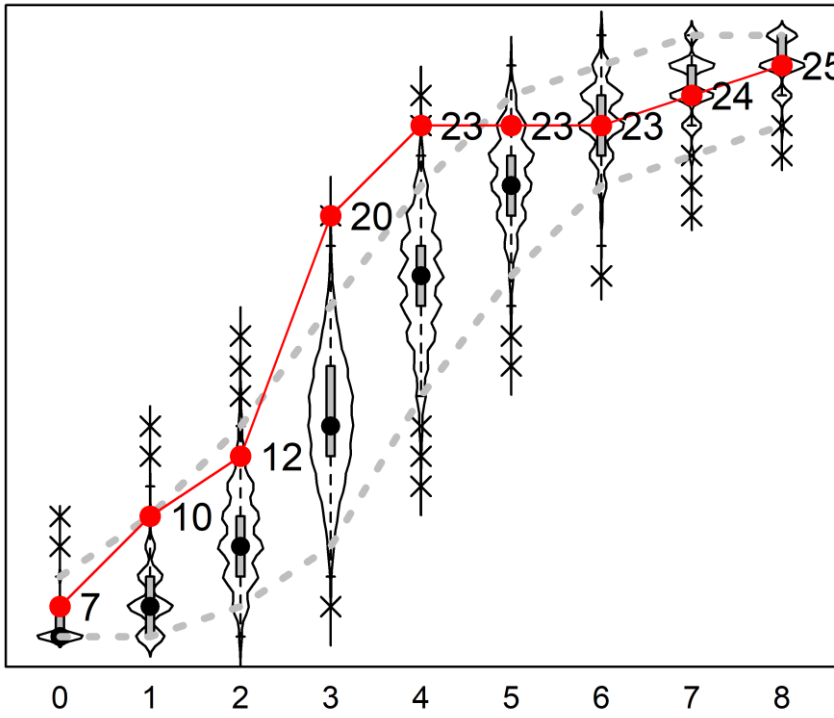


Figure C1. Auxiliary statistic: outdegree distribution.

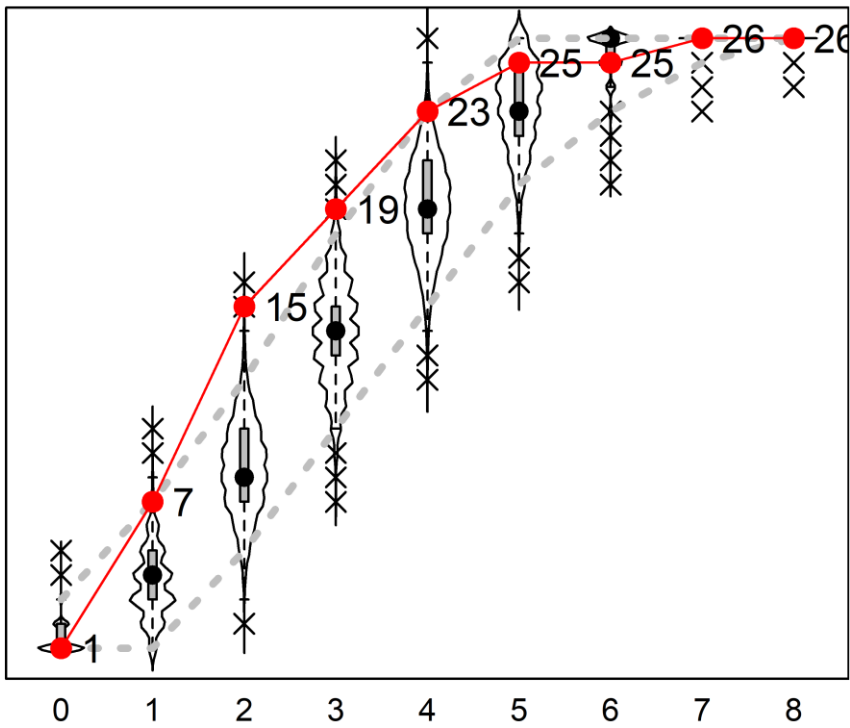


Figure C2. Auxiliary statistic: indegree distribution.

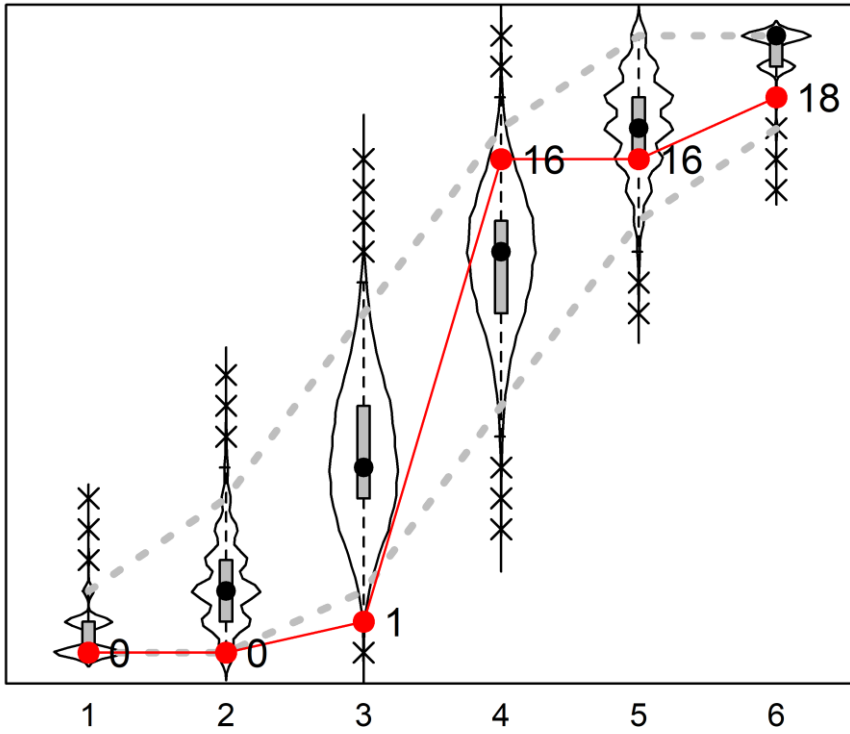


Figure C3. Auxiliary statistic: behavior distribution.

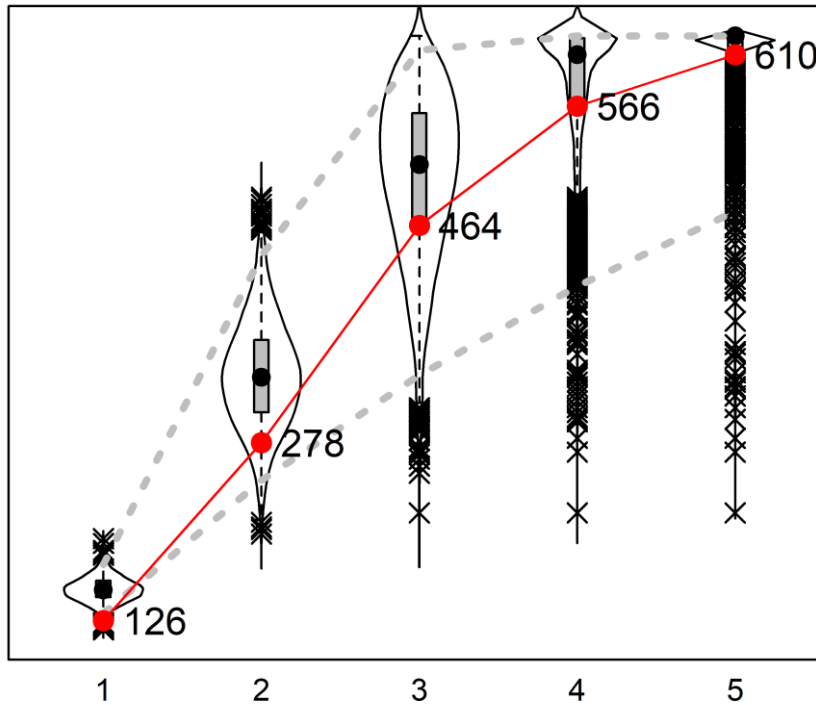


Figure C4. Auxiliary statistic: geodesic distribution.

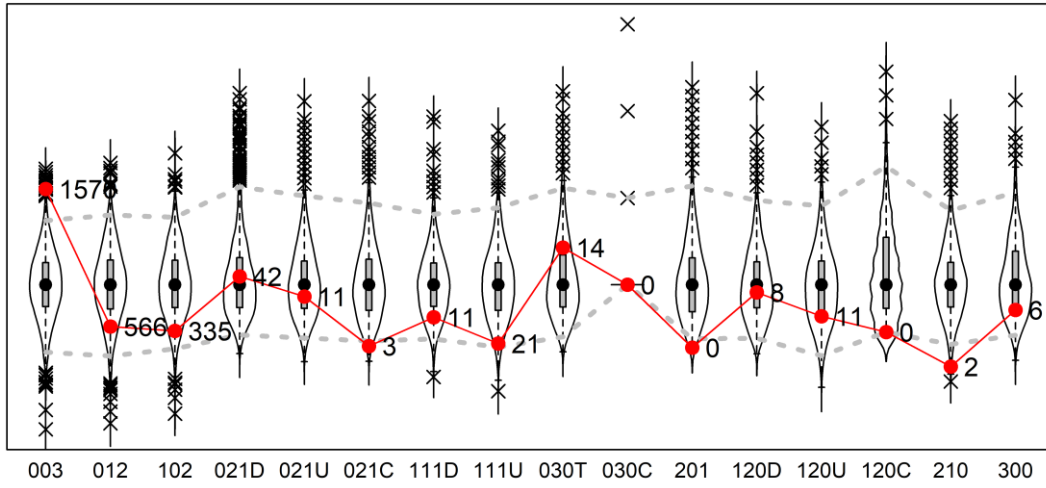


Figure C5. Auxiliary statistic: triad census.



*Sociometric popularity*sociometric popularity

## Online Appendix D

Table D1

*Multi-Group Analysis of Network and Attitudes Change Presenting the Baseline Model (Model 1) and Models that Involve Interactions between Average Similarity and Potential Determinants of Social Influence: Sociometric Popularity (Model 2), Prestige Popularity (Model 3), Being a Clique Leader (Model 4), or Spending Time with Friends (Model 5), Including the Role of Being Turk or Moroccan (N = 837)*

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
<i>Network Function</i>										
(Density)	-3.30***	.22	-.55	16.62	-3.40***	.21	-3.24***	.22	-2.69***	.38
Reciprocity	2.12***	.20	2.74	4.55	2.01***	.21	2.17***	.20	2.25***	.29
Jaccard similarity for outgoing ties effect	5.18***	.95	6.42	13.61	5.01***	.83	5.36***	.90	5.84***	1.09
In-Structural Equivalence	.21***	.04	.23	.17	.21***	.04	.17***	.04	.19***	.05
Transitive Reciprocity Triplets	-.42***	.06	-.49	.68	-.40***	.06	-.44***	.06	-.43***	.07
Transitive Reciprocity Triplets 2	.50***	.14	.75	1.40	.46***	.14	.55***	.15	.51**	.16
Indegree Popularity	.13***	.04	.12	.17	.11**	.04	.09**	.04	.09*	.04

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Indegree Activity	-.36***	.09	-1.29	6.23	-.36***	.11	-.33***	.08	-.56**	.20
Outdegree Activity	.10***	.01	.14	.27	.10***	.01	.09***	.01	.11***	.02
Gender homophily	.47***	.08	.68	1.23	.56***	.09	.49***	.08	.56***	.10
Ego gender	.23***	.08	.50	1.87	.23**	.08	.22**	.08	.33**	.12
Alter gender	-.16*	.08	-.25	.78	-.13 <sup>+</sup>	.08	-.14 <sup>+</sup>	.08	-.16 <sup>+</sup>	.09
Ethnic homophily	.00	.09								
Attitude homophily	.60 <sup>+</sup>	.31	1.03	3.55	.65*	.30	.58 <sup>+</sup>	.31	.80*	.40
Potential determinant of social influence homophily <sup>a</sup>			1.04	2.96	1.33***	.23	-.06	.07	.92***	.25
Ego Potential determinant of social influence <sup>a</sup>			.75	4.10	.06**	.02	.29**	.09	.25*	.11
Alter Potential determinant of social influence <sup>a</sup>					.06***	.01	.39***	.09	.08***	.02
Ego Ethnicity Moroccan/Turk	.21 <sup>+</sup>	.12	.21	.43	.24*	.11	.22 <sup>+</sup>	.11	.29*	.14
Alter Ethnicity Moroccan/Turk	.14	.11	.14	.48	.13	.10	.14	.11	.15	.12
Ethnicity Moroccan/Turk	.41***	.12	.58	1.45	.38***	.10	.45***	.10	.43**	.13

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homophily										
Ego Ethnicity	1.86*	.90	3.12	8.90	1.67 <sup>+</sup>	.89	1.78*	.87	1.83 <sup>+</sup>	1.07
Moroccan/Turk x Attitude homophily										
<i>Behavioral Function</i>										
Attitude Linear Shape	-.09*	.04	-.10*	.05	-.10*	.04	-.09*	.04	-.08	.09
Attitude Quadratic Shape	-.01	.03	-.00	.03	-.01	.04	-.01	.03	-.02	.03
Average Similarity	4.94***	.83	-.98	2.52	4.98***	.85	5.09**	.87	5.37**	1.80
Ethnicity Moroccan/Turk	.07	.10	.08	.22	.05	.11	.07	.11	-.34	.29
Ethnicity Moroccan/Turk x Average Similarity	-4.33***	1.50	-5.19 <sup>+</sup>	2.80	-4.42***	1.59	-4.24**	1.57	-9.86*	4.28
Alters' Average Potential determinant of social influence <sup>a</sup>			-.00	.03	-.00	.02	.19	.17	-.03	1.35
Average Similarity x Potential determinant of social influence <sup>a</sup>			1.12*	.47	.01	.21	1.62	2.87	-.33	1.35
Ethnicity Moroccan/Turk x Potential determinant of social influence <sup>a</sup>			-.02	.12	.04	.06	-.27	.49	1.01	.74

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Average Similarity x Potential determinant of social influence x Being Moroccan/Turk <sup>a</sup>	2.73	2.08	.31	.84	-3.67	7.49	12.99	11.05
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*Note.* Stochastic actor-oriented multi-group analysis. Ethnic homophily, Ego and Alter attitude effects were removed after Model 1 because they were insignificant.

<sup>a</sup>Potential determinant of social influence represents sociometric popularity in Model 2, prestige popularity in Model 3, being a clique leader in Model 4, and spending time with friends in Model 5. In Model 5, we tested the interaction between spending time with classmates (dyadic covariate) and average similarity what enabled us to evaluate whether friends with whom adolescents spent time are particularly influential. In the network function, we used the number of classmates with whom adolescent spent a lot of time instead of a dyadic covariate.

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$ , +  $p < .10$