Beyond Perceptual Maps:

Cognitive Networks for Strategic Positioning Research[1]

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similar products and the attributes which describe them well, and "far" from products which are different and the attributes which describe them poorly.

A primary use for these perceptual maps is to determine how best to reposition a product or service closer to some "ideal" location in the space so as to improve its image or market share. Again, methods vary from crude to heroic in their detail and precision; sometimes ideal points are located only implicitly, while in other cases ideal points are precisely plotted. In some cases the location of each member of the sample of consumers is located in the space so that the distribution of potential consumers can be plotted on the same coordinates as the products and attributes. In some cases, the selection of strategies for repositioning is made by human judgment solely from looking at the picture, while, at the other extreme, strategies can be calculated by specific mathematical algorithms (Serota, et. al., 1978).

Whatever procedure is used for designing a repositioning strategy, the underlying process is fundamentally similar: products are moved closer to attributes and/or other products that are themselves close to the ideal point. (This may be accomplished through advertising, by actual product changes, or both.)

Although opinions are often strongly held, no consensus has been established in either the academic or the applied research community as to which of these various combinations of methods is optimal, and all of them are used promiscuously in day-to-day marketing research, with applied researchers typically cycling through several such methods until a satisfactory outcome is found for a given application.

In spite of the great popularity of perceptual mapping as a basis for strategic positioning studies, the huge differences in results based on different procedures, and the lack of any substantial agreement as to how to evaluate perceptual maps as good or bad, has led to important criticism. The result of the profusion of techniques and models, critics argue, is that the applied researcher can move from procedure to procedure until finding one which yields an outcome acceptable to the end user client -- a tactic which is much more common than most researchers would like to admit. This, of course, gives the appearance of scientific research, but in reality is merely scientific veneer on a basically subjective judgment (Woelfel, 1993b).

Neural Networks

Although the actual workings of biological neural networks are often remarkably complicated, in principle their operation is quite simple: when a concept (or set of concepts) are being "attended to," (i.e., when one is thinking about them or perceiving them) the "neurons" or "nodes" which represent them are "active."

This "activation level" is communicated along the connecting pathways and arrives at each neuron connected to the original active set with a value equal to the original activation multiplied by the degree of connectivity between the originally active node and the receiving node.

If the sum of all signals reaching a node from all the neurons connected to it exceeds a given "threshold," the receiving node itself becomes active, and the process is them "cascaded" further through the network until an equilibrium is reached and/or new input to the system occurs. Over time, activation gradually "decays" according to a mathematical decay function (McClelland & Rumelhart, 1988).

While the neural model is quite simple, it has two major advantages over the spatial model underlying perceptual mapping:

> First, the neural model, while seriously oversimplified, is nonetheless consistent with what is known about the behavior of biological neural systems, and can thus point to a *realistic mechanism which explains why it works as it does*, while the spatial model enjoys no such underlying physical basis.

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compatible replacement for regression modelling, and is widely used in the financial and manufacturing community.

The model described here, however, is quite different. The model most useful for strategic positioning research, and most closely related to perceptual mapping, is a single layer self-organizing interactive activation and competition model. Readers already familiar with back-propagation models need to be aware of the differences between that model, useful in many circumstances, and the very different model presented here.

were collected by ratio-scaled complete paired comparisons, and the perceptual map is taken from the first two dimensions of the solution from a complete linear orthogonal decomposition of the centroid scalar products matrix following Torgerson (1958) as implemented by the Microgal option of Galileo (Woelfel, et. al, 1993)[3]

The map (made with the "Plot" option of Galileo) shows Ford Tempo, like the Toyota Camry and Nissan Stanza, is perceived as practical, affordable and a family car. (Although "sporty looking" also appears close in the map, it is deeper in the plane and farther away than it seems.) Pontiac, on the other hand, is quite close to "Exciting" and "Fun to Drive."[4]

The "strategy evaluation" algorithm of Galileo Plot calculates that the strategic message "Exciting" and "Fun to Drive" is potentially a good one, since these two attributes lie only 31.5% as far from the ideal point (Yourself) as Tempo does now. (Of course, the algorithm which calculated these numbers does not predict Tempo will move *to* that point -- marked "message" in the map -- strategic repositioning theory in general predicts Tempo will move *toward* it by some amount which depends on the magnitude of the campaign and other external factors.)

3 How the plot was made is not central, since most competent MDS programs would have produced similar principle axes for the first two dimensions.

4 Galileo*PLOT contains an algorithm that allows calulating the exact numerical distances of any point or set of points from any other point or set of points in the map. This is important, because two-dimensional projections of multidimensional data can often be misleading from a purely visual aspect.

additional nodes, while deactivating some of the original nodes. On the third cycle, the second set of nodes communicate their activations to those to which they are connected, and so on through a total of nine cycles.

Table 1: Activation values for 18 nodes over 10 cycles
Threshold = .000 Restoring Force = .100 Learning Rate = .005

Concept	Cycle 1	2	3	4	5	6	7	8	9	10
SPORTY LOOKING	.0	.2	.7	1.0	1.1	1.1	1.1	1.1	1.1	1.1
FUN TO DRIVE	1.0	.2	.6	.9	1.0	1.1	1.1	1.1	1.1	1.1
FAMILY CAR	.0	-.5	-.5	-.8	-1.0	-1.1	-1.1	-1.1	-1.1	-1.1
GOOD VALUE	.0	-.4	-.4	-.7	-.9	-1.0	-1.0	-1.0	-1.0	-1.0
PRACTICAL	.0	-.5	-.5	-.9	-1.0	-1.1	-1.1	-1.1	-1.1	-1.1
AFFORDABLE	.0	-.1	-.5	-.8	-1.0	-1.0	-1.1	-1.1	-1.1	-1.1
EXCITING	1.0	.2	.7	.9	1.1	1.1	1.1	1.1	1.1	1.1
APPEALS TO OLDER PEO	.0	-.3	-.6	-.8	-1.0	-1.1	-1.1	-1.1	-1.1	-1.1
LUXURIOUS	.0	.1	.4	.7	.9	1.0	1.1	1.1	1.1	1.1
RELIABLE	.0	-.3	-.3	-.5	-.7	-.9	-.9	-.9	-.9	-.9
HONDA ACCORD	.0	-.1	-.2	-.4	-.6	-.8	-.8	-.8	-.8	-.8
MAZDA 626	.0	.1	.1	.2	.3	.3	.3	.3	.3	.3
FORD TEMPO	1.0	-.2	-.4	-.7	-.9	-1.0	-1.0	-1.0	-1.0	-1.0
TOYOTA CAMRY	.0	.1	-.2	-.3	-.6	-.7	-.8	-.8	-.8	-.8
NISSAN STANZA	.0	.0	-.1	-.1	-.3	-.3	-.4	-.4	-.4	-.4
CHRYSLER LEBARON GTS	.0	.0	.2	.5	.7	.8	.9	.9	.9	.9
PONTIAC GRAND AM	.0	.3	.4	.8	1.0	1.1	1.1	1.1	1.1	1.1
YOURSELF	.0	.2	.2	.5	.7	.8	.9	.9	.9	.9

In Table 1, the first column (cycle 1) represents the activation values set by activating the three concepts in the message strategy FORD TEMPO, EXCITING, FUN TO DRIVE. The second column shows the activation values of all the nodes after one cycle of the network. Notice that SPORTY LOOKING, FUN TO DRIVE, EXCITING, LUXURIOUS, MAZDA 626, TOYOTA CAMRY, PONTIAC GRAND AM and YOURSELF are now active (i.e., have values greater than zero). Since the threshold is set at zero, all those with zero or negative values are inactive, including FORD TEMPO, which is sufficiently negatively connected to this youth-performance set so that it is shut off when they are activated.

At the end of nine cycles of this simulation, it is evident the solution is fairly stable, and the only remaining active concepts are SPORTY LOOKING, FUN TO

Table 2: Activation values of 18 nodes after 10 learning cycles
Threshold = .000 Restoring Force = .100 Learning Rate = .005

Concept	Cycles									
	1	2	3	4	5	6	7	8	9	10
SPORTY LOOKING	1.0	.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
FUN TO DRIVE	1.0	.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
FAMILY CAR	.0	-.9	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
GOOD VALUE	.0	-.8	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
PRACTICAL	.0	-.9	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
AFFORDABLE	.0	-.8	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
EXCITING	1.0	.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
APPEALS TO OLDER PEO	.0	-.8	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
LUXURIOUS	1.0	.7	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
RELIABLE	.0	-.8	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
HONDA ACCORD	.0	-.6	-1.0	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
MAZDA 626	.0	.5	.9	1.0	1.1	1.1	1.1	1.1	1.1	1.1
FORD TEMPO	1.0	.2	.9	1.0	1.1	1.1	1.1	1.1	1.1	1.1
TOYOTA CAMRY	.0	-.6	-1.0	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
NISSAN STANZA	.0	-.4	-.9	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
CHRYSLER LEBARON GTS	.0	.7	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
PONTIAC GRAND AM	.0	.9	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
YOURSELF	.0	.7	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1

Table two shows that, after ten cycles of "learning" to associate FORD TEMPO with the concepts EXCITING, FUN TO DRIVE, LUXURIOUS, and SPORTY LOOKING, Ford Tempo joins the consideration set and remains in it even after extensive cycling.

While this example may at first seem complicated, it's logic is actually quite simple: the neural network model says quite explicitly that, if people do not associate a given product with a set of attributes, then mentioning those attributes in combination with the product will "turn off" their consideration of that product and evoke or "turn on" their consideration of other products that they *do* associate with those attributes. Thus the model can easily predict a non-monotonic response to a strategic campaign under very reasonable circumstances: at first, the campaign will throw attention on other, better positioned products. Only after sufficient energy has been expended to *change the associations between products and attributes in the* segment will the campaign show positive effects.

Early results seem quite promising, and reliable and inexpensive software is commercially available to make research relatively easy and inexpensive. Existing sixth generation software is easier to use and better documented than standard tools already widely used in the industry, and neural networks' demands on data are generally less rigorous than earlier statistical models. Used as a supplement to existing techniques, IAC neural networks can make a useful and perhaps revolutionary addition to the applied researcher's toolkit.

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