

Sociometry: Tools for Research and Practice

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ABSTRACT. This article reviews basic sociometric tools and their analysis, provides information on computer programs to analyze sociometric data, and briefly examines consideration in conducting sociometric investigations.

THE APRIL 3, 1933, SUNDAY ISSUE of the New York Times announced the unveiling, by Jacob Moreno, of a "new science, named psychological geog-raphy, which aims to chart the emotional currents, cross-currents, and undercurrents of human relationships in a community ... at the scientific exhibit of the Medical Society of the State of New York" ("Emotions Mapped," p.17). The New York Times further described that "[t]he maps represent studies of attraction and repulsion of individuals within a group toward one another and toward the group, as well as the attitude of the group as a whole towards its individual members, and of one group toward another group" (p. 17). J.Moreno reportedly claimed at the Medical Society meeting, "If we get to the point of charting a whole city or a whole nation... we would have an intricate maze of psychological reactions which would present a picture of a vast solar system of intangible structures, powerfully influencing conduct, as gravitation does bodies in space" (p.17).

There is little doubt that Moreno's sociometry is one of the most significant contributions to social and behavioral sciences given its widespread applications in a variety of fields (e.g.,

developmental psychology, industrial psychology, individual and group psychotherapy, sport psychology, sociology, agricultural extension, education, government, health) to advance both research and practice (see, for example, Anshel 1994, Breen, 1994; Buchanan, 1982; Gazda, 1982; Hinshaw & Melnick, 1995; Lee, 1991; Mouton, Blake, & Fruchter, 1960; Preck & Singh, 1968). Scholars have viewed sociometry simultaneously as (a) a tool to gather data about relationships, 6) a tool to affect relational changes within therapeutic and work settings, and (c) a philosophy of life and living (see Mendelson, 1989).

Sociometry, in its most basic sense, can be best characterized as a collection of methods to investigate and evaluate networks of existing and preferred relationships. Specifically, sociometry is the study of interpersonal choices regarding criteria of interest to the investigator (Kumar & Treadwell, 1985). Sociometry is not a study of formal group structure (e., official hierarchies), rather it is a phenomenological study of people's interpersonal choices.

This article describes some of the basic sociometric tools for gathering information and analyzing data. Sociometric data may be obtained in writing or in action, as shown by a person placing his or her hand on the shoulder of a group member to display choices. The latter technique is referred to as "action sociometry" because interpersonal choices are displayed in action. The action technique is mostly used in applied settings when immediate feedback is needed.

Sociometry Tools

The basic approach in sociometric methodology is to ask participants to select individuals who, in their view, could accomplish certain tasks with (or. for) them or who have specific behavioral characteristics (e.g., shyness, cooperativeness, sensation seeking, introversion, ability

to lead). This method may also be used to inquire about significant others, events, pets, and objects in an individual's life (present, past, or anticipated) who make that individual's life either meaningful or miserable.

Bjerstedt (1956) differentiated between group-directed and individual-directed sociometry; Kumar and Treadwell (1985) used the terms group-centered and individual-centered sociometry. The former approach requires individuals to restrict their choices within an ongoing group; the latter allows choices from the larger community (deceased or living) to which they belong.

A third approach, "wishful sociometry," may also be used whereby individuals indicate their preference about wished-for relationships (individuals, groups, pets), objects (artwork, gifts), and activities (visit historical and cultural markers, experiment with novel ideas); (see Kumar & Treadwell, 1985; Carlson-Sabelli, Sabelli, Patel, & Holm, 1992; J. Moreno, 1953; Treadwell, Leach, & Stein, 1993; Treadwell, Stein, & Leach, 1989). Self-selection may be allowed if needed; for example, a participant might wish to develop a better relationship with himself or herself (see Sywensky, Litsinger, & Treadwell, 1996). Wishful sociometry seems to be more commonly used in clinical practice than in research.

Method of Nomination Without Ranking

This method involves asking a respondent to nominate one or more individuals (a) to perform a specific task, (b) who best reflect particular behavioral characteristics, and (c) who he or she likes, dislikes, or feels indifferent toward (Ben-David, 1992; Bukowski, Hoza, & Newcomb, 1994). The nomination without ranking procedure does not require members to rank order their choices (e.g., first, second, third). Depending on the purposes of the investigation,

self-nomination may or may not be appropriate. The respondents may be allowed to choose nominees from their community at large (individual-centered) or only the present group (group-centered).

Nomination data can be gathered in writing or by action within the context of a group. By action, group members may be asked to place their left hand on the shoulder of one person and right hand on the shoulder of another person to display their choices. Self-selection may be demonstrated by placing a hand on one's own chest or forehead. Because some members are shy about being touched and touching others, it is important that action sociometry be used only after obtaining consent. The action method may be cumbersome to use when the members are asked to display more than two choices simultaneously.

Method of Nomination With Ranking

This technique requires respondents to select more than one individual (usually between three and five) for a particular task, and also to rank order their preference. Nomination with ranking can be easily used as an action method by asking members to place their left hand on a member's shoulder to indicate their first choice and place their right hand on another member's shoulder to indicate their second choice. Responses are best collected in writing if three or more choices are to be ranked. Written responses are best if the data are to be subjected to statistical analysis.

Kumar and Treadwell (1985) pointed out that "there is no simple answer to [the] question" of how many choices are to be allowed in a sociometric study (p. 10). They recommended that in small groups of 5 to 10 individuals, members may be invited to rank order all their preferences. In larger groups, allowing only three to five choices makes

data handling and analysis easier, particularly if the data are to be used immediately in group work. J. Moreno (1953) observed that either allowing unlimited choices or restricting the number of choices makes no difference in terms of who will receive the highest first choice. The unlimited choice method is useful if one wishes to assess an individual's degree of social expansiveness or social isolation.

Peer Rating Procedure

Asher, Singleton, Tinsley, and Hymel (as cited in Johnson, Ironsmith, & Poteat, 1994) had children rate how likely they would be to play with a particular peer, using a 3-point scale showing sad, happy, and neutral faces. Johnson et al. pointed out that such visual "ratings may be less objectionable to parents, teachers, and human-subjects review committees concerned about the effects of asking children to make negative verbal nominations of their peers" (p. 38).

Hayvren and Hymel (1984; see also Barclay, 1992) indicated that practitioners and researchers are "unwilling to administer negative sociometric measures... [that ask]... children to name peers whom they do not like or with whom they like to play... [because they] ... would implicitly sanction the saying of negative things about others, and in fact, may cause children to view the disliked peers even more negatively" (p. 844). However, Bell-Dolan and Wessler's (1994) review of studies showed that the risk posed by participating in a sociometric study was no greater than "those encountered in everyday life. Children did not increase their negative interactions with unpopular peers, were not more socially withdrawn, and did not express feelings of unhappiness or loneliness following participation in studies that used socio-metric measures" (p. 24). Nevertheless, Bell-Dolan and Wessler cautioned

that because studies vary greatly with regard to various investigative procedures (e.g., consent procedures, confidentiality instructions, individual versus group administrations) "it is impossible to determine, across the board, whether sociometric procedures currently in use are ethically sound" (p. 24). Readers are referred to Bell-Dolan and Wessler's article for greater details on how risk may be minimized in sociometric investigations.

Social Atom

One of J. Moreno's (1947) most significant contributions in sociometry is the conceptualization and measurement of the social atom. The social atom signifies the smallest number of significant others (including pets, objects, groups, events) an individual needs to feel a sense of well-being, complete-ness, sociostasis, or social equilibrium (Hollander, 1974; Kumar & Treadwell, 1985; J. Moreno, 1947, 1953). The social atom construction can be either individual-centered or group-centered, and responses can be obtained either in written or action form.

Hollander (1974, cf. Kumar & Treadwell, 1985) differentiated among three types of social atoms: psychological, collective, and individual. According to Hollander, the psychological atom identifies those significant individuals (e.g., family members, friends, teachers, psychologists, social workers) who contribute to a person's sense of wholeness or completeness. The collective atom includes significant groups to which a person belongs (e.g., church, tem-ple, YMCA, school, neighborhood club, gang). The individual atom includes those individuals who help the respondent maintain membership in the various groups mentioned in the collective atom. J. Moreno (1947) described a particular type of individual-centered social atom for which the respondents are asked to list their significant objects (money, clothes, books,

cars) and pets; for lack of an existing term, Kumar and Treadwell (1985) designated this type of social atom as the object atom.

The traditional method of measuring an individual's social atom is to provide a series of concentric circles (see J. Moreno, 1960). A dot is placed in the center of a circle to represent the respondent, and several concentric circles are provided at increasing distances from the center dot. The respondent is asked to place his or her choices, using distance from the center dot as a measure of closeness. The method of concentric circles works well in ongoing groups. Even a glance at a group member's social atom can reveal conflicts with significant others that may provide themes for action in group therapy (see Kumar & Treadwell, 1986). However, such graphic displays of social atoms are not easy to analyze for research purposes. Furthermore, there are no known scoring systems for graphically represented social atoms. Consequently, their use has been limited to clinical work.

Treadwell and associates (Treadwell et al., 1989; Treadwell et al., 1993) developed the Social Network Inventory (SNI), which allows a comprehensive quantitative assessment of four social atoms: psychological, collective, individual, and ideal dream (wished-for). This instrument is designed to plot choices as well as ratings (closeness-distant) in four quadrants corresponding to each of the social atoms. The psychological quadrant allows for the inclusion of pets and objects. The inventory is formatted in four columns and allows for an unlimited number of choices.

For the psychological quadrant, respondents are asked to list the names of significant others (including objects, pets, and deceased persons) in Column 1; indicate their relationship to the person, pets, or objects in Column 2; rate their closeness on a bipolar 7-point scale (1 = close, 7 = distant) in Column 3; and rate how close they think the persons and pets are toward them on

a 7-point bipolar scale in Column 4 (a role reversal assessment). The instructions to complete the bipolar scale are appropriately modified for the collective and the wished-for quadrants (for example, the instruction for the collective quadrant is "How close are you to the group?" and for the wished-for quadrant, "How close do you wish to be to this person?").

In contrast to the traditional measurement of the social atom, the SNI provides not only qualitative but also quantitative self-report data. Furthermore, it provides for standardized administration, scoring, and mapping procedures. Treadwell et al. (1993) reported that the SNI is easily understood by the respondents.

Sociodynamic Sociometry

Carlson-Sabelli et al. (1992) and Carlson-Sabelli, Sabelli, and Hale (1994) have criticized the traditional sociometric measurement for (a) focusing on choices and ignoring why choices are made, (b) treating opposites (choice versus rejection and indifference) as mutually exclusive categories or as the opposite ends of a continuum (i.e., love and hate toward the same person can coexist resulting in push and pull processes operating simultaneously), and (c) using a linear scale whereby choices are rank ordered from least to most. Carlson-Sabelli et al. (1994) described a sociodynamic approach that uses the traditional nomination procedure (with or without ranking) along with the measurement of opposite processes of attraction and repulsion via the "plane phase of opposites" —or less technically "the diamond of opposites" — toward a person, activity, or opinion (p. 162). The diamond of opposites can be used to gather data in writing or in action. To use it in action, draw a large diamond in the center of a room and ask group members to place themselves within the marked areas of the diamond in a location that

best reflects the intensity of their combined positive and negative feelings toward a significant other.

In Carlson-Sabelli et al.'s (1994) scheme, the bottom vertex of the diamond represents indifferent, neutral, or zero feelings, and the top vertex represents contradictory, ambiguous feeling characterized by intense but opposite (equal-ly positive and negative) feeling. Thus, the area within the diamond of opposites is divided into four quadrants: (a) bottom (weak feelings of both attraction and repulsion), (b) top (strong contradictory feelings of both attraction and repulsion), (c) left (attraction), and (d) right (repulsion) (see Figure 1).

According to Carlson-Sabelli et al. (1994), the diamond can be used to prepare interpersonal profiles for a variety of criteria such as harmony-conflict, approach-avoidance, and attraction-repulsion represented as opposite axes of separate diamonds. Respondents are asked to rank order their significant others in terms of how much time the respondent (a) wishes to spend with their significant others (ideal rank order) and (b) actually spends with their significant others (actual rank order). Next, they locate their significant others by marking points in each of the diamonds (harmony-conflict, attraction-repulsion, and approach-avoidance) first to indicate the actual rank order and second to indicate the ideal rank order. Connecting the dots within each diamond provides interpersonal profiles (for criteria of interest) for significant relationships, which can then be compared. Carlson-Sabelli et al. mentioned that their approach can be used in conjunction with the SNI (Treadwell et al., 1993) to determine social distances. (See Carlson-Sabelli et al., 1992, 1994, for more information on the mathematics of the sociodynamic approach.)

Withstions using dia-nostic criteria seek existing information, for example, "With whom do you go out to movies?" This question does not call for action, as in the case of the question, "Whom would you select to lead the group for the next hour?" According to J. Moreno (1953), sociometric questions need to be differentiated from near-sociometric questions. Sociometric questions have the following four characteristics (Kumar & Treadwell, 1985, p. 3):

1. The questions attempt to determine interpersonal feelings (attraction, repulsion, indifference) in relation to an explicit criterion.
2. The criterion used is specific and action-oriented and not hypothetical, projective, or ambiguous.
3. When asked within the context of a group, the questions should serve an immediate group goal, such as for group warm-up or identifying roles (moth-er, father, brother, lover) for different individuals in the group or for subgroup structures, or a group theme for action (Treadwell, Stein, & Kumar, 1988).
4. The questions must specify whether or not choices can be made outside the group (J. Moreno, 1953; Z. Moreno, 1984, personal communication, cited in Kumar & Treadwell, 1985).

Near-sociometric questions use ambiguous, hypothetical, or projective criteria (e.g., "Who are you most comfortable with in the group?" or "Who in the group is most like yourself?" For additional examples, see Kumar & Treadwell, 1985).

Although the distinction between near-sociometric and sociometric questions is important, J. Moreno (1953) pointed out that the "sociometric procedure is not a rigid set of rules, but it has to be modified and adapted to any group situation as it arises" (pp. 101-102).

Thus, both types of questions are helpful when leading groups. Near-sociometric questions may be particularly helpful in conducting warm-ups before moving to more specific task-oriented sociometric questions. The use of near-sociometric questions in research may lead to unreliable results because they are open to multiple interpretations by respondents in answering such questions.

In traditional sociometric investigations, certain key phrases are used to request nominations: "select a person," "choose a person," or "which person in the group..." Furthermore, the nomination requests may be worded to tap positive (select a person to work with) or negative (name the person that you do not wish to work with) feelings toward a person, activity, or belief. Kumar and Treadwell (1985) noted that phrasing questions to tap positive feelings may be preferred generally in action sociometry, because action makes the results obvious to the group members. A negative question requires deliberate rejection and may be threatening both to the choosers and to those chosen. In contrast, a positive question requires deliberate selection and, consequently, not being selected may not only reflect a lack of feeling rather than a well-developed negative feeling. Feelings of deliberate rejection may cause unnecessary conflict within a group. On the other hand, negative questions may be helpful in locating problem situations to be resolved by the group (Bjerstedt, 1956; Kumar & Treadwell, 1985). In the context of action sociometry, Kumar and Treadwell also suggested avoiding broad ambiguous questions (e.g., "Who do you like most in the group?"), personality trait questions (e.g., "Who in this group is most androgynous?"), and ego-threatening questions (e.g., "Who is the most resistant member in the group?").

Whether one uses positive or negative questions in action sociometry, it is important to educate the group members before implementing sociometry regarding (a) different types of sociometric questions, (b) the four features of sociometric questions, and (c) the proper interpretation of selection decisions (i.e., inform participants that not being selected does not imply rejection, and that selections are criterion-specific, not generalizable to other criteria). In summary, while constructing sociometric questions, either for research or for action purposes, it is important to ask the following questions (Kumar & Treadwell, 1985):

1. Is the question relevant to the goals (or stated hypothesis) of [the] investigation? What I am trying to measure, and why?
2. Is the question a sociometric question? Is the question open to multiple interpretations?
3. Does the question specify whether or not choices can be made to people outside of the group?
4. Is the question realistic?
5. Is the question timely? Are the data immediately usable for action purposes within the context of a group?
6. Is the question potentially threatening to any one in the group?

Administering the Sociometric Instrument

Sociometric questionnaires are relatively easy to construct and administer.

A simple sociometric instrument contains (a) statements (or questions) requesting one or more nominations for a particular purpose, and (b) blank lines to indicate one or more nominations. If the nominations are to be ranked, the blank lines may be prefixed by the phrases Choice 1, Choice 2, Choice 3, and so forth. (See Appendix for an example of a sociometric form.)

Some general guidelines, which readers might find helpful, for implementing a sociometric study are the following:

1. Regardless of whether the sociometric investigation is for research or clinical work, it is important to prepare a clearly stated informed consent form. For research, the informed consent form should include (a) a clear statement for why such data are being collected, (b) an assurance that data will be held in strict confidence, and (C) a request that participants not share their choices with others or to make them public (see Bell-Dolan & Wessler, 1994 for more information on consent-assent procedures, especially if participants are children and minors).
2. For group work, the informed consent form should (in addition to what was previously mentioned) require group members to treat sociometric data as privileged information not to be divulged to outsiders. If action sociometry is to be implemented, the consent form should state that certain exercises involve touching other group members. If group process is being videotaped, the informed consent form must also be signed by camera- and videotaping-technicians. Furthermore, if videotapes are sent home for evaluation by group members, the informed consent form should include an agreement that no one else, other than the group members, will view the tapes.
3. For research with small groups (15 to 20 individuals), data, if needed, can be collected anonymously by handing participants a sheet with names and identification (ID) numbers. If two people have the same name, nicknames may be assigned and made known to all participants along with the corresponding ID numbers. The participants are instructed to use only the ID numbers in reporting their nominations.

4. Completion of sociometric instruments at home is not recommended because members may compare answers or not complete the questionnaires in time.
5. In ongoing groups, it is important to recognize that sociometric data are highly personal, and being chosen or not chosen might be emotionally unsettling to some participants. Thus, the first one or more sessions should be spent educating group members about the nature of sociometry and how it will be used to facilitate group process to improve interactions among group members.
6. For general research guidelines, refer to the ethical guidelines published by the American Psychological Association (1992) and the Association for Specialists in Group Work (1990).

Analysis of Sociometric Data

Sociometric data provide a large amount of information about the nature of interactions within a group. Some of the basic sociometric indices commonly used by investigators to understand structural aspects of groups are reviewed

Here.

Analysis of Individual Status

Positive stars and isolates. The terms *positive stars* (described as stars of attraction in J. Moreno, 1953, p. 508) and *isolates* are used to identify the most and least popular individuals within a group when participants are asked positive criterion questions (e.g., "With whom would you like to associate?"). A positive star is an individual who receives the largest number of selections on a specific criterion of interest when using the nomination procedure without

ranking. When choices are rank ordered, then a positive star would be the most popular individual on the tabulation of the first choice. Of course, a different star may emerge on the second or the third choice.

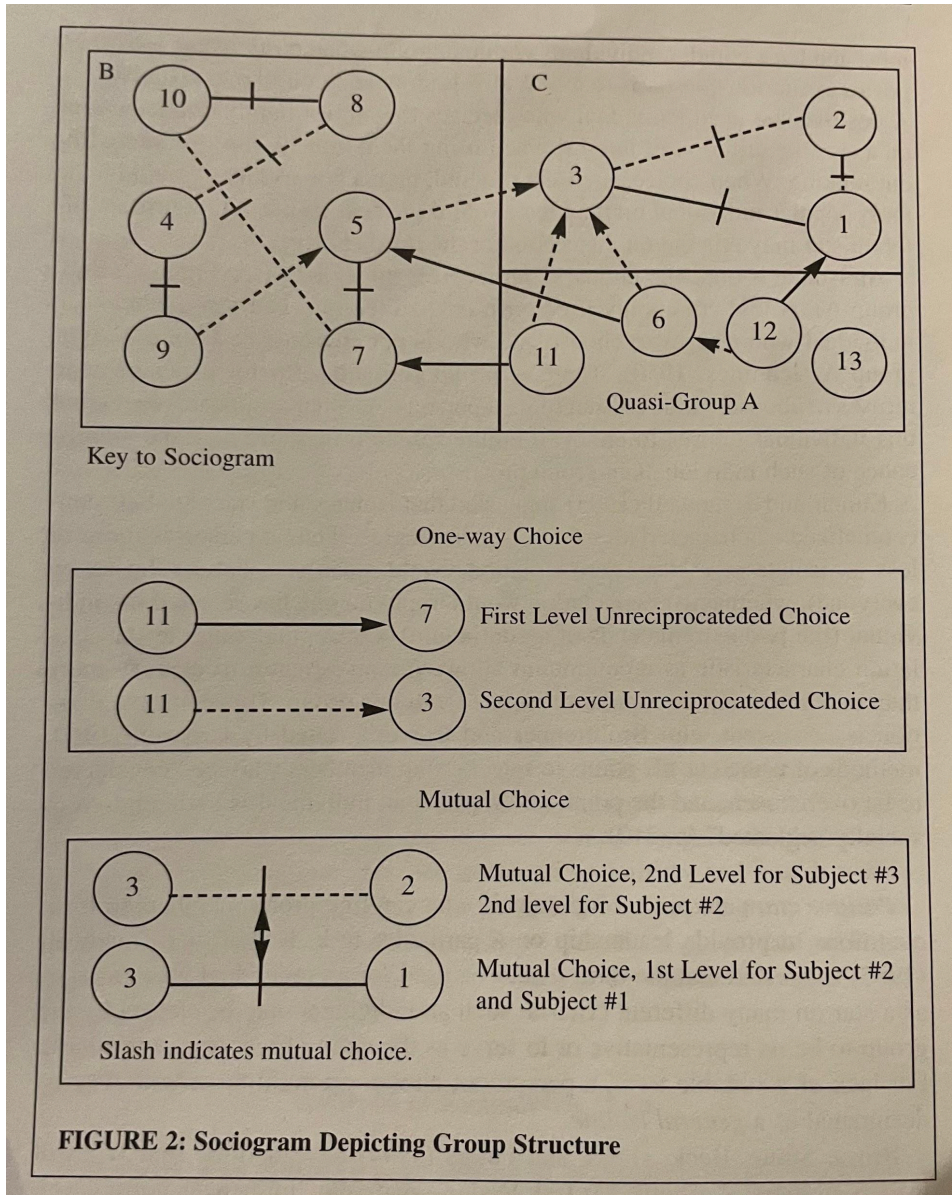
An isolate is one who chooses, but receives no choices (see Figure 2, Subgroup A). A less commonly used term in the literature is a true isolate an individual who refuses to choose and who is not chosen (see Figure 2, Subgroup A; Jennings, 1950). There is no appropriate term for a person who refuses to choose, but is chosen (e.g., a person is elected as a positive star, but this individual refuses to choose). Future research may evaluate the significance of such individuals in group processes.

Kumar and Treadwell (1985) suggested that isolates and stars are best conceptualized as characteristics that occur in degree. Thus a person is more or less an isolate or a star-zero isolation would mean star status (chosen by everyone), whereas 100% isolation would imply no one has selected the individual (the two extreme ends of a continuum). Conceptualizing the star-isolation characteristic as a continuum allows the investigator to classify more than one individual as popular or isolated within a group. This conceptualization is consistent with Bronfenner and Carver's (cited by Criswell, 1960) methods of using cut-off points to select group members who are "considered to be overchosen, and the point below which an individual is underchosen or socially neglected" (p. 210).

Positive stars are pivotal individuals who can link group members to form coalitions to provide leadership on a particular task. Kumar and Treadwell (1985) suggested that the term leader be used for an individual who emerges as a star on many different criteria; such an individual may be elected by the group to be its representative or to serve as the main officer

(e.g., president). For lack of a suitable term, a person not chosen on multiple criteria may be designated as a *general isolate*.

Brusa, Stone, Beck, Dugo, and Peters (1994) have defined four types of leaders in therapy groups: (a) task leader—one who "influences norm development, goal clarification, style of communication, and many other dimensions of group life," (b) emotional leader—"the best-liked person and the most important support person to other members," (c) scapegoat leader—"often the object of attack or nonverbal negative feelings from group members," and (d) defiant leader—"who openly expresses an ambivalence about participation in group" (pp. 82-83). (See Brusa et al., 1994 for a sociometric test to identify these different types of leaders.)



Negative stars. The most frequently chosen individuals on a negative criterion question (e.g., "With whom you would not like to associate?") are called negative stars (J. Moreno, 1953, p. 508, described them as "stars of rejection"). However, there seems to be no appropriate term for the least chosen individuals on a negative criterion question. Such individuals are not isolates in the sense of being excluded from the group. If one defines isolation in terms of exclusion from a group, then by definition a star of rejection must be an isolate who will be excluded from an

activity. Edwards (1960) defined an isolate "as one who receives only 'neutral' or 'dislike' choices" (p. 220).

Negative stars are equally as influential as positive ones, because they may affect the group's direction and cohesion. Negative stars should not necessarily be perceived as negative, because, like positive stars, they can exert their pressure to balance group functioning.

Other methods of classifying individual status. Peery (1979) developed a procedure for identifying from nomination data four types of individuals: popular, amiable, rejected, and isolated. His procedure requires the participants to make nominations on both positive (like most) and negative (like least) criteria.

The total number of positive (p) and negative (n) votes are then used to compute two indices: social impact is the sum of p and n votes ($p + n$) and social preference is the difference between p and n votes ($p - n$). Using the mean scores on two variables as the point of intersection between the two variables, one can identify the four types suggested above: (a) popular-high social impact (above the mean on both p and n); (b) amiable-positive social preference, but low social impact (above the mean on p but below the mean on n); (c) rejected-negative social preference but high social impact (above the mean on n but below the mean on p), and (d) isolated (below the mean on both p and n).

Coie, Dodge, and Coppotelli (1982) used Peery's method of computing social impact and social preference scores to divide the individuals into six types: popular, rejected, neglected, controversial, average, and other. Their method of classification involves first tabulating frequencies of positive (p) and negative (n) nominations and converting them into standard (Z) scores. A social preference (SP) is then defined as the difference between standardized p and n

scores. A social impact (SI) score is defined as sum of the standard p and n scores. Each person is then classified into one of six categories using the following cut-off points:

1. Popular: $SP > 1.0$, $p > 0$, and $n < 0$
2. Rejected: $SP < -1.0$, $p < 0$, and $n > 0$
3. Neglected: $SI < -1.0$, $p < 0$, $n < 0$
4. Controversial: $SI > 1.0$, $p > 0$, $n > 0$
5. Average: SP between -0.5 and 0.5 , SI between -0.5 and 0.5
6. Other: all remaining individuals

Coie et al.'s (1982) method has been used in several studies (Asher & Dodge, 1986; Hinshaw & Melnick, 1995).

Analysis of Interactional Patterns

The previous section presented an analysis of status or relative position of an individual within a group. This section focuses on analyzing interactions among members to discover mutuality or reciprocity of choices, nonreciprocity of choice, and subgroup formations (cleavages and cliques).

Mutuality of choice. A mutual (reciprocal) choice is one in which two people select each other on a given criterion. In an ongoing group, identification of mutual choices is often helpful in forming teams, making role assignments within the team (e.g., to serve as initiator, gatekeeper, provider of support). Mutual choices on positive and negative nominations may be called positive and negative mutuality reflecting mutual acceptance and rejection respectively.

In nomination procedures by which people rank order their choices, analysis, although cumbersome, may provide interesting insights. For example, one might find that person A gives his first choice to B, but on the second choice B selects A. This is an example of "different level reciprocity" (see Figure 2).

Kumar and Treadwell (1985) differentiated between different levels of mutuality; for example, first level mutuality (mutual first choices), second level mutuality (mutual second level choices), and so forth. Levels of mutuality reflect the intensity of attraction or repulsion, depending on whether positive or negative nominations are called for. However, the situation becomes complex when A gives first choice to B, but on the third choice B chooses A. In such cases there is mutual attraction between the two people, but the intensity of A's feeling toward B is greater than vice versa. Kumar and Treadwell have suggested a weighting scheme to investigate the degree of mutuality. If participants are allowed three choices, the mutual first, second, and third level choices are assigned the weights of 3, 2, and 1, respectively. A first level choice reciprocated at second level is assigned 2.5 points, and so on. The authors emphasized that this weighting scheme is arbitrary, and there may be other ways of assigning weights.

Nonreciprocity of choices. These choices reflect a one-way pattern of relationships within a group. Thus, in a four-member group, person A chooses B, B chooses C, C chooses D, and D chooses A. This may also be referred to as a chain, which is typically found in the initial stages of a group formation. The number of nonreciprocal choices is usually reduced as participants get to know one another.

Subgroup formations. Subgroups are groups within groups. A subgroup consists of a smaller set of individuals who are largely connected with each other on a particular criterion of interest. A simple example of a subgroup among six members would be three pairs of mutuals. One might also consider this as an instance of a cleavage. That is, the group is sharply divided on a major issue (or issues) with no selections made across groups (Sax, 1989). In Figure 2, Subgroup B is characterized by three mutual first choices who are connected to each other by second level choices.

A clique is another example of a subgroup that is defined in terms of a group of people who only select each other (see Figure 2, Subgroup C). Cliques may result from cleavages (Sax, 1989). Cliques can be criterion-specific or exist as stable subgroups across a variety of criteria. Thus, it is important that investigators clearly specify their use of the term. Treadwell and Leach (1987) used the term quasi-subgroup to describe a subgroup that consists of members connected to each other by one-way choices. Thus, quasi-subgroups lack mutually interactive relationships (see Figure 2, Subgroup A).

Processing Sociometric Data

Computers have made the formerly laborious task of plotting sociograms by hand and computing various indices much easier. There are at least five computer programs:

1. The NARSOC (Naugher Sociometric), written by Naugher (1975)
2. CompSoc (a modified version of NARSOC), written by Treadwell and Leach (1987; Treadwell et al., 1993)
3. Netmap, designed by John Galloway (cited by Blake & McCause, 1989)

4. Snyder, Mowgli, Assor, and Stellrecht's program for Macintosh 512 computer (cited by Hale, 1987)

5. Group, written by Muir (1994)

The Group and CompSoc programs (both compatible with IBM PC) are in the public domain and copies can be obtained by contacting the authors. A version of CompSoc for Windows 95, GraphPlot, has been released by Martin Sax-ton and Thomas Treadwell. GraphPlot may be accessed on and downloaded from the World Wide Web (<http://www.voicenet.com/~msaxton/GraphPlot>).

Conclusion

Sociometry, a phenomenological methodology for investigating interpersonal relationships, has been used in various research and applied settings. Although there are advances being made in sociometry (see Carlson-Sabelli et al., 1994), the basic methods of nomination with and without ranking remain popular with investigators. Computer technology has made it possible not only to expedite data analysis but also to use sophisticated statistical analysis. The computer programs should be particularly helpful in training students on sociometric procedures. It is possible that the availability of computer software will provide a fresh impetus to greater use of sociometric tools in research and practice.

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