

## Perceptual Mapping

Perceptual mapping has been used as a strategic management tool for about thirty years. It offers a unique ability to communicate the complex relationships between marketplace competitors and the criteria used by buyers in making purchase decisions and recommendations. Its powerful graphic simplicity appeals to senior management and can stimulate discussion and strategic thinking at all levels of all types of organizations.

Perceptual mapping can be used to plot the interrelationships of consumer products, industrial goods, institutions, as well as populations. Virtually any subjects that can be rated on a range of attributes can be mapped to show their relative positions in relation both to other subjects as well as to the evaluative attributes.

Perceptual maps may be used for market segmentation, concept development and evaluation, and tracking changes in marketplace perceptions among other uses.

Perceptual mapping involves two steps: (1) data collection and (2) data analysis and presentation.

### Data Collection

Among the various mathematical and statistical methods used to produce perceptual maps, POPULUS has found—and published research to this effect—that multiple discriminant analysis provides the most reliable methodology. Among the reasons for this are:

1. Discriminant analysis has a close linkage between product points and attribute locations.
2. Discriminant analysis maps do not change if attributes are added that are linear combinations of those already present in the perceptual space.
3. Discriminant analysis is alone in paying attention to “between product” information, after scaling it so that “within product” differences are equal for each dimension and uncorrelated. That means that DA uses a “yardstick” to give every dimension common metric (in terms of equal unexplained variance).
4. Discriminant analysis is the most efficient method in terms of cramming into a space of low dimensionality the most information about how products differ.
5. Unlike mapping based on distances or similarities, DA make use of attribute ratings, which are easy and natural for respondents, and useful for their content even if mapping is not done with them.
6. POPULUS research [Fiedler, 1996] has shown that DA was more successful than Correspondence Analysis at reproducing a known map when the data were distorted in various ways.

Employing this methodology, respondents are never asked about similarities among products or subjects; they are asked to rate products on attributes, and similarities are inferred from differences in respondents’ ratings.

The data required for perceptual mapping thus comes from rating scales where the subjects of the map, from products to populations, are described on the basis of selected attributes. The validity of the map depends on both the overall set of attributes and the subjects of the study as well as the subset of attributes and subjects evaluated by each respondent.

Most studies suffer from too many attributes. Manufacturers and service providers see hundreds of ways in which their products and services differ—or might differ—from those of their competitors. Often the research analyst is unable to impose the discipline necessary to develop a reasonably short list of attributes. In most studies, it is usually desirable (or necessary) to select a subset of attributes for respondents to rate. This can be accomplished by using one of two approaches:

1. Select a subset of most important attributes. Each respondent rates all attributes on importance. The questionnaire is programmed to select a subset of the important attributes for rating. This may assure more meaningful questionnaires for respondents.
2. Randomly select a subset of attributes. The questionnaire randomly selects a subset of attributes for each respondent. This has the advantage that there will be roughly equal sample sizes for each of the evaluative criteria. The obvious disadvantage is that the respondent task may be less interesting.

Research by POPULUS has shown that the first alternative provides for a greater correlation between discrimination and importance.

### **Data Analysis and Presentation**

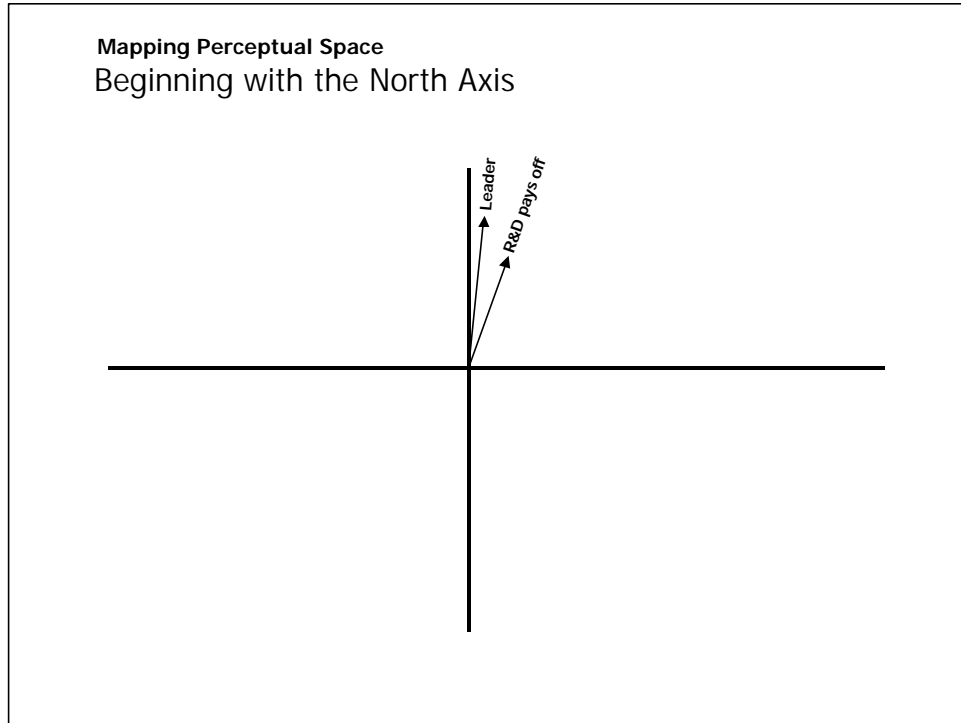
Multiple discriminant analysis uses the “F ratio” to determine attribute and product or subject location in the perceptual space. The F ratio is a ratio of the variance between ratings of different products/subjects to the variance of ratings within products/subjects. In an attribute study, these variations among ratings are generally of two types:

1. The differences between products/subjects, revealed in the difference between average ratings for different products.
2. The differences within products, revealed in the differences among respondents' ratings of the same product.

An attribute would have a higher F ratio either if its product averages were more different from one another, or if there were more agreement among respondents rating the same product.

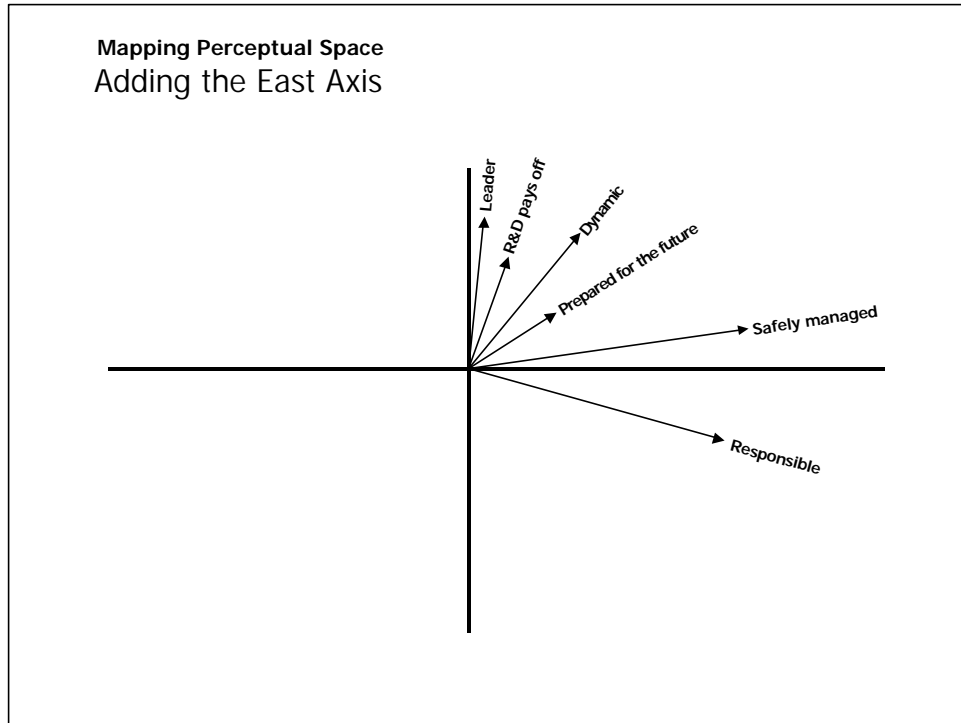
Multiple discriminant analysis finds the optimal weighted combination of all the attributes which would produce the highest F ratio of between-product to within-product variation. That weighted combination of attributes becomes the first dimension of the perceptual map.

An example of this is given below, employing attributes describing corporate activities, such as "Manages operations safely," Prepared for the future," "Contributes to balance of trade," and "Old fashioned" among others.



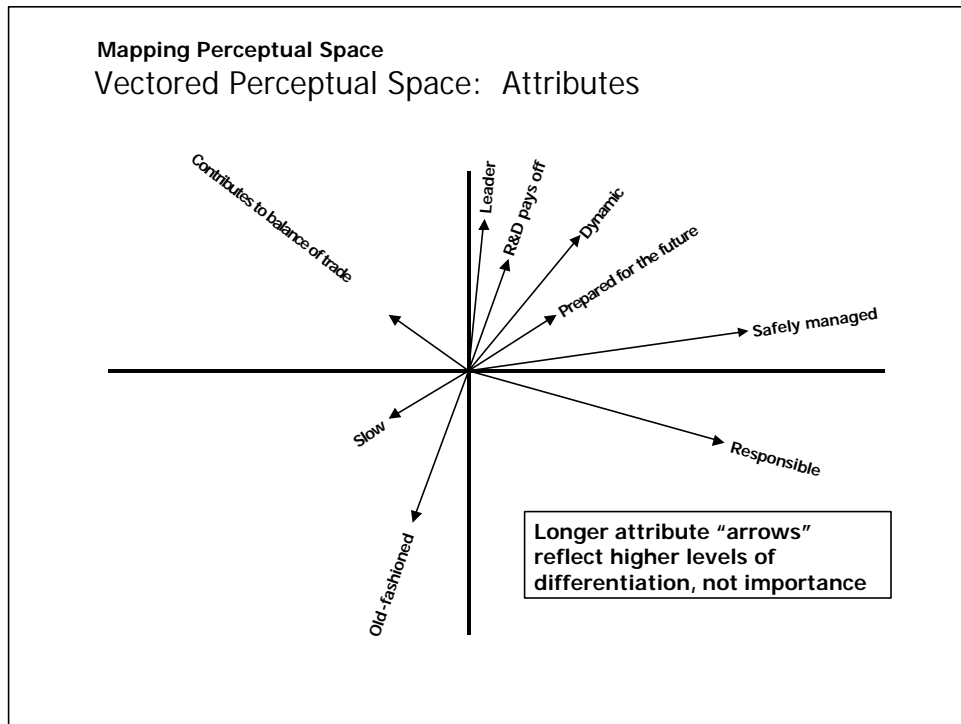
This first dimension contains the most information possible for any single perceptual map, in terms of accounting for perceived differences among products/subjects, measured in terms of the variation among ratings of the same product.

Then a second weighted combination of attributes is found which has the next highest F ratio, subject to the constraint that this combination be uncorrelated with the first. This lack of correlation means that the two dimensions can be expressed as being at right angles.

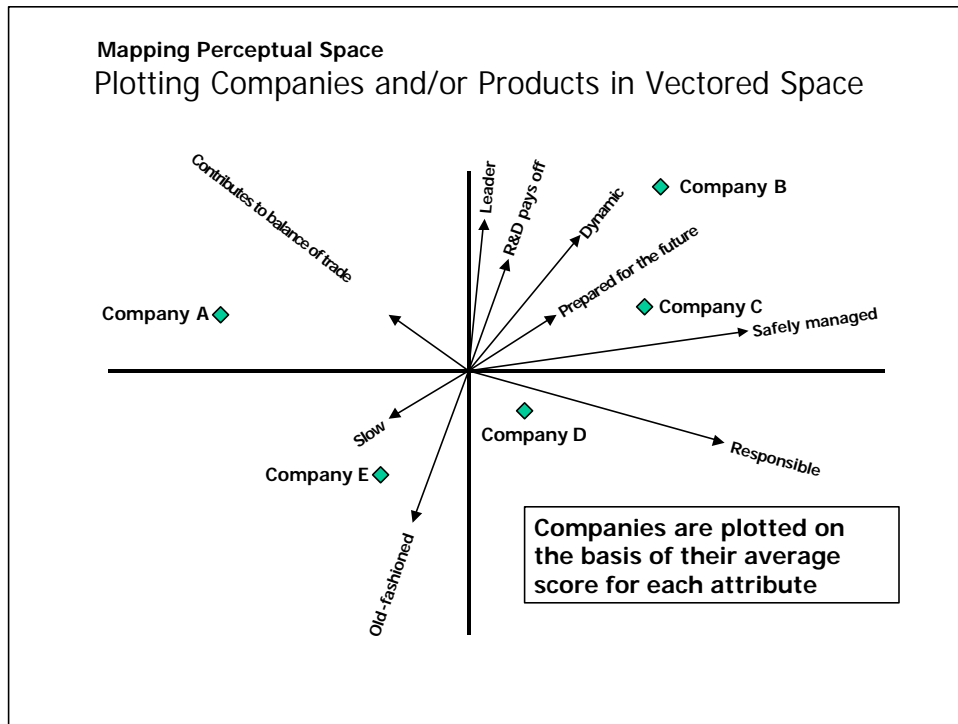


Two dimensions may be all that is needed, but the procedure could be continued to determine additional optimal weighted combinations of attributes, each uncorrelated with those before, which could serve as the bases for dimensions of a high-dimensional space.

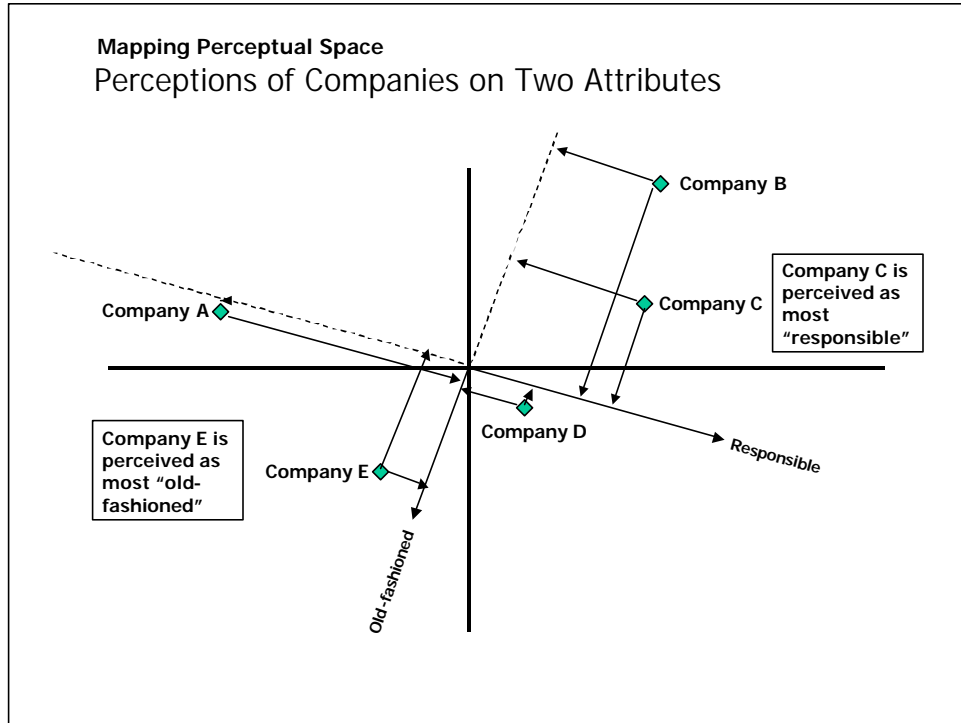
The length of an attribute vector (or arrow, in this map) is equal to the square root of the sum of its squared correlations with the dimension. This can never be greater than one, and the relative length of an attribute vector in any two space is an indication of the extent to which that attribute is "accounted" for by those two dimensions. In general, the longer an attribute vector, the more discrimination that attribute provides, on average, in differentiating products/subjects.



Once the weighted combinations of attributes defining each dimension are determined, it is possible to compute each product's/subject's average score on each dimension. Those scores are used to plot the positions of the products/subjects in space. The averages for all products are zero on each attribute and also each dimension. Geometrically, this means that the "center of gravity" of all the product points lies at the center of the space.



To read perceptual maps, particularly the relation between products/subjects and attributes, a particular product's/subject's relative standing on any given attribute is plotted at a perpendicular angle to the attribute vector.



In the example above, Company C has the highest average score on the attribute "Responsible," while Company E has the highest average score for "Old-fashioned."