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Shaping Complex Ideas

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Abstract

Synthesis is a process of assembling ideas, fragments of ideas, modifications of ideas and wholly new ideas into new patterns able to meet the needs of new contexts, situations or conditions. Great ideas seldom are the simple a-ha! *inspirations attributed to inventors and discoverers. Most often, they are the culmination of thorough and painstaking work that may begin with the glimmer of an a-ha insight. but ends with the synthesis of many supporting concepts into a comprehensive solution.*

Synthesis, in the case of Structured Planning, inherits three forms of major support from the planning phases that go before it: first, Design Factors, which provide insight about what can go right or wrong in meeting the needs of Functions under consideration; second, Solution Elements, which suggest ideas specific to fulfilling the Functions; and third, an Information Structure that reveals which Functions are those of concern for any part of a project.

Good ideas usually have system-like characteristics. That may seem strange, considering how we have been indoctrinated all our lives to believe great ideas are simple, complete and self-evident once conceived (think solutions to problems or opportunities for enrichment). Examples of these abound, many now urban legends. Some of the best known are the "bottle it" idea offered to Coca Cola, the change of green to white in the Lucky Strike cigarette package as "Lucky Strike green went to war", the fresh eggs added to cake mixes in the 50's to convince homemakers that they were still responsible cooks, the plain pencil used by Soviet cosmonauts in contrast to the multi-million dollar space pen bought by NASA for American astronauts, and Post-its, the 3-M product made with a glue overlooked because it wouldn't permanently stick.

Great solutions really can begin with "a-ha" revelations. Post-it notes were the result of 3M researcher Art Fry's need in 1974 to create book marks for his hymnal that wouldn't fall out when he was singing with the choir. He remembered an unusual glue created six years earlier by a fellow researcher. While interesting structurally, it stuck only slightly and was easily peelable. Fry saw its usefulness in its ability *not* to stick well, and it became the basis for a major 3M product success. The a-ha was crucial, but success ultimately required rethinking office needs and creating a system solution of temporary stick-ons useful across the range of business processes.

Others of the instant solution genera were more "wish it were so" than inspirational history. The "bottle it" story—that a stranger offered for $100 (or other figure up to $100,000 depending on the story version) to show how Coca Cola could make a fortune (bottling it)—never happened. Bottling in the 1880's was a chancy business, difficult, expensive and subject to serious health risks from unsanitary bottle cleaning, filling and stoppering. Asa Candler, the owner of Coca Cola, knew about bottling, knew about the risks and expense, and did not think bottling viable in the early years of the company. Coca Cola did become bottled—in the 1890's—but only when the company was wealthier and a safe, systematic (and expensive) bottling process could be developed.

A graphic design success story with supposed instant genesis is the World War II change of the Lucky Strike cigarette package color from olive green with a red bull's eye and black lettering to white with the same red bull's eye and lettering. The story was that, with all the need for olive green paint and dye for the war effort, Lucky Strike would give up its green for the duration. Hence, "Lucky Strike green has gone to war" and instant appeal to patriotism among the smoking public. Actually, marketing research had shown women did not like the green color and men were beginning to reject it also... The white color was a cleaner look, more representative of the graphics coming out of the modern movement. The real basis for the idea was thoughtful analysis of user behavior.

In the late 1950's, major food companies who had introduced instant, complete cake mixes (only requiring the addition of water) saw their sales flattening. Marketing research in this case suggest-

ed that women felt guilty about baking cakes that required them only to add water. Their minimal participation did not measure up to what they had been taught as they grew up. Marketing research consultant Ernest Dichter suggested that, instead of including dried eggs in the mix, companies should ask homemakers to add fresh eggs. Sales climbed back, but was it the eggs? Actually, General Mills opted to go with the fresh-egg idea, but Pillsbury continued with complete mixes. Both enjoyed success! A more likely answer was the transfer of emphasis from cake baking to finishing with frosting, layering and decoration. The perception that the problem was the level of involvement was right, but the solution was more a system solution of total cake creation.

The more recent example of marking instruments in space seems to suggest that good common sense often obviates the need for complex solutions. The truth in the space pen project is that both Soviets and Americans used pencils in the early years of space exploration. In 1965, Paul C. Fisher, a pen manufacturer, saw the need for a space-usable pen because pencil leads loose in space are dangerous to eyes and breathing, and both pencil wood and lead are highly flammable in a 100% oxygen environment. His company developed a pressurized, fireproof ball-point pen that uses an ink safe below 200 degrees Celsius. Since 1968, both American astronauts and Russian cosmonauts have used Fisher pens. Fisher charged nothing for development and sold pens to NASA in 1967 for $2.95 apiece.

Along with Post-its, where the urban legend is true, these stories, when investigated, actually corroborate the idea that good solutions are usually much more than simple ideas. They may start out simply—seemingly complete and elegant in their simplicity—but they are really still "glimmers" of ideas that, in the end, achieve their strength through the work required to make them holistic and multifunctional.

The Nature of Synthesis

From the Greek, "to put together", synthesis is a good word to cover what goes on as ideas are expanded from glimmers to what is necessary to solve a problem or take advantage of an opportunity. The synthesis process is one of composition or combination of parts or elements to form a whole.

Synthesis is not invention—except as invention may be included incidentally or intentionally for special problem considerations. Most solutions to problems combine things well known in new patterns or compositions appropriate to a new situation or opportunity. Invention' s role in synthesis is providing components of the solution not already available and enabling available components to achieve better fit through innovative modification of their characteristics.

Where does invention occur overall? In most development processes, formal or informal, invention is a part of the process from the beginning. At early stages of a project, it may come as creation of policy when broad directions for a solution are formulated. As information is developed and analyzed, it may come as specific ideas in response to insights. At the synthesis stage, when ideas are finally assembled and refined into compound, system solutions, it comes as the infill necessary to complete a mosaic of existing component ideas and modifications of existing ideas.

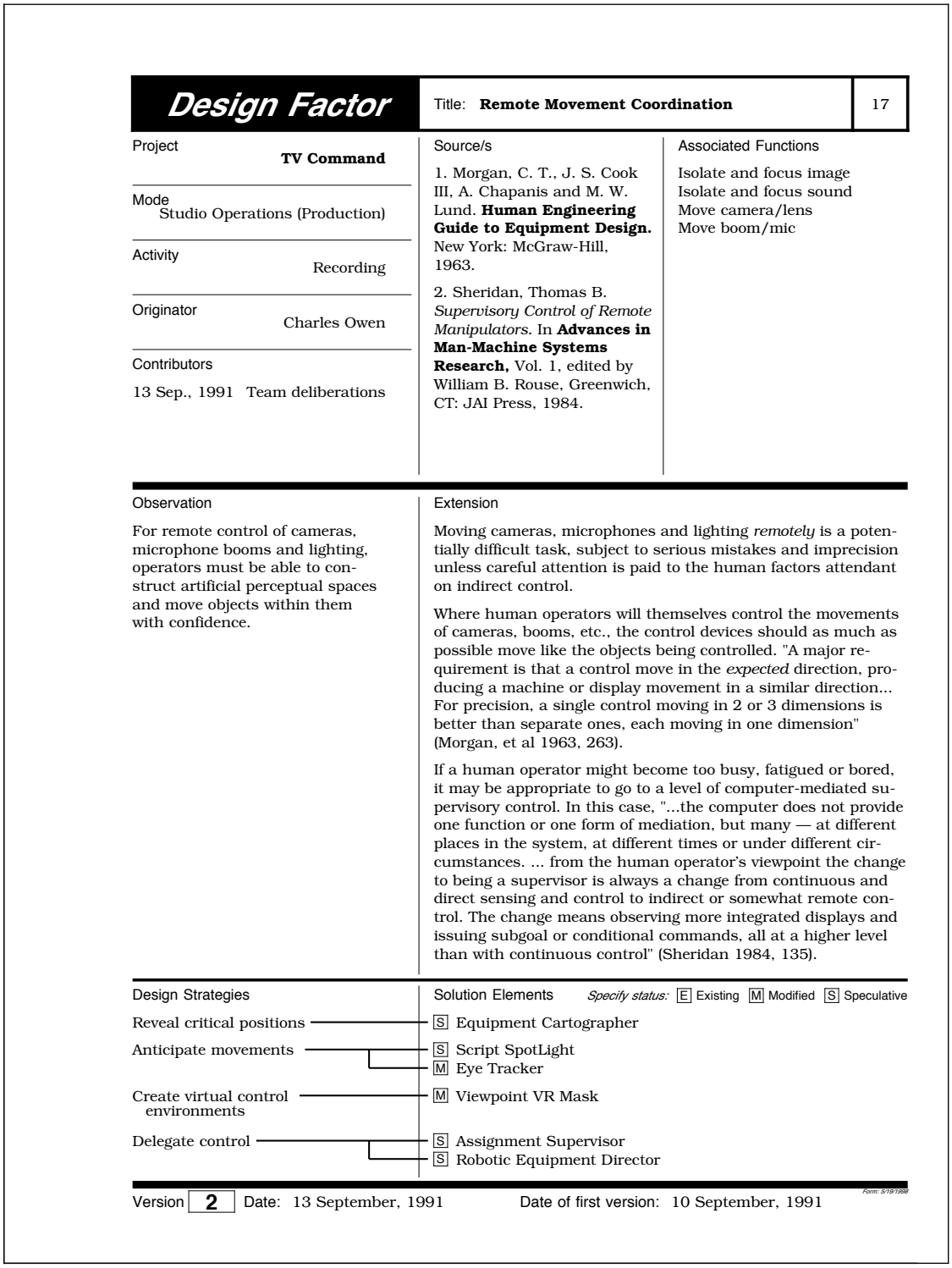
The Synthesis Process

In Structured Planning, Synthesis has a phase all to itself. In this article, I will consider synthesis from that special perspective because tools developed in the evolution of Structured Planning uniquely support and enhance the synthesis process.

Synthesis implies assembly, and the parts and tools needed include candidate ideas for consolidation (these may well include glimmers of ideas that have set the whole development process in motion), some kind of road map for the composition process, and insights for what to watch out for, what to improve, and what good things to incorporate almost "as is" in the final solution.

In previous articles, I introduced some of these elements in the process of discussing how insights are gained and used (***Insight and Ideas***), how ideas are focused and articulated (***Capturing Ideas***), and how structuring is applied (***Using the Tools of Structure*** and ***Organizing for Innovation***). For a Structured Planning team, products of each of these processes are already available for use in the Synthesis phase: Design Factor documents, Solution Element documents, and an Information Structure.

Design Factors (see Figure 1) are one-page documents recording insights gained during the study of users and required system functionality. Solution Elements (Figure 2) are one-page documents describing ideas developed from the insights or otherwise attained during the project. An Information Structure (Figure 3) is a hierarchical organization of the Functions expected to be performed by the system under design. The Functions are organized by scoring the Solution Elements (usually hundreds) against them and measuring the degree to which pairs of Functions are in a condition of common support by Solution Elements or are in a condition of support for one and obstruction for the other—both of which reasons they should be considered together.



Design Factor | Title: **Remote Movement Coordination** | 17

Project: **TV Command**

Mode: Studio Operations (Production)

Activity: Recording

Originator: Charles Owen

Contributors

13 Sep., 1991 Team deliberations

Source/s

1. Morgan, C. T., J. S. Cook III, A. Chapanis and M. W. Lund. **Human Engineering Guide to Equipment Design.** New York: McGraw-Hill, 1963.

2. Sheridan, Thomas B. *Supervisory Control of Remote Manipulators.* In **Advances in Man-Machine Systems Research,** Vol. 1, edited by William B. Rouse, Greenwich, CT: JAI Press, 1984.

Associated Functions

Isolate and focus image
Isolate and focus sound
Move camera/lens
Move boom/mic

Observation

For remote control of cameras, microphone booms and lighting, operators must be able to construct artificial perceptual spaces and move objects within them with confidence.

Extension

Moving cameras, microphones and lighting *remotely* is a potentially difficult task, subject to serious mistakes and imprecision unless careful attention is paid to the human factors attendant on indirect control.

Where human operators will themselves control the movements of cameras, booms, etc., the control devices should as much as possible move like the objects being controlled. "A major requirement is that a control move in the *expected* direction, producing a machine or display movement in a similar direction... For precision, a single control moving in 2 or 3 dimensions is better than separate ones, each moving in one dimension" (Morgan, et al 1963, 263).

If a human operator might become too busy, fatigued or bored, it may be appropriate to go to a level of computer-mediated supervisory control. In this case, "...the computer does not provide one function or one form of mediation, but many — at different places in the system, at different times or under different circumstances. ... from the human operator's viewpoint the change to being a supervisor is always a change from continuous and direct sensing and control to indirect or somewhat remote control. The change means observing more integrated displays and issuing subgoal or conditional commands, all at a higher level than with continuous control" (Sheridan 1984, 135).

Design Strategies	Solution Elements (*Specify status:* E Existing M Modified S Speculative)
Reveal critical positions	S Equipment Cartographer
Anticipate movements	S Script SpotLight
	M Eye Tracker
Create virtual control environments	M Viewpoint VR Mask
Delegate control	S Assignment Supervisor
	S Robotic Equipment Director

Form: 5/18/1998

Version 2 Date: 13 September, 1991 Date of first version: 10 September, 1991

Figure 1 **Design Factors record insights.**

Functions so associated are linked to form a network, or graph. The graph is then decomposed to identify clusters of highly-linked Functions, and the clusters are re-composed into a hierarchical Information Structure, an optimal tool for directing synthesis (see ***The Power of Abstraction***).

Using the Information Structure as the road map, a Structured Planning team synthesizes system solutions using a method called Ends/Means Synthesis. This method can be used very effectively anywhere as a structured form of brainstorming, but it is particularly effective in the Synthesis phase of Structured Planning because of the support materials, already accumulated, that can be used with it.

Solution Element | Status: ☐ Existing ☐ Modified ◉ Speculative | Title: **Equipment Cartographer** | **7**

Project: **TV Command**

Mode: Studio Operations (Production)

Activity: Recording

Originator: B. Coppom

Contributors:
18 Sep., 1991 S. Burks
20 Sep., 1991 T. Bulger

Description:

A wearable, multiple-screened computer and communication device able to provide real-time information on equipment location and the characteristics and status of all physical elements and ongoing processes in the studio environment.

Properties — *what it is:*

- Size, weight and form designed for easy-access, hands-free portability
- Real-time connectivity with all studio operations
- Multiple screens for simultaneous use at high resolution
- Integrated data base organization for information on equipment and scripts
- Battery operations for up to eight hours

Features — *what it does:*

- Provides text and graphic communications among technicians, camera/sound operators and director
- Enables ongoing processes to be monitored simultaneously
- Helps camera/sound operators to anticipate movements required of cameras and microphones
- Keeps accurate inventory of equipment with locations retrievable graphically
- Integrates set construction with script requirements to optimize camera angles and sound pick-up positions

Associated Function/s:
Isolate and focus sound
Isolate and focus image
Move camera/lens
Move boom/mic

Source Design Factor/s:
Selective Filtration
Remote Movement Coordination

Form: 5/18/1998

Version 3 Date: 20 September, 1991 Date of first version: 11 September, 1991

Figure 2 **Solution Elements capture ideas.**

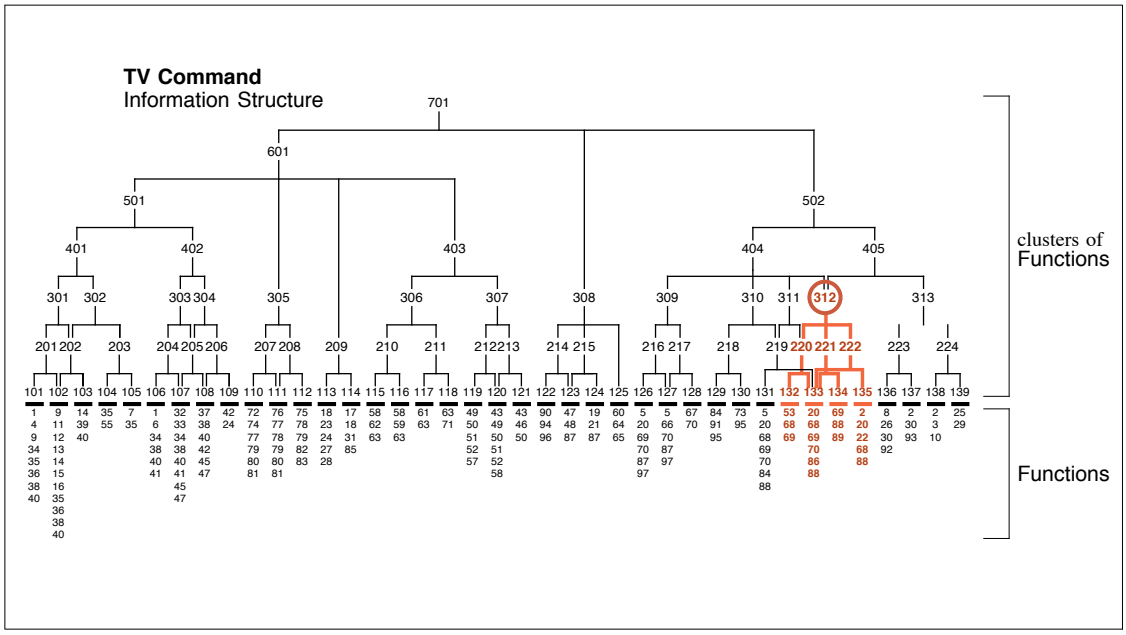


Figure 3 **An Information Structure organizes Functions to associate those that should be considered together when developing a system solution. Cluster 312 is highlighted as a sample target node for synthesis.**

Ends/Means Synthesis

Figure 4 shows a form used in Ends/Means Synthesis. The form itself isn' t actually necessary, but its graphic structure provides direction for an individual or group new to the method. On the left, is a box in which to write a high-level goal as an "end" to be achieved. In Structured Planning, it is a node within the Information Structure (for example, the node 312 circled in Figure 3). Progressing to the right are, first, a longer box to contain "means", and then still longer boxes to contain new means and new ends.

When the process is used by a team (Figure 5), the team leader begins a session by asking, "What means do we need to achieve this end?", pointing to the goal at the left. Team members respond, and the team leader enters their ideas as verb phrases in the box just to the right of the end goal. When the means that have been generated together cover the goal additively (*and's* not *or's—or's* would introduce alternatives and unacceptable complication), the team leader moves to the first of the means, and announces it as a new end for which new means need to be generated. The process then continues in the next box to the right, entering new means—now noticeably more specific—for each new end.

Over three or four cycles, means become specific enough to become describable components of a system solution. As the process approaches this level of detail, the benefits of Structured Planning begin to kick in in full. Solution Elements associated with Functions in the target node of the Information Structure become candidate final System Elements. Design Factor insights focus attention on potential problems and opportunities in this part of the Information Structure that should be taken into consideration. Finally, the Functions themselves become criteria to judge the solutions—every Function must be satisfied by one or more features of the System Elements for the system solution to be successful.

The result, after applying the process progressively to nodes across the entire Information Structure, is a holistic system synthesized from existing, modified and invented component concepts.

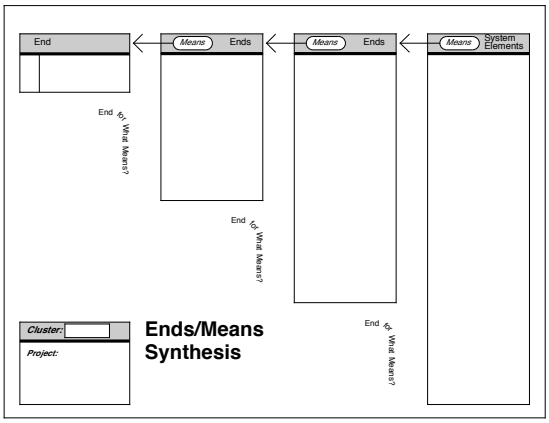


Figure 4 **An Ends/Means form guides the synthesis process.**

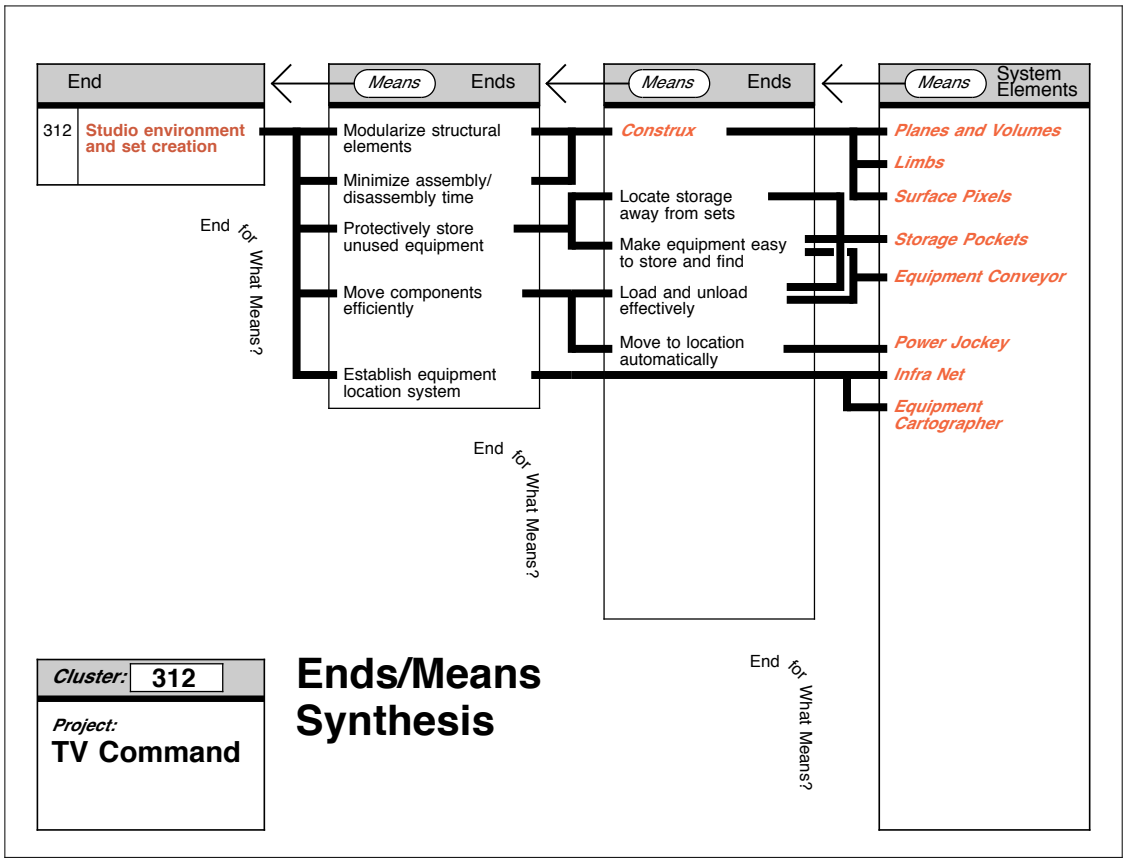


Figure 5 **The Ends/Means process leads the Synthesis team through a chain of progressive means to meet ends. Closure occurs when ideas are specific enough to be described as System Elements.**