Manufacturing Phenomena or Preserving Phenomena? Core Issues in the Identification of Peer Social Groups With Social Cognitive Mapping Procedures

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Introduction

We greatly appreciate the opportunity to provide a commentary on the *Multiple Meanings of Peer Groups in Social Cognitive Mapping*. In this commentary, we discuss core issues in the identification of peer social groups in natural settings using the social cognitive mapping (SCM) procedures. We applaud the authors for their efforts to advance the study of social networks by considering alternative approaches for analyzing data generated from the SCM protocol. Neal and Neal have proposed possible new avenues for utilizing SCM to examine children's peer affiliations and social networks. However, their suggestions appear to be derived from logical analysis, and it is not clear that the utility of the proposed approaches has been adequately demonstrated in real-world examples or validated with rigorous empirical investigation. Further, the lack of a conceptual foundation significantly limits the scope and meaningfulness of their analyses and corresponding recommendations. Perhaps of greatest concern, the authors provide examples that misrepresent the use of the SCM program, and they attribute results to SCM that simply are not accurate. In sum, we believe the collective limitations of the analyses put forth by Neal and Neal significantly constrain the relevance of their arguments, and we caution that their recommendations could result in findings that do not provide a reliable account of children and youths' social networks in schools and other settings. Specific concerns are discussed below.

The Conceptual Foundations of SCM

The arguments presented by Neal and Neal focus exclusively on how SCM data are analyzed without consideration for the conceptual foundations on which these procedures are grounded. Bridging social interactional (Cairns & Cairns, 1994), ethological (Strayer & Trudel, 1984), and sociocultural (Corsaro & Eder, 1990) perspectives of peer relationships, one primary tenet of the SCM approach is that when youth are aggregated together in a social setting (e.g., school), they tend to synchronize their behaviors in ways that result in distinct peer groups that are typically organized into a hierarchical social structure (Farmer, Lines, & Hamm, 2011). A second tenet is that the social structures formed in school settings tend to be fluid and reflect dynamic developmental processes as youth negotiate relationships with multiple peers (Cairns & Cairns, 1994). When social relationships move from the dyad to the triad and beyond (Wolff, 1950), the necessity to balance the needs of multiple individuals can result in a variety of interpersonal strategies and exclusionary practices that promote the ongoing refinement of social network boundaries, and the reshuffling of social alliances and peer group membership (Adler & Adler, 1998). The final tenet of the SCM procedures is that peer groups and social structures are public, and children tend to have a 'cognitive map' of the social system in which they are embedded (Cairns & Cairns, 1994). This means that children have an understanding of the peer affiliations, group membership, and activities of others who are salient to them within the broader peer ecology (Cairns, Xie, & Leung, 1998). Based on these three tenets, the SCM probe was constructed to capture children's conceptions of their social world by asking: 'Are there any children in your class who hang around together a lot? Who are they?'

Neal and Neal do not build from the conceptual framework that undergirds the establishment of the SCM probes, and they fail to present alternative theories to guide their work. Instead, these authors provide logical analyses of techniques for analyzing students' responses to these probes, and they make three assumptions about data generated from the SCM probes that are not adequately supported. The first assumption is that individual nominations reflect real groups that are completely accurate and do not require external validation. As discussed below in the section on omissions and co-missions, there are many reasons why children do not provide completely accurate accounts of peer groups, and any method that is designed to leverage children's reports of classroom affiliations should include procedures to account for potential inaccuracies (Cairns et al., 1998). The second assumption of Neal and Neal's argument is that the SCM probe simply assesses children's social interactions, and they imply that each nomination a respondent makes represents a distinct interaction group. Although we agree that the SCM probe taps into children's perceptions of who interacts together (see Gest, Farmer, Cairns, & Xie, 2003), we believe that children's nominations reflect more complex and sophisticated social judgments, and we expect that respondents tend to use other information beyond observed interactions when they nominate peer groups (see the discussion below on the preservation of phenomena). Neal and Neal's third assumption is that social interactions are the totality of the social connectedness of youth who affiliate together. As we outline below in the section on classroom social dynamics, we believe a variety of social processes bring youth together and contribute to the establishment, maintenance, and transformation of peer groups. The three distinct matrices and algorithms contained in the SCM program are carefully designed to work together to generate peer groups that reflect these processes (Cairns & Cairns, 1994).

Omission, Co-mission, and the Risk of Manufacturing Phenomena

Although it was assumed during the original development of the SCM that children collectively possess expert knowledge about the networks of relationships, this does not imply that a single report from any child is 100 percent accurate. When individual students make nominations about 'who hangs around together a lot?' there are a variety of ways in which they may make errors. There are two broad categories of possible errors: omissions and co-missions.

In errors of omission, a respondent may leave out peers who actually belong to a group, or they may fail to name entire groups. Omissions may occur because an individual or group is not salient to the respondent, the respondent may erroneously deem that the individual is not in a group or that the group does not exist, or the respondent may selectively choose not to include the individual or group because of social motives (e.g., rivalry, animosity, exclusiveness) that inhibit their nominations. In errors of co-mission, an individual names someone to the group who is not actually a member of the group. Errors of co-mission may occur because of inaccurate perceptions of peer groups, a desire to enhance someone's social standing by placing her or him with higher status peers, a desire to demote someone's social standing by placing her or him with lower status peers, or a misunderstanding or literal interpretation of the SCM probe (e.g., listing all of the students in the classroom, naming a teacher constructed group such as a reading group).

Although each individual child's report is subjected to potential biases and errors, the collective information combined across reporters would overcome such issues. The first task in conducting social networks analyses with SCM is to move from the nominations generated by individual respondents to a composite representation of the social structure that guards against errors of omission and commission. Since the 1980s, we have used SCM procedures in schools across the United States and have found common aspects in how youth respond to the question 'who hangs around together a lot?' For this commentary, we examined data on nominations from 20 randomly selected classrooms for each of six grade levels (grades 2–7) in our databanks. Most students who responded to the SCM probe named between two and three groups with youth in the later grades, naming slightly more groups than children in second grade. In terms of the number of peers named to groups, over half of the groups listed by children in the earlier grades (2–4) contained only two or three nominees. By contrast, over half of the groups listed in grades 6 and 7 contained four or more nominees, with a third of the groups being composed of five or more students.

These data on nomination tendencies point to important limitations in Neal and Neal's suggestion that researchers identify 'interaction groups' by treating each group listed by each respondent as though it is an actual peer group. In their examples, the hypothetical scenarios are not consistent with real-world nomination tendencies and do not take into consideration variation within and across respondents in terms of the number of peers listed in a group. For a typical class, between 30 and 45 groups are likely to be listed by respondents, and the authors do not specify how these nominations can be reduced to identify meaningfully the actual groups in the class. Further, Neal and Neal imply that each student's list is accurate, and they do not provide a way for guarding against omissions or co-missions in the nominations of individual respondents. Likewise, Neal and Neal do not provide guidelines to address overlap in nominations and for leveraging commonalities and differences across respondents to

sharpen the accuracy of the data reduction process. Finally, the approaches suggested by Neal and Neal do not appear to take into consideration developmental differences in children's social structures and their cognitive conceptions of such structures. In our opinion, these issues converge to produce results that are vulnerable to the reification of nomination errors, particularly errors of commission that may result in the identification of peer groups that do not actually exist within the social structure.

For instance, two respondents may report the same group (e.g., A, B, C, D) but differ in one member (Respondent 1: A, C, D; Respondent 2: A, B, C). It is misleading to assume these two reports refer to two distinct groups. This issue is salient in the example given in Figure 2, in which four groups were identified by Neal and Neal with an overlap of two third of members between any two groups. Do they represent four groups, different reports of the same group, or separate interactions within the same group across different times or contexts? Benenson and Heath (2006) found that even when all group members are present at the same time, interactions do not always involve every member. Thus, in natural social groups, it is arbitrary to require all members to have the same patterns of contact or interaction with every other member. Therefore, a more reasonable conclusion is that reports from Figure 2 collectively represent one peer group as presented in Figure 3, which emerges after aggregating reports from multiple informants.

To prevent the arbitrary determination of whose reality is correct, systematic procedures are needed that go beyond the lists of groups generated by individual students (i.e., what Neal and Neal term as interaction groups), and to aggregate these lists (i.e., recall matrices) in a way that facilitates additional data reduction. Such procedures should preserve the actual features of the social network without magnifying erroneous responses and treating them as if they reflect the reality of peer group structures. The co-occurrence and correlational matrices of the SCM approach are designed to iteratively analyze data in the recall matrix to reduce the impact of erroneous nominations and to preserve the nuances of classroom and school social systems.

The Preservation of Phenomena and the Strength of Collective Perceptions

As described in the introduction, a fundamental assumption of the SCM procedure is that students' responses to the question 'Are there any children in your class (or school) who hang around together a lot? Who are they?' are, in fact, individualized cognitive maps that reflect the respondent's own conceptions of the classroom or school social structure. From this perspective, these maps go beyond simple reports of peer interactions and represent judgments about affiliations and social dynamics within the peer system.

Children are not only aware of which peers have frequent interactional contact with each other, they also tend to have knowledge of more complex levels of information about affiliations. Such information includes varying levels of understanding of whether peers simply interact with each other because teachers have placed them in close proximity, whether they prefer each other as associates, whether they share common characteristics and interests, and whether they share common friends and a common identity within the social system. In addition, some youth may have membership in multiple groups and bridge relationships between two distinct peer groups, and in other cases two or more youth may form a distinct peer clique within a larger group or crowd (Cairns et al., 1998). Further, during late childhood and early adolescence, peer social dynamics becomes increasingly salient and youth develop a variety of interpersonal strategies of inclusion and exclusion to maintain the social boundaries

of their peer group (Farmer et al., 2011). Within this context, peer affiliations are fluid, and the composition of groups can be highly dynamic, with frequent reshuffling of close associations and changes in the actual membership of social networks (Adler & Adler, 1998; Cairns & Cairns, 1994).

The offshoot is that peer groups are moving targets, and efforts to identify them must take into consideration the dynamics of interpersonal relations and fluidity of affiliations and group membership. SCM procedures focus on identifying commonalities in respondents' nominations as well as preserving nominations made by a few students who have unique information about recent or ongoing changes in the social structure (Cairns, Gariépy, Kindermann, & Leung, 1994). Thus, there are algorithms built into the SCM program to account for the identification of youth with dual membership, youth who bridge multiple groups, small groups (i.e., dyads or triads) within a larger group, and youth who are on the periphery of the social system (i.e., youth named to a group by a couple of classmates but who are not salient members of a group). There are also decision points in the SCM program including the exclusion of self-nominations, the exclusion of someone being identified to a group who is not represented in the recall matrices, and the variable use of correlational cutoff points depending on sample characteristics and nomination anomalies (e.g., one or more students naming the whole classroom as a single group).

The core strength of these peer group identification procedures and techniques is the correspondence between the analytic approaches and the conceptual foundations on which they are founded. Moving from the recall matrix to the co-occurrence matrix, two complementary points of information are generated and preserved. Firstly, the co-occurrence matrix makes it possible to identify the number of times that each pair of students is named together relative to the total number of nominations that each received. Secondly, the co-occurrence matrix retains information about the number of times each pair of students is named with every other youth within the social system. The information in the co-occurrence matrix is then used to generate a correlational matrix that examines the correspondence of each pair of students' co-occurrence profiles. It is expected that youth who are members of the same group will be named together a relatively high proportion of their overall nominations, and that youth who affiliate together will have similar profiles of co-occurrence with other peers. When youth are named together frequently but diverge in their co-occurrence profiles, it suggests that they may have dual membership or be part of a smaller group embedded within a larger crowd of peers. When youth with common associates are not named together but are frequently named with diverging associates as well, it is likely that there are two groups with overlapping members. Working across the co-occurrence and correlational matrices, the SCM program identifies distinct peer groups and the placement of individual students within the social system by utilizing information about the correlation of each co-occurrence profile, the number times that pairs of youth are named together, and a series of algorithms that take into consideration the correspondence of these two sets of information as well as the characteristics of the data. This output also identifies anomalies in the results to help guide additional considerations in the interpretation of the data.

Yet, Neal and Neal treat the co-occurrence (or 'co-nomination' matrix) and correlation matrices (or 'similarity' matrix) generated in SCM as separate information sources for deriving different types of groups. This practice violates the conceptual foundations of the SCM procedure and ignores the dynamic social interactions of peer

Table 1. Correlation Matrix Generated According to the SCM Procedure

	Greg	Hope	Ivan	Jane	Kris	Lucy
Greg	1	−.50	−.50	.00	.00	.00
Hope	−.50	1	−.50	.00	.00	.00
Ivan	−.50	−.50	1	.00	.00	.00
Jane	.00	.00	.00	1	−.50	−.50
Kris	.00	.00	.00	−.50	1	−.50
Lucy	.00	.00	.00	−.50	−.50	1

groups. In addition, the validity of their claimed 'co-membership' groups and 'similarity' groups has not been empirically demonstrated. By contrast, SCM procedures have been empirically validated and show reliable correspondence with actual social interactions observed in a natural setting (Gest et al., 2003).

Misrepresentation of SCM Outcomes

In their hypothetical examples, Neal and Neal provide scenarios which they suggest demonstrate that SCM procedures are vulnerable to yielding arbitrary groups. We believe that these examples are misleading on three fronts. Firstly, they are founded on extreme examples of nomination patterns that we have not encountered in our 25 years of conducting social network analyses. Secondly, the changes or use of different matrices that Neal and Neal propose would not address the difficulties that these hypothetical examples present. Thirdly, Neal and Neal attribute problematic results to the SCM procedures that, in fact, would not be generated from the use of the SCM program but would be the outcome of the changes that they propose.

The correlation matrix in Figure 5 of Neal and Neal's article should be as shown in Table 1 and not as the authors presented. None of the similarity correlations meet the .40 cutoff value that is typically the minimum standard in the SCM program. Therefore, according to the SCM program, no group exists in the hypothetical date presented in Figures 4 and 5, and Box #4 in Figure 6. Yet, Neal and Neal claim that two groups could be derived, which is totally incorrect, because (1) the procedure adopted by Neal and Neal ignores the fact that members of the derived group (e.g., Greg, Hope, and Evan) had never been nominated together into the same group, and (2) their calculation of correlations was solely based on the similarity of profiles with other non-members and excluded co-occurrence values among members. Thus, their claim that arbitrary groups could be created based on similarity is misleading. Further, the authors ignore the fact that SCM output not only reflects the combination of recall, co-occurrence, and correlation matrices but also involves other algorithms built into the program to identify groups. In addition, in a real-life setting, respondents' reports of groups hardly ever only contain dyads (as shown in Figures 4 and 5 and Box #4 in Figure 6). If this happens, it is likely that respondents did not understand the probe, and the researcher should consider whether it is appropriate to identify groups. Using any program with such data runs the risk of inappropriately imposing groups.

Social Networks, Developmental Dynamics, and the Self

Development involves dynamic interchanges between the individual and the ecology. As Bronfenbrenner (1943, p. 363) observed, 'variations occur not only in the social status of a particular person within the group, but also in the structure of the group itself—that is, in the frequency, strength, pattern, and basis of the interrelationships which bind the group together and give it distinctive character'. Further, peer associations and the social conceptions of others contribute to one's own sense-of-self and corresponding social adaption. As Baldwin (1897, p. 30) concluded, 'the development of the child's personality could not go on at all without the constant modification of his sense of himself by suggestions from others. So, he himself, at every stage, is really in part someone else, even in his own thoughts of himself'.

In accord with these views, the SCM procedure is designed to go beyond a focus on the structural aspects of social networks, and was created to capture the dynamic interplay between the individual and the social context in developmental analyses (Cairns et al., 1998). Thus, although such sociological concepts as centrality and density can be determined with the SCM procedures, the strength of this program is that it retains information about both the identity of the members of peer groups and individuals' conceptions of the social system. This information can be paired with other measures of students' interpersonal features to examine the development of the child in relation to the peer group, changes in the individual and group across time, and general peer group processes in relation to students adjustment. For example, youth tend to sort themselves into distinct groups with peers who are similar to them on such characteristics as academic achievement, aggression, and popularity (Cairns & Cairns, 1994). Further, students' academic effort and achievement appear to reflect the interplay between their conceptions of the value of academic performance, perceptions of the peer group's norms and values for school engagement, and the dynamic characteristics of the peer group (Hamm, Schmid, Farmer, & Locke, 2011).

Although the SCM procedures have been used extensively to examine dynamic linkages between the characteristics of the individual and the peer group, much less work has examined how youths' individual conceptions of the social system and corresponding social choices are related to those of their specific peer groups and the general peer ecology. Such work could help clarify peer group processes that contribute to the development of the self. For example, Leung (1996) compared individual students' peer group nominations with the composite social cognitive maps generated from SCM, and found that when youth list their own social group, they tend to include peers with favorable characteristics and exclude peers with unfavorable features. Other analyses of self- and peer nominations have focused on the within group congruence of youths' nominations of peers that they like and dislike. Youths' choices of who they like are strongly linked to who their peer group likes, but who youth dislike reflects a more general sentiment across the classroom and is not bound by the views of one's own group (Farmer et al., 2009).

We believe these studies demonstrate that the analyses of individual conceptions of the social structure and other social phenomena are an untapped but highly fruitful area for study. It is in this point that we see the value in the suggestion that there are multiple meanings that can be generated from SCM. We believe that at the core of Neal and Neal's suggestion is the view that data generated from the SCM probe can be used to look beyond the composite identification of peer groups and can also be leveraged to conduct more fine-grained analyses of the interplay between youths' individual

conceptions of their social worlds and how this relates to dynamic processes within the peer system. Although we caution that Neal and Neal's proposed changes are not empirically validated and may result in data tyranny and arbitrary groupings, we support the broader message that these data can be used in innovative ways to generate novel perspectives on social development processes. Accordingly, we view Neal and Neal's article as a thoughtful impetus for the creation of analytic strategies for SCM data to promote new avenues of inquiry and understanding about the social network influences on the development of the self.

Conclusions

There is a fundamental difference between our conception of the information generated from the SCM probe and the conception that guides the Neal and Neal proposals. We believe that when children respond to the question 'are there any kids in your class who hang around together a lot?' they are reporting their own cognitive maps of the social world in which they are embedded. We expect these responses are based on factors that are socially salient to them, and include their knowledge and judgments about social relationships that go beyond observations of simple social contact and interaction among peers. We believe these responses tend to include a complex understanding of the shared preferences, values, abilities, interests, and proclivities among peers that are at the core of social affiliations and group membership.

By contrast, Neal and Neal imply that the information generated from this probe is an accounting of social interactions with each of the respondents acting as an observer of peers' social contact. This assumption is central to their criticisms and serves as the foundation for their suggested changes in how SCM findings are analyzed and reported. However, there are three fundamental problems with this assumption: children can frequently interact with peers who are not in their group; children's conceptions of peer groups and the corresponding social structure involve a variety of social judgments that go beyond interaction and reflect their understanding of the complexity of social dynamics; and children's individual reports of peer groups are likely to include errors of omission and co-mission that can obscure the reality of the social structure.

SCM has been established to aggregate children's conceptions of the social system and to generate a composite social map that is designed to reduce the impact of individual reporting errors by moving across recall to co-occurrence and correlational matrices, and utilizing a series of algorithms to identify social groups and structures. This approach has been empirically supported with a range of studies that examine how the groups identified by the SCM program correspond with other measures and indices of social dynamics. To our knowledge, the changes proposed by Neal and Neal have not been tested in real-world samples and validated with other measures of peer relations. This is an empirical question. We believe SCM procedures and other measures of social networks can be sharpened by conducting analyses to examine commonalities and differences in the groups they yield and determining relative advantages and disadvantages. At its core, we view the Neal and Neal article as a challenge to move beyond current approaches, and to consider new innovations and refinements in social network analyses. But we believe it is premature to adopt their suggested changes in SCM reporting without more careful consideration and empirical validation of what such changes would mean for the identification of peer groups.

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