

Boxicity and the social context of Swedish literary criticism, 1881–1883

Linton C. Freeman

School of Social Sciences, University of California, Irvine, CA 92717, USA

This paper attempts to cast new light on the results of an earlier study of the social context of Swedish literary criticism. Data from a study of persons mentioned by literary critics are re-analysed using new ideas and techniques from biology, mathematics and social network analysis. The results of this new analysis suggest that there may be previously unrecognized structural dimensions of the 'frame of reference' within which new literary works are evaluated.

Introduction

This is a paper on sociology, but it will draw on several other fields and try to show how ideas and tools from those fields may help to cast some light on a sociological problem. First, I shall describe an intuitive idea that biologists have borrowed from physics—the notion of ecological phase space. Second, I shall argue that the sociological concept, variously called frame of reference or social context, is structurally identical to the phase space idea. Third, I shall show how that idea has been turned into a tool for analysing empirical data by using the mathematical notion of boxicity. Finally, I shall use the analytic procedures suggested by the boxicity notion to reanalyse some data on the social history of Swedish literary criticism from 1881 to 1883.

Ecological phase space

Animal ecologists use the concept of 'ecological niche' to describe the fact that the members of any given animal species are, by their very nature, restricted to some relatively small segment—niche—of the total environment. Obviously, living reproducing members of a species will be found only in an environment that can support their survival. Members of any species will be restricted to, say, a limited range of temperatures in which they can survive. Then too, there may be limitations in the amounts of moisture that are tolerable, or levels of light or degrees of acidity or any number of other environmental factors that turn out to be critical for their survival.

When one of these factors is relevant to the survival of a species, it will be characterized by an interval or range of values with an upper and lower bound beyond which survival is unlikely or impossible. Thus, if temperature is relevant, there will be a range of temperatures in which species members can survive. If they find themselves in a situation that is too hot or one that is too cold, they will be wiped out. When several, say m , such

factors are involved in the survival of a given species, then each factor will produce such an interval. Taken together, these m intervals thus specify a 'box' in m -dimensional space. That box is the ecological niche of the species in question.

In any given case, the dimensionality of this ecological niche is virtually impossible to determine. If an investigator tries to specify all the possible relevant ecological factors in advance, he or she can never be sure that every factor in the list does, in fact, play a role in restricting the survival of some newly studied species. Then too, the investigator cannot ever be certain that the list is exhaustive; in a particular case some new, unanticipated factor may come into play. This problem is confounded further by the fact that two or more relevant ecological factors may vary together, at least within their effective ranges for the species being considered. This means that, in effect, these several inter-related factors will turn out to be reducible to but a single compound factor or underlying dimension.

Overall then, the problem of actually determining dimensionality from this perspective is very difficult or perhaps impossible. Thus, though the idea that species adapt in the context of an m -dimensional ecological niche is intuitively appealing, in practice it is extremely difficult to calculate a realistic value for m . It is almost impossible, therefore, to talk coherently about the dimensional complexity of an ecological niche space.

Fortunately, there is another, quite different, way of approaching this problem. Obviously, the ecological niches of two or more species can, and frequently do, overlap. Since only members of species with overlapping niches could possibly be found in the same environment, if we had information about the presence of two or more species in the same physical space, it would be safe to conclude that their niches do have at least some overlap.

Cohen (1978) suggested that the overlap between two species can be discovered by examining their predation patterns. To the degree that the two species share one or more common prey, they are at least sometimes found in the same ecological niche. Moreover, if we collect data on the predation patterns of all the species in a geographic area, we can examine the overall pattern of the co-occupancy of the whole collection of ecological niches in that area. Then, to the extent that we are able to work out a way of determining the dimensionality of this collection as a whole, we can answer our question about the complexity of their ecological niche space. We shall see later, in the discussion of biocivity, how such a determination can actually be made.

Literary milieux

In a series of books and papers, Rosengren (1968, 1980, 1983) reported the results of a sociological study of the Swedish literary system. His particular focus was on properties of the social, cultural and literary milieu—the frame of reference or background social context—into which new writings were introduced at various points in history. As envisaged by Rosengren, the milieu into which new writings are entered may consist of any—or any combination—of a number of relevant social and cultural factors or dimensions. Depending on historical circumstances, the public in general and critics in particular may respond not only to the literary style, but to the political point of view, the economic orientation, the moral tone or any of an almost unlimited number of other characteristics of a new work. Different factors and different combinations of those factors will be mobilized at different times and in different settings.

When a new work is published then, it is evaluated in terms of the factors that are considered to be important at that time and place. A new literary work may or may not

embody important political, economic, moral or other relevant perspectives. But if it does, and if those issues are considered to be important in that cultural setting, its acceptance or rejection by critics and the public alike will depend on its stance vis-a-vis those perspectives. At a place and time where a given factor plays a part, critical response to a new work will be determined by the accepted norms with respect to that factor. In effect, critics and the public will define a range of acceptable expression in terms of the relevant factor, and other perspectives will be seen as unacceptable. Suppose, for example, that an accepted norm in a given setting values an egalitarian form of social organization. Then, if a new literary work is seen as espousing an hierarchical social form it is apt to be rejected.

From this perspective, each of a large and unknown number of social and cultural norms might be relevant factors in the evaluation of a particular new work. The success or failure of a new piece of literature, then, would be determined by its apparent location with respect to the interval or range of acceptable expressions of each factor. Taken together, all the relevant factors to which reviewers or the reading public respond at a particular moment define a kind of 'literary-sociological niche space' in which new works are evaluated.

Rosengren (1980) examined all the literary reviews published in Sweden during the 1880s. That period was chosen because it was a time of dynamic change in Swedish literature. It began with the publication of *The Red Chamber* by Strindberg in 1879, and opened up an era dominated by a set of new realist novelists known as the 'Young Sweden Group'. This was a group of 'young Turks'. They completely rejected the traditional romantic literature of Sweden that had been dominated by the church and the university. As a substitute, they introduced a whole new literary perspective that was grounded in social and political concerns.

After a careful analysis of these historical materials, Rosengren produced a list of the factors he saw as critical to the literary reviews of new works during that period. There are four 'dimensions' in his list: aesthetic, religious, moral and political. Presumably then, in Rosengren's eyes, new literary works were evaluated in terms of their locations in a four dimensional literary niche-space and their success or failure was a consequence of their perceived position with respect to relevant aesthetic, religious, moral and political issues.

The difficulty here is that we cannot take Rosengren's list at face value. All of the problems in determining the dimensionality of ecological niches also obtain for their literary-sociological counterparts. A sensitive observer of the social milieu can come up with a set of factors that seem to be relevant to the reception of a particular work. Other observers, however, might come up with other, equally plausible factors. Even if every observer agreed to the same list, the problem of untangling the interrelations among the factors would not be resolved. The several factors involved in evaluating a piece of literature might be independent, or they might be interrelated and reducible to a smaller number of dimensions. So here again, and again for the same reasons, the problem of determining the dimensional complexity of the niche space is insoluble.

Like Cohen, however, Rosengren (1980) found another way of approaching the problem. He reasoned that in the literary review milieu, the overlap among authors might be determined empirically. He noted situations in which sets of authors other than the one being reviewed were mentioned together in reviews, and he recorded those sets that were mentioned together in any published literary review in the Swedish press. Thus, Rosengren's actual data are frequencies of co-mention among pairs of authors. However, he conceived the problem to be one in which a pair of authors either was or was not linked together in the minds of the reviewers. He wanted therefore to eliminate any

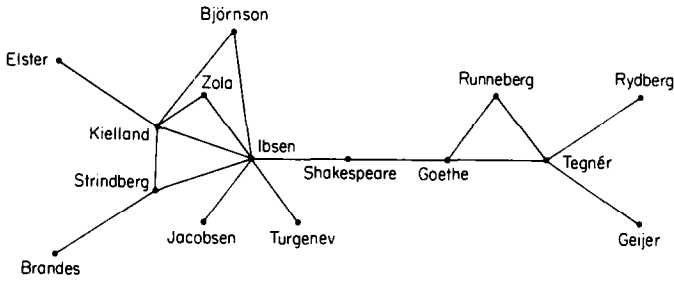


Fig. 1.

pairs that were mentioned together so infrequently that they were unlikely to represent any sort of consensus among reviewers. He took two steps towards that end. First, all pairs that were mentioned together less than five times were eliminated. Then, to minimize the possibility of linking those pairs of authors that were mentioned together simply as a consequence of their both being mentioned a great deal, a probability-based procedure was used. The expected proportion of co-mentions were calculated on the basis of the proportions of mentions of each of the authors being examined. Finally, the standard error of that expected proportion was computed, and only those pairs of authors whose proportion of co-mentions was more than three standard errors above its expectation were linked together.

Rosengren's data showing the largest connected set of authors that were linked by reviewers during the period 1881–1883 are shown in Fig. 1. In some sense, pairs of authors that are linked in the figure can be taken to occupy a common literary 'niche', at least in the minds of Swedish critics of that period.

Rosengren described these graphic data as reflecting a single dimension. He said, 'The two subfields of the period 1881–1883 probably represent a polarization of the frame of reference, mirroring the deadly quarrel raging between *les anciens* and *les modernes* . . .' This is a reasonable conclusion, since the Swedish 'classical' romantic poets (Runneberg, Tegnér and Rydberg) are clustered on the right, while the then contemporary Scandinavian realist novelists (Strindberg, Kielland, Elster and the like) are clustered on the left in Fig. 1. Somehow, bridging these two warring camps, are two of Europe's leading non-Scandinavian writers, Shakespeare and Goethe.

The upshot of all this is that, depending upon the level of his analysis, Rosengren presented two quite different views of the literary niche-space in Sweden in the early 1880s. On one hand, after a literary historical analysis of reviews of the period, he suggested that the four dimensions of aesthetics, religion, morals and politics were involved in the review process. However, after inspecting the pattern shown in Fig. 1, he decided that the four dimensions were so interrelated that they collapsed into a single traditional-modern dimension. Both conclusions are reasonable, but neither was based on any systematic procedure for assessing the question of dimensional complexity. Fortunately, such a procedure has been developed by Roberts.

Boxicity

Boxicity was explicitly introduced by Roberts (1969) to address the problem of the dimensionality of the structure represented by a graph. The boxicity notion is a straightforward generalization of an established concept in the study of structures, that of an interval graph. The most natural and intuitively appealing notion of a single dimension

is embodied in the real number line. It is an unbroken continuum running from negative infinity to positive infinity. It has no loops or branches and any real number can be unambiguously located somewhere along its length. Moreover, any pair of real numbers, a and b ($a \neq b$), differ only with respect to their locations on the line—either a precedes b or a follows b .

We can talk about relations if we define intervals on the real number line. Suppose we define a set of intervals. Two such intervals are related if and only if they overlap on the line. So, if we have a whole collection of intervals, we can distinguish between those pairs that overlap and those that do not, and we are still operating in the context of a clear, one-dimensional representation.

A graph like the one shown in Fig. 1 is no more and no less than a picture of a relation. Points are objects (in this case, writers) and edges or lines are connections (in this case, being mentioned together) that define a relation over the set of objects; a graph is an interval graph if each of its points can be mapped to an interval on the real number line such that the intervals representing two points overlap if and only if there is an edge connecting those points on the graph. Thus, an interval graph embodies a linear ordering of elements that is consistent with the existence of a single underlying continuum. The resulting pattern of overlaps produces an unambiguous ordering of the points in the graph.

All graphs are not necessarily interval graphs. In some cases the pattern of edges will not permit mapping the graphs to overlapping intervals. In such cases, it is clear that the structure of the relation embodied in the graph is not one-dimensional; its dimensionality is more complex. But the question is, how complex? Does it require two, three or more dimensions? Roberts (1969) provided a way of answering this question by generalizing the notion of interval graph (see also Freeman, 1983, for a further generalization of this approach). Suppose that, instead of restricting ourselves to looking at overlaps of lines in one dimension, we could look also at the overlap of various kinds of boxes: squares in two dimensions, cubes in three dimensions and so on. Then, the boxicity of a graph is the minimum number of dimensions needed to represent the pattern of edges in that graph. From this perspective an interval graph has a boxicity of one.

Most important, higher order boxes are decomposable into their one-dimensional interval graph components. Roberts proved that a graph has a boxicity equal to some value, m , if and only if it is the intersection of m one-dimensional interval graphs. Thus, the boxicity notion is a straightforward generalization of the idea of interval graphs.

Now, with the Robert's concept in mind, we can go back and examine the dimensionality of the Rosengren data. First, looking at the structure shown in Fig. 1, it is entirely possible that Rosengren's intuition that the structure is one-dimensional is correct. The obvious first question therefore is, can these data be mapped to an interval graph?

An attempt to fit the data from Fig. 1 to a set of overlapping segments of the real line is shown in Fig. 2. All but one of the points (Elster) in Fig. 1 are shown in the picture in Fig. 2. The reason for excluding Elster is that one part of the structure shown in Fig. 1 cannot be mapped into a single interval graph. At the 'modern' end of the continuum is a special kind of substructure shown in Fig. 3. This structure is called an 'asteroidal

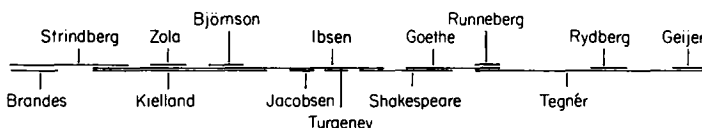


Fig. 2.

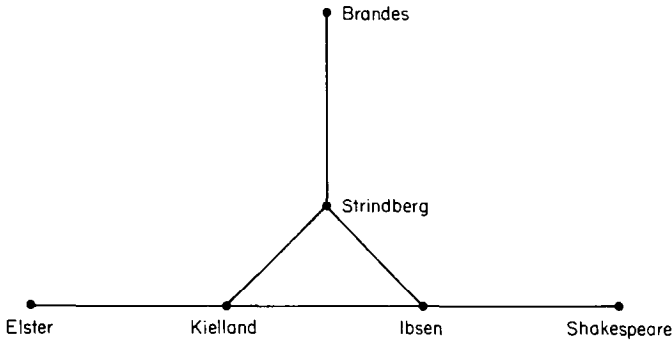


Fig. 3.

triple'. Its presence indicates that the links among these more recent writers are more complex; they do not constitute a simple linear ordering.

The problem lies in a "strain" in the proximities of the six points shown in the asteroidal triple in Fig. 3.

- (A) Strindberg is adjacent to Brandes,
- (B) Ibsen is adjacent to Shakespeare,
- (C) Kielland is adjacent to Elster, and
- (D) Strindberg, Ibsen and Kielland are all adjacent, but
- (E) Brandes, Shakespeare and Elster are not.

We can see the implication of this triple by looking back at the attempt to represent the data in one dimension in Fig. 2. Note that the right extreme of the representation is 'used up' because Tegner has to stick out enough to allow both Rydberg and Geiger to overlap him without permitting either of them to overlap anyone else. On the left extreme a similar situation obtains; Strindberg must protrude to permit overlap of Brandes, but, on the other hand, Fig. 1 shows that Elster must overlap with Keilland, so Keilland must also protrude. Clearly, both are not simultaneously possible, so either Brandes or Elster had to be excluded from the linear representation shown in Fig. 2. Elster was arbitrarily selected.

Thus, this is a structure that has no linear one-dimensional order. It seems to be 'pulled' in at least three distinct directions. The newer writers need more than one dimension to describe the pattern of their adjacencies. Figure 4 shows that exactly one more dimension is needed. The data may be represented by squares in exactly two dimensions. Boxicity, therefore, is equal to two for these data.

Discussion

Rosengren, it will be remembered, came up with four dimensions when he looked at the substantive content of the data, and one when he more or less casually examined the structure of the graph. The current, strictly structural analysis suggests that neither of these earlier conclusions is correct; there turn out to be exactly two dimensions in Rosengren's data on authors.

This observation that there are two dimensions might simply be an artefact of the way the data were handled here. Rosengren's original frequency counts were transformed into on-off connections between pairs of authors. The two observed dimensions might have been generated by the rules Rosengren used to create his dichotomies.

From the data available there is no way to tell whether a less stringent criterion, one that generated more connections, would have reduced the dimensionality of the graph. But we can test the consequences of applying a more stringent criterion using available data. Connections may be removed, according to how far they depart from their expectation, moving successively from the weakest to the strongest. Using this procedure, it is necessary to remove ten of the 18 recorded connections before the second dimension disappears. This suggests that using any reasonable, more stringent criterion would not have changed the observed result. Indeed, it seems that the second dimension is a robust part of this structure.

Let us therefore accept that this is a two-dimensional structure. How are we to think about these two dimensions? The horizontal one probably does capture something about the traditional–modern division seen by Rosengren. Indeed, the frame of reference in earlier periods contained only the Swedish romantic poets, Tegner, Geijer, Rudberg and Runneberg, along with Goethe and Shakespeare, apparently as a link into the broader context of European literature. By the 1870s these writers were viewed as having produced the ‘Golden Age of Swedish poetry’. They were the core of the ‘classical’ standard in terms of which contemporary writings were evaluated. When Strindberg published *The Red Chamber* in 1879, however, it simply could not be fit into that existing frame of reference. It was realistic and it was a novel, and in terms of either of these criteria it had no place in standard Swedish literary conceptions. To come to terms with this work, the Swedish literary community was forced to look beyond the boundaries of Sweden. Throughout much of Europe, particularly in the other Scandinavian countries, Strindberg’s realist–naturalist literary style simply reflected the norm. The form and scope of this new style had been defined primarily by the French—in particular by Zola. Closer to home, the same style was embodied in the works of the Norwegians, Ibsen and Keilland. Moreover, it had been explicitly defined as *the* proper literary form in essays by the Danish critic, Georg Brandes.

Thus, the Swedish literary frame of reference was broadened. By the 1881–1883 period it included not only the home-grown romantic poets of the Golden Age, but it centred around the modern realist novelists and dramatists from the other Scandinavian countries. The older and the newer writers were tied together in the minds of critics of the period by a link between Shakespeare, as a representative of the old school, and Ibsen as a representative of the new. Both, after all, were playwrights and both were authors of great stature.

The main left–right dimensions of Fig. 4, then, would seem to have captured Rosengren’s traditional–modern division. According to Rosengren (1983), this horizontal axis may be viewed as a general dimension of literary conservatism–radicalism. At the conservative end we find romantic poets. At the radical end are realistic novelists.

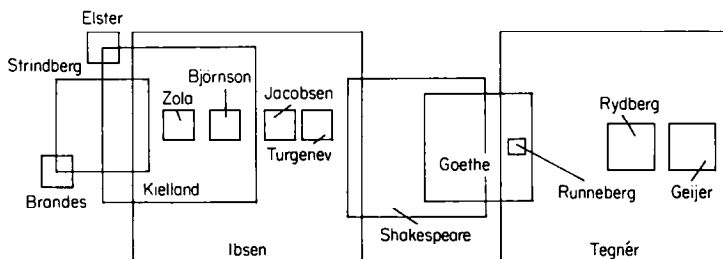


Fig. 4.

Moreover, while the conservative end includes only Swedish writers, the radical end is dominated by those from other countries. As Rosengren has suggested, aesthetic, religious, moral and political factors were all intercorrelated and all involved in this dimension. All of these factors went together to make up an overarching radical-conservative dimension in the literary frame of reference.

From this perspective, most of the links shown in Fig. 1 reflect the reviewers' perceptions of similarities among sets of authors in terms of this overall radical-conservative axis. Each author was placed somewhere along that dimension and sets of authors were mentioned together when they were seen as having overlapping niches in those terms. It is at the modern end of this continuum that this scheme breaks down. There, depending on whether Elster or Brandes is chosen as the polar extreme on the first dimension; the other author is the extreme on a second. Either Kielland or Strindberg seems to have been viewed by reviewers—though they are linked to each other and to Ibsen—as pushing off in an entirely different direction, a direction that also involved the work of either Elster (if Kielland) or Brandes (if Strindberg). This kind of phenomenon would emerge if the ties between the several strands of radicalism-conservatism were somehow different in one of these linked pairs of authors. If either pair, Strindberg and Brandes or Kielland and Elster, were viewed as noticeably more radical in some particular way—say morally or politically—but not so radical in other ways, they would not fit in with the simple, one-dimensional scheme for classification. In effect, they would be seen as 'veering off' in a new direction and they would no longer fit into a linear set of niches.

The Kielland-Elster pair are unlikely candidates. Both were Norwegian naturalist novelists, and both were in the Norwegian literary mainstream at the time, along with the dramatists, Ibsen and Bjornson. Moreover, Elster was a rather minor figure, who was probably included only because he had just published two novels that were current in the period under study. My guess is that the second dimension centres around the works of Strindberg and Brandes. Strindberg is the only Swede in the modern frame of reference and Brandes, though Danish, had great influence in Sweden. Moreover, they shared an unwillingness to get caught up in the kind of moralistic fervor that characterized the Norwegian writers of the period. They embraced a kind of what might be called moral relativism, while other realist writers were struggling with problems of good versus evil. Gustafson (1961, p. 259) describes Strindberg as having shown only 'a partial willingness . . . to be reconciled with his contemporaries and a determination to continue the iconoclastic satirical strain of *The Red Room*'. Further, (p. 248) he contrasted the works of Brandes and Ibsen in the following words:

But while Brandes represented a kind of modern emancipation which tended to loose contact with any and all ethical norms, Ibsen brought to the literature of his day a sense of moral values of the most rigid and demanding kind.

I am too far from being an expert in Swedish literature to provide any sort of final answer to the question of untangling the two dimensions shown here. That remains for further study by specialists in the field. At the very least, however, the present study has shown that the use of an explicit measure of dimension can help to clarify previously hazy structural concepts. In particular, a boxicity-based dimensional analysis has been shown to be useful in literary research. This study has focussed attention on a potentially important structural component of the data that previously went unnoticed. The job now is for literary specialists to re-examine these data and come up with a basis for either rejecting these results or accounting for the structural complexity revealed here.

References

- Cohen, J. E. (1978). *Food Webs and Niche Space*. Princeton: Princeton University Press.
- Freeman, L. C. (1983). *Social Networks* 5, 139–56.
- Gustafson, A. (1961). *A History of Swedish Literature*. Minneapolis: University of Minnesota Press.
- Roberts, F. S. (1969). In *Recent Progress in Combinatorics* (ed. W. T. Tutte). New York: Academic Press.
- Rosengren, K. E. (1968). *Sociological Aspects of the Literary System*. Stockholm: Natur och Culture.
- Rosengren, K. E. (1980). *Literaturw. und Lingustik (LILI)* 12, Empirische Methoden der Literaturwissenschaft.
- Rosengren, K. E. (1983). *The Climate of Literature: Sweden's Literary Frame of Reference, 1953–1976*. Lund: Studentlitteratur.