3-4-2006

Modeling Third Sector Organizations: A Proposal for an Organizational Modeling Language

Roger A. Lohmann

Modeling Third Sector Organizations: A Proposal for an Organizational Modeling Language

Roger A. Lohmann
West Virginia University

Sector-talk is one of the stable features of discussions of nonprofit organizations today. However, little progress has yet been made in defining or measuring the allegedly different social relations which characterize the sectors. This paper proposes an approach to operational definition of the sectors, grounded in use of chemical modeling software to modify the lowly organization chart.

Beyond Branching Diagrams

Something like the basic organizational chart is at the heart of many, if not most, contemporary models of organizations: Hierarchal clusters of box-shaped nodes representing defined organizational positions – what Weber called offices – and straight or angled lines portraying officially prescribed relations between positions.

The standard organization chart uses two-dimensional space to model the single dichotomy of hierarchical authority; from top to bottom, as it were. From this view, there are two distinct dimensions in the plane of hierarchy which can be displayed on the surface of a printed page or a computer screen. These can be termed subordination and equality. The standard organization chart displays these as intersecting principles in Cartesian space: subordination or obedience to authority is ordinarily portrayed on the vertical axis and equality or equivalent rank is shown on the horizontal. In this one respect, at least, organizational charts are a useful reflection of certain key perceptions: In most large organizations, everyone involved has a pretty good idea "where they rank": who is above them in the hierarchy, who is on their level, and who is below. Ranking of this type fits some organizations (e.g., the Roman Catholic church) better than others (e.g., some American protestant denominations). Such positional ranking also leaves many vital questions about organizations unanswered. For example, it typically leads to interminable confusion over whether it is persons, roles, offices or all of these that are being ranked. The concept of "informal organization", for example, is necessitated by the shortcomings of the "formal" or official projections of the organizational chart. Yet, no organizational chart satisfactorily captures (or strives to capture) the informal aspects of organization.

The conventional wisdom on organizational charts in organizational science consists, roughly, of two contrast statements: On the one hand, managers and policy makers appear to believe that organizational charts offer a useful, if somewhat elementary, tool. At any rate, such charts appear everywhere, and are required in many funding and reporting situations. On the other hand, it is widely (perhaps universally) acknowledged that such organizational charts offer misleading visual representations of actual organizational realities. The views they present are static, one-dimensional, idealized and often obsolete, inaccurate or misleading. On the whole, organization charts are generally discounted as serious tools for research and treated largely as artifacts and ephemera. This may be a mistaken, or at least an incomplete, view. These limitations are all particularly apparent in the case of nonprofit, third sector and civil society organizations, which are the principal concern of this article.

In *Mapping the Third Sector*, (1988) Jon Van Til provides the basis for raising the question of appropriate visual and geometric metaphors with his references to "mapping." Following his mapping (or charting) image in a visual sense (in contrast to the analogical and metaphoric senses which were Van Til's principal concerns) it is possible to suggest that a map (consisting of a large number of organization charts, realistically drawn and laid out side by side) of the third sector should look different than similar maps of business (market), government (state) and family (household) sectors.

The underlying question explored in this paper is the extent to which it is reasonable to analyze and represent the complex, verbal expressions which constitute social organization in the form of various two- and three-dimensional graphs. Mathematically, the standard organization chart is an elementary form of graph, and organizational charting is grounded in a branch of mathematics known as graph theory. The same can be said of PERT Charts, which currently illustrate a great deal more of both the mathematical and the presentational potentials of applied graph theory than the typical organization chart.

The two-dimensional imagery of organizations captured by the typical organization chart has distorted our understandings of organizational, and in particular, nonprofit activity in ways close to the core of a number of important conceptual and theoretical issues. Not all relations in life or in organizations are easily shoe-horned into the dichotomy of superior-subordinate relations or matters of simple equality. Yet, standard organization charts continue to reinforce such a hierarchical view of social life. In a national nonprofit or other multi-office organization, for example, where do subordinates in the central office rank in comparison to top officials in a local office of the same organization? Where does the board (including board members beholden to the CEO) fit in the hierarchy? What about support staff? Volunteers? Clients? Clients or board members who

volunteer? There is also the complicated issue of whether the standard organizational chart is meant to portray relations as they actually exist in the organization, or as they are intended to exist, or both?

Data Visualization

Standard organization charts present in visual form the relations of authority and responsibility spelled out in classical management theory. The problem is that classic management theory offered an essentially medieval, European or patrimonial view of the world which in untold ways fails to fit with contemporary organizational realities. Ironically, many people in business organizations seem to recognize this to a greater degree than people in the nonprofit world. Many of the problems which organizational charts present are, in fact, the results of on-going conflicts between the inherited medieval ideals of hierarchy, early modern ideals of equality and the structural complexity introduced by contemporary organization theory in its multiple corporate forms. While many in the third sector are attracted by visions of "alternative", non-hierarchical models of organization, escaping the vision of hierarchy in daily organizational life has proven to be an enormously difficult challenge. Alternative visual models which do a better job of presenting the complexities of actual organizations might offer one path toward dealing with such issues.

A variety of interesting, but inconclusive initiatives along this line have been undertaken: Several decades ago, Moreno's sociometry offered a technology for two-dimensional graphing of social relations. Moreno's approach was most typically used to model "informal" relations like friendship and had very little impact on organizational modeling. More recently, scholars and practitioners of the family have developed a variety of schema for “genograms” and other notation systems and sociological and practical experiments with "block models" and matrices contributed to the matrix model of organizations. In all cases, however, the real effects of these perspectives on organizational modeling have also been limited, and hierarchy has remained the only widely used basis for organizational modeling.

Chemical Modeling?

A number of years ago, I began a series of simple experiments with three-dimensional organizational models using scissors, string and a “ball & stick” chemical modeling kit used in undergraduate chemistry classes and sold in most college bookstores. While chemical modeling software allows complex and quantitative approaches to modeling far beyond anything suggested here, the basic approach is highly enlightening and instructive. The analogy of organization charts or models with chemical models suggests that it may

be possible to construct highly complex, two- and three- dimensional models of organizations which model more dimensions than hierarchical authority, and thus more accurately reflect different types of relations between actors and offices.

Computer-based data visualization strategies in general offer an interesting and thought-provoking alternative to traditional line-and-node organizational models which nonprofit organizations – especially those interested in alternatives to hierarchy – would do well to explore. Data visualization software grounded in graph theory has moved far beyond the humble organization chart in a number of ways which seem potentially applicable to the civil society organization of today. In particular, the wealth of software for modeling the dynamic complexities of chemical reactions, molecules, compounds, viruses, etc. may offer unheard-of possibilities in this regard.

At first, the suggestion of possible analogies between chemical compounds and the relations exhibited in organizations may strike the reader as a bit odd, or even bizarre. Afterall, the social sciences have had more than their share of difficulties in the past arising out of "social physics", social biologies and other false materialist analogies. Closer examination, however, will reveal that what is at issue here is not any assumed correlation of physical and social phenomena, but different applications of similar underlying formalisms.

In particular, graphical chemical modeling demonstrates a strong ability to model extremely complex relations, similar in many respects to the complex relations of formal and informal organization. Chemical models, by the very nature of the science, afford strong (and bidirectional) links between mathematical and visual understandings, in the process taking advantage of the relative merits of each approach. Moreover, ever-present possibilities of chemical reaction make many complex molecular models in chemical modeling as inherently unstable and ever-changing as organizations resulting from human social interaction. Thus, chemical modelers have had to deal with instability and dynamism in ways which will be at least vaguely familiar to the organizational analyst.

There are, of course, risks inherent in drawing any analogies between physical and social processes too tightly. One needs to be constantly alert to the limitations of physicalist and mechanistic views of social relations. The specter of mechanism is not really an argument against following up on the chemical-organizational analogy, however, since existing organization charts are equally mechanistic, and less viable as accurate models in the bargain.

Four Basic Relations

In what follows, I propose a new method for constructing complex, robust organizational models called Organizational Modeling Language (OML), including geometric objects ("nouns") representing positions and persons; four verbs using lines to represent social actions, or dynamic social relations; and five adverbs, represented by different line characteristics to modify and quality relations.

The principal verbs of OML represent different visual representations of four basic social relations, which I call, dominance, exchange, intimacy and mutuality. Each of these is theorized to be the predominant, defining, pattern of relations in one of the four principal sectors of state, market, household and commons. (See Table 1)

Dominance, or command and control, can be seen, following Weber's classic definition, as the unique province of the state, or what Americans generally prefer to call government. Exchange, or trading, is the province of the market sector or what Americans generally call business. Intimacy, or confidentiality, the realm of the confidant, is the realm of the household. And mutuality, or civic friendship, is the provenance of the nonprofit sector or commons.

Table 1
Verbs of OML[1]

Sector	Verb
State	Dominance
Market Order	Exchange
Household	Intimacy
Commons	Mutuality

The basic OML strategy is to model various organized, structured networks of social relations involving dominance, exchange, intimacy and mutuality using a regularized system of lines and nodes. In this way, a number of readily identifiable characteristics of lines and nodes formed into standard geographic figures like triangles, circles and rectangles can be used to create various, increasingly complex structural models of organizations. Based on the chemical analogy, one might be tempted to call such groups "social molecules", but there is no readily apparent advantage in doing so. While one may notice that simple chemical models of molecules bear a certain resemblance to the sociometric models of groups, the presentation here is in no fundamental way dependent on this analogy.

[1] Technically, these terms are listed here in their adjective forms, but each refers to a conventional process verb: to dominate, to exchange, to love, to befriend, etc.

Nodes: Rectangular and Circular

In fact, in order to make the visual analogy between models of chemical molecules and models of organizations work, we need only begin with a slight modification of the standard structural observation of standard organizational charts (already noted). Introducing a few systematic variations in the nomenclature of the traditional organizational chart opens up a vast universe of possibilities for representation of organizational relations. In the conventional manner, nodes in the shape of rectangles can be defined to represent various organizational positions or offices and lines of various types can be said to represent different relations between those positions. At the same time, the problem of whether nodes portray positions or persons is easily resolved by borrowing the convention from sociometry of portraying persons as circles. This has the further advantage of conveying an additional piece of information about the organization: Nodes shown as a circle within a rectangle (literally, a person in an office) are currently filled, while nodes shown as only rectangles (with no person in the office) are "vacant" positions. The third possibility here becomes a matter of concern in some instances with respect to volunteers and clients: a circle without a rectangle conveys a person without a defined or official position in the organization.

Lines As Relations

In the classic organization chart, lines connecting rectangles convey the "structure" of social relations within the organization, as noted previously. Graphic representations of many different organizational characteristics can be derived from even the most elementary variations of five different characteristics of lines: arc, thickness, number, direction and length.

Arc. Lines depicting relationships, for example, could be either straight or curved. In some of the experiments mentioned above, I developed a number of physical models of organizations using plastic straws (or "pipes") for formal relations and strings (or "bands") for informal ones. This notion can be refined and generalized by distinguishing straight and curved lines. If we define straight lines as depicting formal organizational relations, and curved lines (arcs) as modeling informal relations, we would have a basis for depicting graphically one of the most fundamental insights of modern organization theory. One might even press this point further by suggesting that straight lines connote officially defined relations between positions and curved lines connote observed or experienced relations between persons.

Moreover, if as a matter of definition, we were to suggest at least a rough approximation between the degree of arc and the degree of informality or intimacy, personal relationships between office-holders become a measurable variable which can be represented on an organization chart. While this variable might offer little assistance to the program planner, its

uses in organizational research are not at all difficult to imagine. More importantly, using the degree of arc in straight and curved lines to measure a formality/intimacy dimension offers an operational definition of the household sector (otherwise known as the sector of curved lines) as well.

Several of the major possibilities for visualization which arise from this can be represented as alphabetical letters or typographical forms. The typographical form of a single formal relation, then, would be a graphic figure like the capital letter "I", while the paradigmatic form of intimacy would be modeled as the letter "C" or "U". The typographical form of a joint informal-formal bond in organizations would be the "D" relation (composed of one straight line and one arc) in which two officials are related by a single formal (straight-line) relation and a single informal (curved) relation. At the same time, relations of two unrelated persons with a third could be represented by a "P" (or lower-case "b") if both had a formal relation and one had an informal one, or a "B" if both were formal and informal.

Thickness. A glance at virtually any chemical model will reveal also the use of thick and thin lines to model characteristics of the chemical bond. In like manner, we might use the thickness of the line to model the strength of relationships, whether formal (straight) or informal (curved). Thus, thinner lines would generally connote weaker relations and thicker lines connote stronger ones. On the basis of these two characteristics alone, one might know that a sharp parabola constructed with a very thick line suggests a strong personal relation between two officials. At the same time, a thick straight line probably connotes a program characteristic. One might posit that more thick lines would be indicative of greater personal relations (in the household sector and the commons) and more thin lines would be indicative of fewer personal relations (in the state, where impersonality of administration is treated as a characteristic of justice, and the market, where impersonality is held up as one of the characteristics of equitable exchange.)

Number. One of the banes of ordinary organization theory is the fact that while relations between positions, as well as between people can be complex and multi-faceted, the standard organization chart allows only one possible "link" between hierarchical nodes. As a result, positions in different tiers of the hierarchy are only every connected through vertical chains, and some are not connected at all. Chemical modeling, on the other hand, has established procedures for presenting single, double and triple bonding of both thin and thick lines. While there is, theoretically no limit on the number of such bonds which can be portrayed between two nodes (whether positions, persons or persons-in-position), certain practical considerations do emerge. For example, how many relations can be portrayed in a chart before they become indistinguishable? Likewise, there are certain conceptual limitations: How many distinct aspects of a relationship can be kept in mind before they begin to blur? Typographically and cognitively, it is very difficult

to convey a large number of multiple bonds, but even the most basic chemical modeling software includes this option. In contemporary computer formats, conveying such relations through multiple “views” or “layers” makes this relatively simple to convey.

Direction. Certain directional notions are inherent in the standard organization chart because of the previously discussed assumptions in the classic management theory on which it is based. "Up" and "top" always connote "higher" authority, for example, while "down" and "bottom" suggest "lower" or "lesser" authority and "across" denotes equality. This presents certain inherent problems, which are usually ignored or glossed over: What, for example, is the meaning of relations on the diagonal? What does it mean, for example, that one may be "higher" or "lower" than another on some other branch of the hierarchical tree? Or even a different tree?

Following the conventions of chemical modeling, it is proposed instead to show relations of hierarchy as "flows" using directional arrows rather than positions. This approach, when combined with other characteristics such as color, will also allow representation not just of official authority but also of other possible "flows"; e.g. (influence, information and resources).

There appear to be four general possibilities in the approach suggested here, each of which is convened with the purposeful use (including nonuse) of arrows. There are undirected (–), one way either way (–>, <–), and bidirectional (<–>)relations, used alone or in combination with the other traits (arc, thickness, number and length). Undirected lines would be indeterminate or unknown, one-way lines would suggest the direction of a hierarchical relation (whether control, exchange, intimacy or mutuality) and bidirectional lines would be reciprocal. Thus, a thick undirected line accompanied by a thin bidirectional line would be suggestive of a dyad characterized by a dualistic relation, one bond of which is indeterminate or unspecified and one body of which is reciprocal. Certain relations would, of course, be ruled out definitionally; Unidirectional exchange, for example, is an oxymoron. Reciprocal control, on the other hand, offers some intriguing possibilities well supported by the research literature.

Length. Finally, line length appears to be a singularly intuitive measure of a range of variables which can be summarized as "social distance". Persons or offices which are closer (or "work closely together") can be modeled with shorter lines and those who are more remote can be presented with longer lines. The advantage of applying graphical modeling to problems of social distance is that it can circumvent some of the measurement problems involved. Taken together, however, they also suggest additional approaches to modeling organizational characteristics.

Typographically, these differences can be shown by variations in font size: A 12-point "I" for example, suggests lesser social distance than an 18-point

"I" (which in this case, also inadvertently connotes a stronger relation because of its greater thickness!)

Groups As Polygons and Networks

Structurally, any group or organization can be treated both as a system of social positions (the "formal organization") or as a set of relations between individual persons (the "informal organization"). The elements of Organizational Modeling Language (OML) introduced so far have the capability of showing either option or both. Using only the terminology already introduced, it is possible to prepare and present structural models of a complex variety of groups and social organizations as polygons connected by lines. In that case, the polygons can be used to represent positions and lines can be used to represent relations. In the even more general terms of networking theory, the position/polygons can be thematized as "nodes" and the relations/lines can be said to represent "links".

Groups, Work Groups, Organizations and Communities

Communications theory has already articulated the model that organizations and groups can be conceptualized as networks of nodes and links. On this basis, we need only observe the ease with which communications networks of groups, work groups, organizations and communities can be modeled visually with a standardized nomenclature of polygons and lines exhibiting certain defined characteristics.

> *Circles.* As noted previously, persons, for example, can be presented as circles and positions as rectangles. More generally, a circle may also be said to represent an undetermined, undefined or unknown or not fully knowable or understood node, which may contain or encompass other nodes or links.
>
> *Dumbbells and Polygons.* Moreno's proposals for a science of sociometry made much of the importance of dyadic and triadic relations, based on earlier work of structural sociologists like Georg Simmel who also attended with great interest to these two particular social forms. Incorporating many of these concerns into organizational models is relatively simple, using the conventions outlined above.

Two nodes connected by a single straight line form the simplest case of a dyadic relation (which takes the general shape of a dumbbell). Likewise, adding sides one at a time suggests a range of increasingly more complex structures which could model groups from 3-12 or more members: triangles, rectangles, pentagons, hexagons, heptagons, octagons, nonagons, decagons, hendecagons and dodecahedrons, etc.

Triads

The simple case of a triadic relation appears to be possessed of a range of particularly interesting possibilities: Three lines can form a regular triangle by converging (/_\ ), a semi-hexagon by a mixture of divergence and convergence (_/) or a wishbone (Y) by divergence. These are well illustrated by the case of the three-person workgroup: The triangle may present three workers who form a single group. The semi-hexagon may present three separate work groups of two workers, with two of the workers belonging to two groups each. The wishbone (known in sociometry as a star) shows a work group of four workers made up of three separate subgroups of two in which there is only one common (or, in mathematical set theory "union") member who belongs to all three dyads. Even a moments reflection will reveal the degree to which these are quite distinct organizational patterns with identifiable implications for action. It is possible to capture and symbolize all of these triadic relations simply by showing three lines in various proximities to one another.

Graphing The Basic Relations

Now that we have defined the basic OML organizational "grammar", we can use those and an additional set of basic graphic terms to create graphic definitions of the four basic relations discussed previously: exchange, dominance, intimacy and mutuality, and through them, of the four sectors.

> *Exchange.* The generalized model of exchange has proved to be a powerful and widely employed model of organization for the nonprofit sector. Exchange dimensions in relationships can be shown independently of any other characteristics through the use of arrows, quite independent of the particular "currency" of the exchange. Thus, undirected lines generally connote an unknown or unspecified exchange relation, while the direction pointed by a single arrow would suggest a condition of asynchronous benefit for one of the parties, such as might be found in either gifts or tribute. Double headed arrows on the other hand connote the ordinary equilibrial exchange or *quid pro quo*. If one of the parties clearly has the upper hand in the exchange, this might be indicated by different thickness of the arrowheads.
>
> *Dominance.* It is a characteristic of the above that dominance can be represented by the thickness of lines, together with indications of direction as above and, in cases where domination/subordination is a theme in personal relations (as in the patrimonial family), curved lines. Thus, the type of direct superior-subordinate relation characteristic of classic bureaucracy can be show with lines of varying degrees of thickness and arrows pointing in one direction. In the simplest case, adding such an arrow to the clerical/support staff boxes

which frequently sprout from Dual headed arrows on lines, perhaps connote structural power struggles or conflicts of authority, such as the classic line-staff problem. Finally, curved lines could be used to connote a personal dimension to the relation, as in the classic struggle between King Henry and Thomas Becket, Archbishop of Canterbury, who had been youthful friends.

Intimacy. Within the basic terms of the model expressed so far, relations of intimacy both in formal organizations and in social organizations of other sectors such as the family are matters of the arc, length and proximity of lines. This is suggestive of a kind of "trigonometry of intimacy". The key to understanding this is perhaps found in the common expression of intimacy used to characterize friends, lovers, relatives and others: "We're very close."

Mutuality. While intimacy is a matter of proximity in the model, mutuality is presented as a matter of the number (and type) of bonds. In a very real sense this approach models the kind of complex, multivalent relations which are such an important characteristic of action in the third sector. Thus, the board president, with whom one sings in the community choir, who is also a fellow member of the Rotary club and married to one's cousin is a familiar figure to everyone in the nonprofit world.

A Sector Index

Operationally, one would expect to find a relation between the density of each of the basic types of relations – exchange, dominance, intimacy and mutuality – in a particular organization and what might be termed its "centrality" to a particular sector. Thus, this approach could provide a consistent means for classifying organizations into sectors[2]: Thus, organizations characterized primarily by relations of dominance should be accorded their proper status as part of the state apparatus, regardless of their legal classification. However, many traditional families and "patriarchal" business corporations may operate on very similar patterns of hierarchical domination.

Color Models

Color in organizational modeling of the type discussed here can have a number of different uses. In something like conventional “ball and stick” mode of chemical models, for example, coloring circular nodes, for example,

[2] This hypothesis assumes what is a straightforward assumption of the widely accepted among sector theorists – that there are meaningful differences between organizational forms which characterize the different sectors: That families are different structurally and functionally from public bureaus, commercial firms and commons, or civil society associations.

might convey a range of characteristics of incumbents, such as race, gender, age, education, salary level or other personal characteristics. At the same time, coloring office “boxes” might be used to locate different departments or programs of the organization rendered in different colors.

Likewise, in analogy with temperature modeling in chemical models, coloring lines (relations) might be used to capture structural information about the role of emotion (or, what classic liberal political theory styles "the passions") in organizational terms.

One real advantage of the use of color in modeling continuous variables like age or salary is that even relatively subtle variations and shadings can hold immediate meaning for the viewer, but with an underlying mathematical basis. (Witness the use of color in temperature graphs). Likewise, in capturing certain emotional information embedded in organizations, the contrasts of certain "cool" colors (greens and blues) with "hot" colors (reds and oranges) has some obvious parallels with such verbal constructions as "people in that office always seem to be so calm and cool."

Moreover, as the variations of wireframe, stick, ball and stick, backbone, space fill, ribbon and strand models in chemical modeling programs like ResMol make clear, ability to display the same basic information in different forms reveals tremendous nuances of difference inherent in the data and suggests the real power of the data visualization approach. Simply color mapping different demographic (age, gender, race, etc.) characteristics and programmatic characteristics would yield tremendously interesting charts.

Three-Dimensional Models

Three-dimensional modeling also seems to offer promise for entirely new ways of viewing organizations. In particular, the unfortunate, and quite medieval, tendency to equate the top of the page with "higher" authority can be overcome. Instead, models can be presented in three-dimensional space so that they can be rotated and viewed from all sides, while the dimensions of the space itself are freed up from the burdens they carry in present organizational charting.

Layers

While many different and complex bonds can be shown in this type of organizational model, the level of complexity involved soon becomes overwhelming. Fortunately, a standard feature of many computer software modeling programs is the ability to separate layers, each of which can be presented separately, but which remain mathematically/logically connected. This feature could be used to good advantage in this case with more complex

organizations to show different "views" of the organization emphasizing different features.

Two layers, in particular, are important to note here: First, one of the objects attached to each noun representing positions or persons should be a link to one or more text fields allowing entry of descriptive/narrative information. Secondly, it should be possible to collapse and burst (with a double-click?) “regions” of large organizations into single rectangles (something like the Apple Meta-Content Language “Hot Sauce”?).

Interorganizational and Intersectoral Relations

It should not escape mention here that the different sectors which have concerned nonprofit researchers for more than a decade should show up as clusters of "organizational molecules" whose physical appearance is quite distinctive: Thus, a model of paradigmatic third sector organizations (which I have called "commons") would show up primarily as a series of multi-bonded nodes, while the presence of the state would be detected in the density of thick lined bonds. The intimate relations of the household sector should show predominantly in sets of arcs and market relations would be evident in the density of double headed directional links.

Most importantly, however, even a relatively simple model of this type with representatives from each sector would create a vocabulary for modeling the interpenetration of each sector into the other; itself a major objective of recent third sector work. Thus, nonprofit organizations engaged in the market or quasi-market sale of services, based at least in part on third-party government contracts would be signaled by relatively thick lines, with double arrows, and at least some multiple bonding.

The Grandstand: Taking the Field

The discussion of possible formal analogies between chemical and organizational models to this point has taken for granted something which no adequate study of social organizations can afford to ignore entirely: the point of view or observation of the modeler. This is a more-or-less standard viewpoint of most "social structural" theory, but one which has been heavily taken to task in the past by Marxians, interactionists and some systems theorists. In the commons, I characterized this as the "grandstand" position: much like sitting in the stands observing the positions, strategy and tactics of opposing teams in a football match.

Interestingly, the three-dimensional possibilities of chemical modeling (whether in physical models or software) open up to new interpretations some of the underlying observational questions. For example, because you can "walk around" (move the point of observation) of three-dimensional models, it

becomes possible to observe and to speculate more accurately on what effects organizational position may have on the ways in which organizations are seen -- by upper and lower-level participants, for example, or by outsiders. Merely setting such a three-dimensional model on a glass-top table and observing it from below, for example, can give one an accurate sense of the bewildering complexity which the typical organization presents to lower participants: clients, students, customers, etc.

Moreover, the plasticity of vantage points offered by three-dimensional models makes it possible to "come down out of the stands and take the field" – to actually observe from various positions "inside" the model how differently the structure of an organization may look to various participants.

Conclusion

This paper offers a brief outline of a method for three-dimensional modeling of groups and organizations, through a series of analogies grounded in graph theory, network theory and the available technology of chemical modeling. Through the presentation of social structures as graphs composed of polygon/nodes and line/relations, it is possible to create graphical models of groups, organizations and ultimately, sectors. The arc, thickness, number, direction and length of lines all can convey relational information, while the shapes of polygons circles and 3-12 sided objects convey information about the number and proximity of participants, and colors can be used to convey nodal information such as personal and organizational characteristics and relational information such as predominant emotional "tones" of interactions. The use of some or all of these modeling techniques constitute alternatives to the present regime of simple branching diagrams (organizational charts) used to model organizations today.

References

Moreno, J. L. (1956). *Sociometry and the science of man*. New York,: Beacon House.

Moreno, J. L. (1960). *The sociometry reader*. Glencoe, Ill.,: Free Press.

Ray, L. J. (1991). *Formal sociology : the sociology of Georg Simmel*. Aldershot, Hants, England; Brookfield, Vt.: E. Elgar.

Van Til, Jon. 1988. *Mapping the Third Sector: Voluntarism in a Changing Social Economy*. New York: Foundation Center.