General Report

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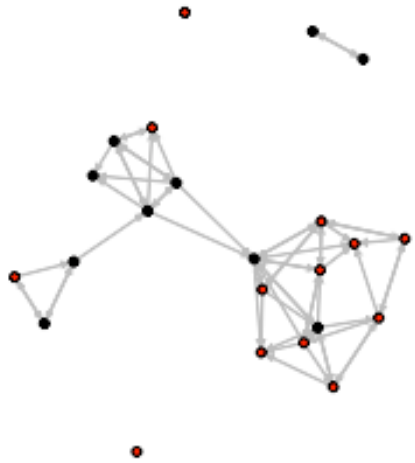
Why the mechanism of gender homophily might create networks in which there is a high degree of reciprocity and transitivity, even if no explicit mechanisms of reciprocation and transitive closure operate? The reason could be about how micro-level network processes aggregate into the network structure at the macro-level. First of all, the homophily of a group of people could lead to the connection of network ties in both directions and network closure (Block, 2015). This correlation between increased homophily and transitivity has some empirical grounds as the number of transitive triads would increase if the density of a network increase (Louch, 2000). However, in some networks such as friendship networks, groups tend to have high connectedness within but are weakly connected with each other (Stadtfeld et al., 2020). Reciprocity and transitivity tend to be limited to the illustration of local patterns and sometimes could fail to completely accurately predict connections of the whole network. Therefore, on the one hand, homophily may increase reciprocity and transitivity, while on the other hand, the reciprocation and transitive closure may not be evident in the macro-level network despite their emergence in the local pattern.

However, the mechanisms of reciprocation or transitive closure do not generally create gender-segregated networks. There could be a case of integration in the friendship network context with high reciprocity and transitivity. Even if students choose friendship with similar attributes, but not at all, it could lead to the integration of a network. It may also be due to other exogenous factors like how much weight people put on the friendship ties and other attribute factors such as age and race. Block and Grund(2014) highlight this multitude of sociological attributes when evaluating the effect of homophily. For example, they explain that when choosing school friends with the same ethnicity, being of same-sex is a less important consideration. In this case, ethnic homophily is more likely to emerge in friendship networks than gender homophily. In a word, the feature of high reciprocation and transitivity does not necessarily mean the homophily of gender in a network.

To test these assumptions, I picked the first wave of the SNA2020-24 network data set. As seen from the following figure, The friendship network is segregated at certain levels but there are a few connections across gender.



Structurally absent actors are dropped. Three models are fitted in the following table.

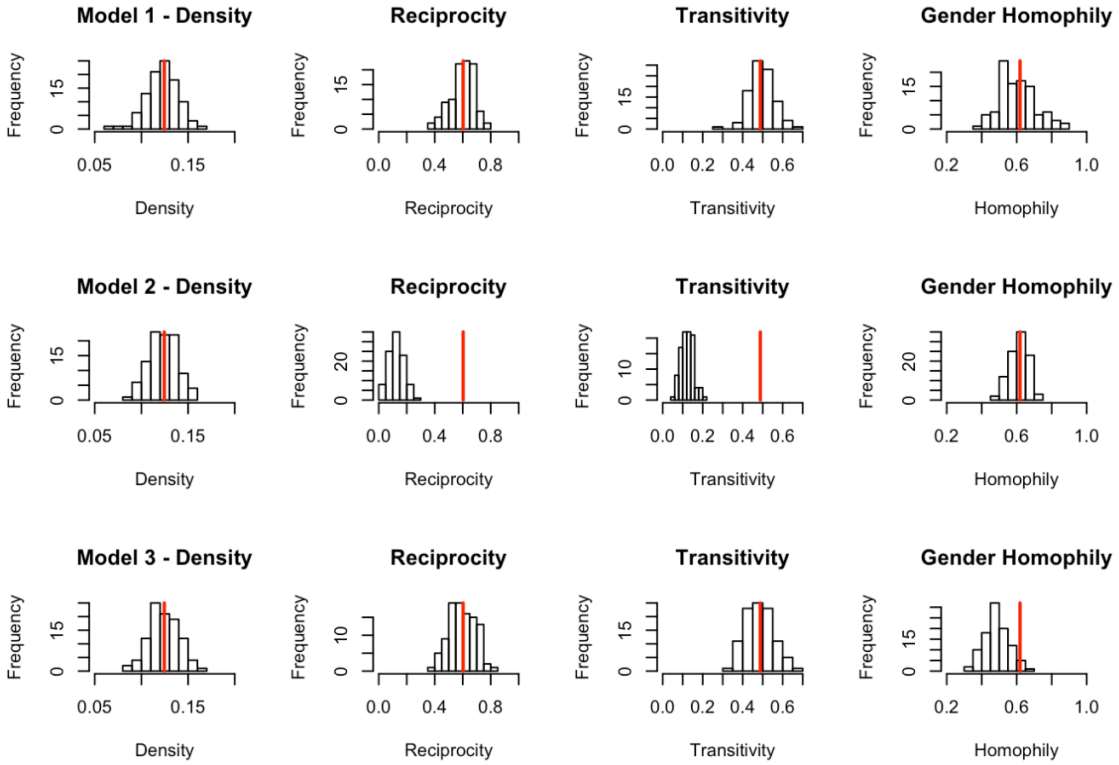
Summary of Models Fit

	Dependent variable:		
	(1)	(2)	(3)
edges	-2.907***	-2.359***	-2.779***
	(0.370)	(0.504)	(0.358)
mutual	1.902***		1.918***
	(0.490)		(0.505)
nodematch.sex	0.272*	0.623**	
	(0.149)	(0.275)	
gwesp.fixed.0.5	1.508***		1.506***
	(0.222)		(0.224)
twopath	-0.290***	0.014	-0.287***
	(0.070)	(0.086)	(0.073)
Akaike Inf. Crit.	275.946	381.175	277.568
Bayesian Inf. Crit.	297.079	393.855	294.475
Note:			*p<0.1;* ***p<0.05;*** p<0.01

It can be seen from the table that across all three models, students have few friendship ties or low density, but there is evidence for reciprocity in the model 1 and 3, gender homophily in the model 1 and 2, transitivity closure in the model 1 and 3. Specifically, in model 1, being of same-sex increases the odds of friendship by a factor of exp(0.284)= 1.33, or around 30%, though the coefficient is marginally significant. And they reciprocate friendship and clustered. In model 2, after

dropping reciprocity and transitivity, the effect of gender homophily becomes larger. In model 3, after gender homophily is dropped, the effect of reciprocity and transitivity on friendship tie formation becomes larger than their performance in model 1.

Then, I simulated 100 networks for each model. The distribution of their density, reciprocity, transitivity, and gender homophily is plotted as follows. Note that these indices of observed data are marked by red lines.



Model 1 controls for the overall tie tendency, reciprocity, transitivity, and gender homophily. The simulated data reflects the high reciprocity, transitivity, and gender homophily of the observed friendship network. In model 2, without the control of reciprocity and transitivity, the simulated data with only gender homophily mechanism does create a certain level of reciprocity and clustering though they are less than the level of observed data. This confirms the expectation that homophily could generate a network with a high degree of reciprocity and transitivity. And in model 3, after dropping the control of gender homophily, with the mechanism of reciprocity and transitivity, most of the simulated data produces gender homophily at 0.5 less than the level of observed data, while a very small percentage of networks reach gender homophily over 0.6. This case supports the argument that the mechanisms of reciprocation or transitive closure can create gender-segregated networks but it may not be general for all network contexts.

REFERENCES:

[1] Block, P. (2015). Reciprocity, transitivity, and the mysterious three-cycle. Social Networks, 40, 163-173.

[2] Block, P., & Grund, T. (2014). Multidimensional homophily in friendship networks. Network Science (Cambridge University Press), 2(2), 189.

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[4] Stadtfeld, C., Takács, K., & Vörös, A. (2020). The emergence and stability of groups in social networks. Social Networks, 60, 129-145.