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Organizing for Innovation

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Abstract

Information is almost always organized categorically. Characters for classification are abstracted from intrinsic qualities of the information, and information elements are associated by their likeness, or similarity, on these characters.

For innovation, this kind of organization is not appropriate. Creative thinking thrives on the imaginative leaps triggered by counterintuitive juxtapositions of information. Information derived and organized categorically lacks these juxtapositions. For creative synthesis, a new kind of measure is necessary, along with appropriate forms for the information elements to be organized and the discrimination variables to do the organizing.

*An **Interaction Measure** is presented that associates Functions, as the information elements, using Solution Elements (ideas) as extrinsically pertinent discrimination variables. The interaction measure associates Functions by establishing **reinforcement** where Solution Elements support fulfillment of two Functions, or **conflict** where Solution Elements support fulfillment of one Function, but obstruct fulfillment of the other.*

How should information be organized? Better yet, how should it be organized for innovation?

The conventional way to organize almost anything is to look for similarities and put like items together in categories. Sometimes the categories are predefined, and the likenesses among items are established by reference to the characteristics of the category. Sometimes (as in numerical taxonomy) the categories are post-defined by the natural grouping of like objects based on selected intrinsic characteristics. The characteristics, or characters, become variables, attributes or "keys" for classification. A number of measures of similarity have been developed for clustering subjects in this way.

A somewhat different, but closely related problem, is: How can information most easily be found? Here, the value of categories is apparent; if it is known how something is likely to be classified, the item can be retrieved readily by looking through the category. Keywords help to navigate the categories.

Surprisingly, the problem that is seldom addressed is whether organization by categories of intrinsic likeness is the best way to deal with a particular kind of information! People use information in different ways. For those whose job it is to plan, design and invent, the kind of information needed at the moment isn't always so obvious. Interesting results often come from a process that is more serendipitous than algorithmic because counterintuitive juxtapositions often lead to creative solutions. Seeing the right things together sparks innovation.

To arrive at a model that will serve these users well, three aspects of information structuring need to be reconsidered. First, the means of association—what kind of measure of association should be used to put elements of information together optimally for innovation? second, the form of information—what form should information elements take to be most useful in the conceptual development process? and third, what kinds of characteristics or discriminants should be used to create the organization? A good answer for the first question would allow information to be organized in a way natural to the inventing process. A good answer for the second would establish a format for describing information elements uniformly. And a good answer for the third would provide a sound basis for creative association.

A Special Measure of Association

Considering first the problem of association, the objective should be to link information elements, as subjects, in such a way that considering one leads the planner to another that he or she should consider at the same time. This should not come out of some intrinsic likeness possessed by the subjects, but rather from meaningful, important factors—probably extrinsic—that are relevant to the design process.

The distinction is subtle. An example from nature will help to get started: a conventional measure of association like similarity would link monkeys to monkeys and parrots to parrots in the world of animals. A biologist would not expect to find a parrot to be similar to a monkey because the underlying mechanism of association, biological similarity, works on the principle that living things are related that have like intrinsic physical characteristics. On the other hand, a planner concerned with the design of a zoo might see particular species of monkeys and parrots naturally associated because they share the same habitat or because they eat the same foods. In the first case, the association is built around likenesses inherent in characteristics intrinsically possessed by the subjects; in the second it derives from extrinsic characteristics otherwise unassociated with the subjects except for the analyst's purposeful selection.

From this idea, that two subjects can be associated on the basis of how they are related to external factors or entities, a special measure of *interaction* can be constructed. The measure can recognize not only agreements (e.g., that certain species of both monkeys and parrots favor rain forest environment), but disagreements (e.g., that a parrot species and a monkey species might react oppositely to a food; edible and desirable for one, sickening for the other), and even independence (e.g., that a parrot species might use a certain nesting material irrelevant to a monkey species that does not build nests). The measure has direct application to planning.

Information Elements

In my article, ***Covering User Needs***, I showed how a design/planning problem can be modeled as a set of Functions specified systematically as a Function Structure is created. Described with verb phrases such as, "distribute heat evenly" and "recognize done condition" (from a *cooking* Activity within a *food preparation* Mode of a *House of the Future* Project), Functions such as these—in the hundreds—provide a simple form of criteria thoroughly covering a problem. Functions must be fulfilled well in a successful solution. The Function Structure, with its categorically derived major Modes of operation, Submodes, Activities and Functions would also seem to provide an ideal framework for creating and synthesizing ideas.

It does not. While categorical derivation works beautifully for analysis, it creates an organization almost diametrically opposed to the needs of creative synthesis. Creativity thrives on unexpected juxtapositions. Categorical derivation maintains subject conformity. Continuing the housing analogy, a functional analysis of a house might have, among others, such major modes of operation as Water Management, Power Distribution and Space Creation. Functions concerning plumbing would show up under Water Management; functions concerning support of floors and ceilings would appear under Space Creation; those concerning electrical wiring would be under Power Distribution. The point is, nowhere would there be a place where they might show up together—and, thus, the idea that a structural column might also be a conduit for wiring and/or a vertical water channel, might never occur. Categorical derivation restricts Functions to silos of their own classification—fine for discovering them in the analysis process; dead wrong for responding to them in the synthesis process.

Functions are excellent information elements to work with; a categorically derived Function Structure is not. A proper structure will use Functions as information elements, but will associate them on the basis that they ought to be considered together in the process of concept creation.

Discrimination Variables

If the intrinsic characteristics embodied in a categorical derivation are not ideal organizing agents for synthesis, what are? The example of the parrots and the monkeys suggests extrinsic characteristics of particular concern to the purpose of the project.

Planning and designing projects are extensively concerned with ideas—solutions and partial solutions to individual problems. If ideas—call them Solution Elements—are used as the extrinsic variables for organization, then Functions will be linked on the basis of shared solution. Two Functions will *interact* if Solution Elements in enough numbers work for one as well as the other. Linkage built up like this puts Functions together that ought to be considered together because they have potential solutions in common—serendipitous association. In such a rich context of association, ideas can be modified and fine-tuned to a degree of elegance that marks solutions that solve multiple problems! An information structure built around this kind of association meets the needs of creative synthesis.

Solution Elements as discrimination variables can do more. Just as disagreement could be reg-

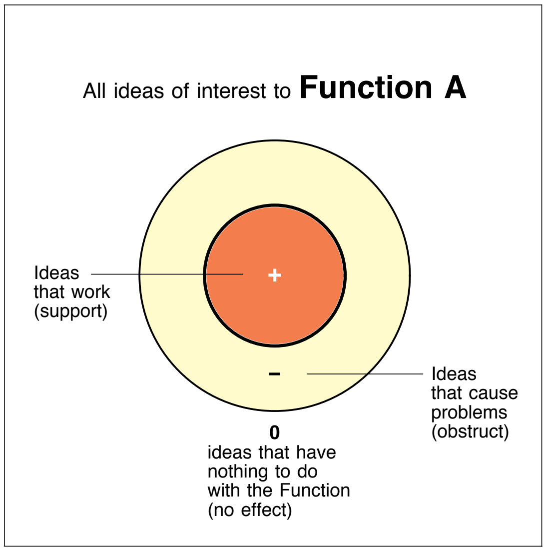

Figure 1 **Classification of Ideas for a Function**

istered between monkey and parrot on the basis of food incompatibility, *conflict* can be recognized between Functions based on Solution Element incompatibility. When a Solution Element *supports* (helps to fulfill) one Function, but *obstructs* (makes it hard to fulfill) another Function, the two Functions are in conflict for that Solution Element. The planner needs to see these Functions together also—in order to avoid solutions that contribute to system problems. An idea that is so alluring that it can't be passed by may also have negatives easily forgotten in the celebration of the positives. Recognition of the association as a conflict marks a Solution Element and associated Functions as a problem for consideration and adds to the strength of the bond between the Functions.

An Interaction Measure

Diagrams will help to explain the interaction concept. In Figure 1, a "function space" is described as a means to classify how all ideas in a project relate to a particular function; call it *Function A*. In the center region, are all the ideas that work for the function (i.e., support its fulfillment: +). In the outer ring are all the ideas that might cause a problem for the function (i.e., obstruct its fulfillment: –). Ideas that neither support nor obstruct Function A are outside the bull's-eye diagram (i.e., no effect: 0).

To build a model of interaction, the diagram for Function A's classified ideas is combined with a similar diagram for the ideas of a second function, *Function B*. The diagram on the left of Figure 2 shows what happens if the two diagrams are simply overlapped like a Venn diagram. Because A and B each have three separate regions, the combined diagram should have 3 x 3 or nine regions. It doesn't. Because of the concentric-circle bull's-eye geometry, there is an extra (–,–) region. Moving the central regions to the edges of the diagrams retains the integrity of the regions while making it possible to combine the diagrams into one with the proper nine regions. It is shown on the right. The +,–,0 labels, now used together, show how each region simultaneously classifies ideas for both functions, left symbol for their relation to Function A, right for Function B.

In Figure 3, the diagram is explained as a model of interaction. Only five of the nine regions are applicable for the kind of interaction we want—many more kinds of interaction can be

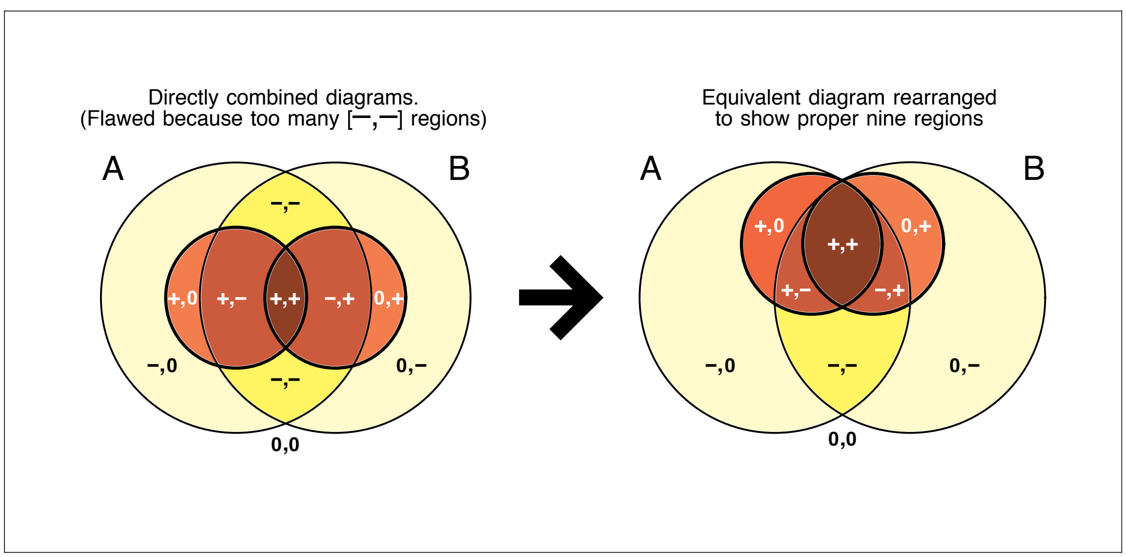

Figure 2 **Modifying a Venn Diagram to Obtain Proper Regional Representation**

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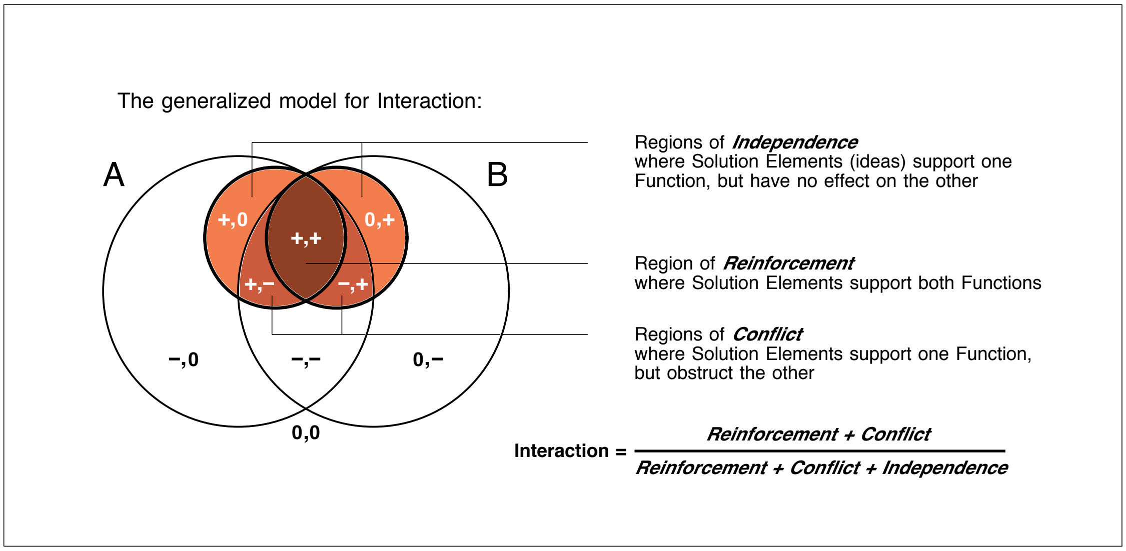

Figure 3 **The Interaction Measure**

defined from this model, but the one pertinent to innovative planning and design focuses on the five regions that have at least one + sign in their labels. These are the only regions from which an idea might be selected for consideration in the little two-function project represented. Ideas in the other regions (which may be positive for other functions) would not be chosen because they either have nothing to do with the project at hand (0) or actively obstruct one or both of the functions (–).

Intuitively, the amount of interaction between the two functions—the strength of association suggesting how strongly they should be considered together—is proportional to the number and value of the ideas in the three regions common to both functions, relative to the number and value of the ideas in all five regions. In Structured Planning, this measure is quantified to allow Solution Element ideas to be scored on a scale that registers positive support, negative obstruction or no effect for a function. A computer program, RELATN, calculates the amount of interaction for each pair of functions and creates a graph showing how functions are linked and, therefore, which should be considered together.

For innovation, the measure uniquely associates the right kinds of information elements (Functions) using the right kind of discriminating variables (Solution Elements), while combining reinforcement as a value promoting multifunctional solution with conflict as a value detecting sources of potential solution failure.

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