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I Know Who My Friends Are, But Do You? Predictors of Self-reported and Peer-inferred Relationships

Jennifer Watling Neal

Department of Psychology, Michigan State University

Zachary P. Neal

Department of Sociology, Michigan State University

Elise Cappella

Department of Applied Psychology, New York University

Abstract

Using social network data, this study examines which features of social and spatial proximity predict self-reported, or “real,” and peer-reported, or “inferred,” relationships among 2695 pairwise combinations of African American second through fourth grade students (ages 7-11). Relationships were more likely to exist, and more likely to be inferred to exist by peers, between pairs of children who were the same sex, sat near one another, shared a positive academic orientation, or shared athletic ability. Sex similarity had a dramatically larger effect on peers’ inferences about relationships than on self-reported real relationships, suggesting that children overestimate the importance of sex in their inferences about relationships. Results were stable across different grade levels in middle childhood and for boys and girls.

Keywords

peer relationships; social proximity; spatial proximity; inference; middle childhood

Classrooms allow children to interact daily with the same peers and form relationships (Gifford-Smith & Brownell, 2003). A relationship between two children might be described as “real” when there are “reciprocated, positive feelings” (Bukowski & Hoza, 1989, p. 30). However, only the two dyad members know whether they have reciprocated, positive feelings for one another, while their peers must infer the existence of a relationship from observations. Thus, there is only moderate agreement between reciprocated self-reported and peer-reported classroom relationships (Neal, 2008). In this paper, we are interested in understanding predictors of self-reported “real” relationships, and how they differ from predictors of peer-reported “inferred” relationships.

We use cognitive social structures (CSS) to examine how social and spatial proximity predict the existence of real and inferred “hanging out” relationships among low income, urban African American second through fourth graders. CSS assesses children’s perceptions

of the presence of a relationship between each pairwise combination of students in their classroom (Neal, 2008). This differs from social cognitive mapping (SCM), which focuses on children's identification of peer groups rather than individual relationships (Neal & Neal, 2013). Thus, CSS provides data about both children's self-reported relationships and their perceptions of classmates' relationships, making it useful for comparing real and inferred relationships.

Children tend to form relationships with others who are *socially proximate* (i.e. similar in demographic or behavioral characteristics) and *spatially proximate* (i.e. close in physical space). Although this paper examines "hanging out" relationships, the mechanisms of proximity are expected to operate on most types of affiliative relationships. Thus, we review the literature that includes both childhood friendships and hanging out relationships, using the word "relationship" to refer generically to positive linkages that exist between two children, but words like "friendship" when discussing specific previous studies that refer to particular types of linkages.

The preference to form same-sex peer relationships is well documented from preschool to early adolescence. Children form sex-segregated peer groups at an early age, leading developmental researchers to describe the worlds of boys and girls as two cultures (Maccoby, 1998). Martin et al. (2013) demonstrated that sex segregation in preschool peer groups is explained in part by children's preferential selection of same-sex play partners. These tendencies remain present through middle childhood and early adolescence (e.g., Neal, 2010), and longitudinal research has demonstrated that children are more likely to become friends with same-sex peers (Tuma & Hallinan, 1979). Children also tend to form relationships with others who are similar on a range of behavioral characteristics (Gifford-Smith & Brownell, 2003), including academic orientation (e.g., Kindermann, 2007; Ryan, 2001; Tuma & Hallinan, 1979) and athleticism (e.g., Crockett, Losoff, & Peterson, 1984; Seagoe, 1933), which provide opportunities for children to form relationships. Academic grouping may bring children with similar academic orientations into contact, while similarly athletic children may have opportunities to interact through sports participation (Cairns & Cairns, 1994). Spatial proximity also affects relationship formation by providing opportunities for individuals to interact (Gifford-Smith & Brownell, 2003). George and Hartmann (1996) found that elementary school children form almost half of their friendships with peers in the same classroom, where seating arrangements facilitate children's opportunities to interact (van den Berg, 2013) and shape their liking of one another (van den Berg et al., 2012). Thus, we hypothesize that real relationships are more likely between children who (a) are both boys or both girls, (b) both have positive academic orientation (c) both have athletic ability, or (d) sit near one another in class (**H1**).

Peers are often considered expert observers of classroom relationships (Kindermann, 2007), but as outside observers they lack direct knowledge of the existence of relationships. There is variation in how children perceive their classroom social networks (Cappella, Neal, & Sahu, 2012), and reciprocated self-reported relationships are often only moderately correlated with peer-reported relationships (Neal, 2008). Lacking direct knowledge, peers must use environmental cues (e.g., proximities) as markers to infer the likely existence of relationships. In middle childhood, children's conceptions of friendship include expectations

of demographic similarity, participation in common activities, or physical propinquity (e.g., Bigelow & La Gaipa, 1975; Furman & Bierman, 1984; McDougall & Hymel, 2007). Thus, we hypothesize that peers are more likely to infer a relationship exists between two other children who (a) are both boys or both girls, (b) both have positive academic orientation (c) both have athletic ability, or (d) sit near one another in class (**H2**).

Not all dimensions of proximity are equally visible to peers. Similarity in sex or proximity in classroom seating is readily observable, whereas similarities in behavioral characteristics are less obvious. Visible dimensions of social and spatial proximity may play a particularly important role in peer-inferred relationships in middle childhood, when children tend to focus on concrete characteristics when conceptualizing friendship. Demographic similarity and physical propinquity emerge as expectations of friendship in middle childhood (Bigelow & La Gaipa, 1975), but children are less likely to invoke complex, intangible characteristics like loyalty, commitment, and trust (e.g., Berndt, 1981; McDougall & Hymel, 2007). Thus, we expect differences in the effects of proximities on the existence of real and inferred relationships. First, we hypothesize that proximity along more highly visible dimensions (e.g. sex, physical space) more strongly predicts the existence of inferred than real relationships (**H3**). Second, we hypothesize that proximity along more highly visible dimensions (e.g. sex, physical space) more strongly predicts the existence of inferred relationships than proximity among less visible dimensions (e.g., behaviors; **H4**). Finally, we hypothesize that the proximities under consideration predict inferred relationships better than real relationships because inferences are based on observable cues, while the formation of real relationships is driven by multiple complex processes (**H5**).

Across grades, children consistently have more same-sex friends (e.g., Graham & Cohen, 1997), but less is known about whether associations between other proximities and real relationships differ through middle childhood. Associations between proximities and inferred relationships may change as children become increasingly likely to agree with peers in their perceptions of the classroom network (Cappella et al., 2012), and change their conceptions of what constitutes friendship (e.g., Berndt, 1981). Associations between proximities and inferred relationships may also differ by the inferrer's sex, but evidence is mixed on whether girls have more accurate social perceptions (e.g., Cappella et al., 2012). Thus, we explore whether the associations between proximities and real and inferred relationships vary by grade in middle childhood or by the sex of inferrers.

Method

Setting and Sample

Data were collected in five urban, public elementary schools in the Midwestern United States. Among 682 students in second through fourth grade classrooms across these schools, 426 had active parental consent and assent, yielding within-classroom response rates ranging between 45% and 92% ($M = 62\%$, $SD = 0.13$). Classroom response rates did not differ by grade. The sample included roughly equal percentages of girls (53%) and boys (46%) and across the 2nd grade (30%), 3rd grade (37%), and 4th grade (32%). Because most participants were African American (98%) and free or reduced price lunch eligible (96%), we include only children with both characteristics to avoid variance error. Data from participating

students were analyzed dyadically within classroom, resulting in a final sample of 2695 pairwise combinations.

Procedure

Participants completed two in-class surveys, constructed using class rosters. One survey used CSS to collect self-reports of who the participant “hangs out with often” and inferences about who each classmate “hangs out with often,” following previous uses to examine elementary school peer relationships (e.g., Cappella et al., 2012; Neal, 2008). Another survey used peer nominations to measure participants’ perceptions of their classmates’ behaviors (Metropolitan Area Child Study Research Group, 2002). The lead researcher read each behavioral descriptor (e.g., *Who is smart and does good work in class?*) and asked participants to circle the names of classmates who fit that descriptor; participants were not limited in the number of classmates they could circle.

Measures

Relationships—A “real” relationship is present (coded as 1) between two children, A and B, when both A reported hanging out often with B and B reported hanging out often with A. Viewing such relationships as real is warranted because the reports are cross-validated and provided by the only individuals to have direct knowledge of its existence (e.g., Bukowski & Hoza, 1989). An “inferred” relationship is present (coded 1) between two children, A and B, when more than 50% of these children’s participating peers reported they hang out often. Sensitivity tests indicate that other thresholds (e.g. more than the classroom mean) yielded similar results and do not impact the findings and conclusions.

Proximities—The binary variable, SAMESEX, is coded 1 when the teacher reported that both members of a dyad are of the same sex. The binary variable, BOTHSMART, is coded as 1 when both members of the dyad were nominated by an above-classroom-average number of their peers as “smart and do[ing] good work in class”. The binary variable, BOTHSPORT, is coded as 1 when both members of the dyad were nominated by an above-classroom-average number of their peers as “good at most sports and games” (Lease, McFall, Treat, & Viken, 2003). The binary variable, SITSNEAR, is coded 1 if one or both members of the dyad indicated they sit next to each other.

Results

Descriptive Analyses

The sample is composed of within-classroom pairwise combinations of children ($N = 2695$). Table 1 presents means and tetrachoric correlations; Table 2 compares the presence and absence of real vs. inferred relationships. Peer inferences are “accurate” (i.e. consistent with self-reports) in 80% of cases (mean within-classroom $\kappa = 0.49$; see Neal, 2008). However, in 6% of cases peers infer that a real relationship exists when it does not, while in 14% of cases peers infer that a real relationship does not exist when it does. Children in each grade made inferences with similar accuracy: 80.2% in 2nd grade, 79.5% in 3rd grade, and 80.6% in 4th grade, but girls made slightly more accurate inferences than boys (79.5% vs. 76.9%).

Logistic Regression Models Predicting Children's Real and Inferred Relationships

Table 3 reports the results from two logistic regression models estimated for the entire sample. Statistical significance was assessed using grouped dyadic standard errors, which corrects for bias due to clustering by classroom and dyad (Fafchamps & Gubert, 2007). Testing **H3**, the column labeled “R–I” reports a test of significant difference between the real and inferred coefficients. Testing **H4**, within the model predicting inferred relationships, shared subscripts identify significantly different pairs of coefficients based on non-overlap of their 95% confidence intervals.

We find that all four dimensions of proximity are significant, positive predictors of real (supporting **H1**) and inferred (supporting **H2**) relationships. Children are more likely to have a real relationship, and peers are more likely to infer the relationship exists, when they are the same sex, sit near one another, are both smart, or are both good at sports

Comparing the magnitudes of these coefficients across the two models, we find partial support for **H3**. Consistent with our hypothesis, sex similarity more strongly predicts inferred relationships than real relationships. Same-sex children are nine times more likely to have a real relationship ($OR = 9.16$, 95% CI [6.83, 12.28], $p < .01$), but peers are more than 50 times more likely to infer they have a relationship ($OR = 51.54$, 95% CI [28.16, 94.32], $p < .01$). In contrast to our hypothesis, physical proximity does not predict inferred relationships more strongly than real relationships.

Comparing the effects of different dimensions of proximity on inferred relationships, we find partial support for **H4**. Consistent with our hypothesis, we find that sex similarity plays a significantly larger role in children's inferences about the existence of relationships than any other dimension of proximity. Sex similarity leads peers to be 50 times more likely to infer a relationship exists between two children, while other dimensions of proximity are associated with only a 2–3 times greater likelihood of such an inference. Contrary to our hypothesis, we do not find that spatial proximity plays a larger role than other dimensions.

Finally, these two models' abilities to predict the presence of peer relationships can be compared by examining the area under their receiver operating characteristic (ROC) curves, which ranges from 0.5 for a non-predictive model, to 1 for a perfectly predictive model (Green & Swets, 1966). Comparing the two models' ROC-areas, we find that proximities are more useful for predicting inferred relationships than real relationships, lending support for **H5**.

To consider whether these patterns are consistent across grades in middle childhood and by the inferrer's sex, we repeated these analyses within subsamples (see Table 4). We find generally identical patterns in these subsamples. The only exception is that while sex similarity more strongly predicts inferred relationships than real relationships among 3rd and 4th grade children, there is no difference for 2nd grade children. We find no between-grade differences in predictors of real relationships or of inferred relationships.

Although within-classroom response rates vary in our sample, sensitivity tests confirmed that response rates are not associated with the presence of (or discrepancies between) real or

inferred relationships, and do not impact the findings. Specifically, we repeated each of the above analyses, separately examining classrooms with below 75% participation and those with at least 75% participation. The coefficients in models predicting real relationships are unchanged, while coefficients in models predicting perceived relationships vary slightly. However, in all cases the pattern of magnitudes and the results of all statistical tests and contrasts remain the same.

Discussion

Confirming prior research, real and inferred relationships were more likely between children who were socially and spatially proximate. Real and inferred relationships were more likely between children of the same sex, reflecting recognized preferences in middle childhood to form same-sex peer relationships (Maccoby, 1998) and beliefs that peers prefer same-sex play partners (Martin et al., 1999). Moreover, real and inferred relationships were more likely between children who shared a positive academic orientation or athleticism, suggesting that shared behaviors may be linked to opportunities for children to form relationships (Cairns & Cairns, 1994) and for their peers to observe these relationships. Finally, consistent with the link between physical propinquity and childhood relationships (Gifford-Smith & Brownell, 2003), real and inferred relationships were more likely between children who sat next to one another in class.

Sex similarity plays a key role in peers' inferences about their classmates' relationships. It had a much larger effect on inferred than real relationships, and also had a much larger effect on inferred relationships than any other dimension of proximity. This suggests that peers rely heavily on sex as a highly visible marker to infer the existence of relationships. Such heavy reliance on this characteristic may lead peers to overestimate the importance of sex similarity in relationships, and to incorrectly perceive the social structures surrounding them. Seating proximity, although presumably also highly visible, did not play a similarly key role. Unlike sex similarity, which is immutable, seating proximity may change periodically, making it less visible. Additionally, because classroom seating is often assigned rather than chosen, children may not weight this information as heavily.

The small set of proximities in this study more accurately predicts inferred relationships than real relationships. This is consistent with the notion that, in middle childhood, peers make inferences about relationships using a relatively limited set of observable markers (e.g., Berndt, 1981; Bigelow & La Gaipa, 1975; McDougall & Hymel, 2007), while in contrast, real relationships are driven by a larger, more complex set of factors. Thus, although proximity markers offer children heuristics to navigate their social worlds, they do so at the expense of accuracy.

Only one grade level difference emerged in the findings: 3rd and 4th grade children overemphasized sex similarity in their inferences about peer relationships while 2nd grade children did not. This mirrors prior developmental research, which has found that children started including demographic similarity as a feature of their expectations about friendship in the third grade (Bigelow & La Gaipa, 1975) and that children's conceptions of peer relationships become increasingly sex-differentiated (Martin et al., 1999). Although girls

were slightly more accurate in their inferred relationships than boys, no differences emerged in the role of proximities by the inferrer's sex, adding to the already mixed literature on sex differences in social perception (e.g., Cappella et al., 2012).

While findings regarding real relationships confirm past work, findings regarding inferred relationships advance theoretical understandings of how proximities shape children's social perceptions. Children may take cognitive shortcuts in inferring peer relationships, relying heavily on sex similarity as a marker. This has real-world implications because children's ability to accurately infer peer relationships is important for promoting positive social adjustment and school functioning (Cappella et al., 2012). Given high levels of sex segregation in middle childhood (Maccoby, 1998), using sex similarity as a marker may be adaptive because it provides an easy, and often correct, proxy for the existence of peer relationships. However, it can also lead to errors in judgment that compromise children's ability to navigate peer relationships. More research is needed to examine how children's use of proximity markers help or hinder their social adjustment and school functioning.

This study also has practical implications for methods in research on peer relationships. Touted as alternatives to self-report methods in the case of limited response rates, peer-report methods of collecting classroom relationship data like CSS and SCM are widespread. These methods assume that peers are "capable of describing much of the basic information about the social structure in [their] classroom" (Cairns & Cairns, 1994, p. 101), but our results suggest peers overestimate the effect of sex similarity, which can lead them to make erroneous reports about who is affiliated with whom. Analysis of peer-reported data may lead to inflated estimates of sex segregation in the classroom, and researchers using these methods should be cognizant of how peers' use of proximity markers may distort data on peer relationships. Girls' more accurate inferences also suggest considering the sex composition of peer reporters.

These results should be interpreted within the context of some limitations. First, the homogeneity of the sample prevented examining the impact of race, social class, or longer-range developmental trends on classroom relationships. Second, although sensitivity tests revealed that results did not vary by classroom response rates, we note that some of these rates were low and may limit measurement accuracy. Third, the cross-sectional design prevented determining the direction of associations. Nonetheless, in some cases, there are good reasons to assume directionality: time ordering requires that sex similarity is a cause and not effect of relationship formation, and because teachers assigned classroom seating, the same is likely true for spatial proximity. Fourth, we examined only academic and athletic dimensions of behavioral similarity, but other dimensions like prosociality may also be important. Finally, this study only examined "hanging out" relationships; replication studies are needed to determine whether proximities operate similarly for other affiliative relationships.

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Table 1

Descriptive statistics

Variable	Mean	Tetrachoric Correlation Coefficient				
		Real	Inferred	Sitsnear	Samesex	Bothsmart
Real	0.362					
Inferred	0.285	0.790**				
Sitsnear	0.203	0.340**	0.360**			
Samesex	0.496	0.693**	0.874**	0.164**		
Bothsmart	0.195	0.377**	0.310**	0.182**	0.153**	
Bothsport	0.166	0.320**	0.344**	0.110*	0.162**	0.382**

**
 $p < .01$,

*
 $p < .05$ (using grouped dyadic standard error)

Table 2

Comparison of Real and Inferred Relationships

Real A and B report having a relationship	<u>Inferred</u> Peers report that a relationship exists between A and B		Total
	Yes	No	
Yes	604	372	976
No	163	1556	1719
Total	767	1928	2695

Table 3

Predictors of Real and Inferred Relationships

Variable	Real			Inferred			R-I ^a
	B	GDSE	exp(B)	B	GDSE	exp(B)	
Sitsnear	0.91	0.117	2.50**	1.16	0.144	3.18 _b **	no
Samesex	2.22	0.150	9.16**	3.94	0.308	51.54 _{bcd} **	yes
Bothsmart	0.99	0.196	2.70**	0.78	0.250	2.19 _c **	no
Bothsport	0.72	0.211	2.06**	1.03	0.238	2.79 _d **	no
Constant	-2.38	0.145	—	-4.36	0.308	—	
ROC ^e		0.81			0.88		
N		2695			2695		

GDSE=Grouped dyadic standard error;

* $p < .05$

b-d Coefficients with the same subscript differ significantly (H4).

**
 $p < .01$,^aTest of difference between real and inferred coefficients (H3).^eArea under the receiver operating characteristic curve (H5).

Table 4

Predictors of Real and Inferred Relationships, by Grade Level and Sex of Inferrer

Variable	Grade 2			Grade 3			Grade 4			Boys			Girls		
	Real	Inferred	R- χ^2	Real	Inferred	R- χ^2	Real	Inferred	R- χ^2	Inferred	R- χ^2	Inferred	R- χ^2	Inferred	R- χ^2
Sitsnear	2.09**	3.53** _b	no	2.70**	2.73** _e	no	2.67**	3.33** _h	no	2.66** _k	no	2.85** _n	no		
Samesex	7.35**	26.55** _{bc}	no	11.76**	76.00** _{efg}	yes	8.42**	61.00** _{hij}	yes	29.48** _{klm}	yes	44.51** _{nop}	yes		
Bothsmart	2.91**	1.34 _c	no	2.14**	2.33** _f	no	3.53**	2.16 _i	no	1.92 _l	no	1.97** _o	no		
Bothsport	1.38	4.85**	no	2.22*	2.72** _g	no	3.68**	2.39** _j	no	2.98** _m	no	2.13** _p	no		
ROC ^q	0.78	0.87		0.82	0.89		0.82	0.88		0.86		0.87			
N	778	778		874	874		1043	1043		2688		2695			

Note: Odds ratios;

b-p Coefficients with the same subscript differ significantly (H4).

**
 $p < .01$,*
 $p < .05$ (using grouped dyadic standard error)^a Test of difference between real and inferred coefficients (H3).^q Area under the receiver operating characteristic curve (H5).