U-SIT And Think News Letter - 41

Unified **S**tructured **I**nventive **T**hinking is a problem-solving methodology for creating unconventional perspectives of a problem, and discovering innovative solution concepts, when conventional methodology has waned.

Updates and Commentary

Dear Readers:

- Plastic heuristics, introduced in the last newsletter, started our search for a better model for concept generation. Discussion of heuristics is drawn from material in the free ebook, "Heuristics for Solving Technical Problems – Theory, Derivation, Application".

3. Mini USIT Lecture – 41

USIT – a Method for Solving Engineering-Design Type Problems

I. Plastic Heuristics

A plastic heuristic has trappings (symbols) that cue to applicable problems and ambiguity that preempts bias.

The fundamental use of heuristics in problem solving is to spark useful ideas. To be useful ideas must be relevant, and new, fresh, surprising, inventive, unique, etc., and not whimsical. Sounds like a list of preferred terms for advertising. However, they make a cogent point; namely, that we are faced with a problem to be solved. The majority of the time the problem will already have a solution in place, but one that has proven to be inadequate. Furthermore, the problem exists because conventional problem solving (e.g., brainstorming) has not resolved it.

Obviously, new, fresh, surprising, inventive, unique, etc., beg for a change in conventional problem solving or a better application of conventional methodology. Conventional problem solving uses heuristics. I am not going to argue that the existence of problems having inadequate solutions is indicative of inadequate heuristics. Rather my conclusion is that our conventional wisdom regarding heuristics is inadequate. By that I mean that we need a better understanding of heuristics both theoretically and strategically. Such issues are subjects of the HSTP manuscript. Better understanding of heuristics should support more thorough and successful application of heuristics.

It is shown in HSTP that there are three strategies for resolving an unwanted effect; i.e., a problem. You can utilize it, nullify it, or eliminate it. That statement is a heuristic. Heuristics are used in every imaginable area of problem solving, both technical and non-technical. The lore of everyday living

consists of denumerable heuristics. A theory for understanding and deriving heuristics and a strategy for their application provides a methodology for mastering them.

Key to mastering such an expanse of knowledge, as amassed in denumerable heuristics, is the use of abstract models that provide effective plasticity. Abstraction removes the bias of specific wording that ties a specialized heuristic to its field. Thus specialized heuristics from many fields may be cataloged under one abstract heuristic.

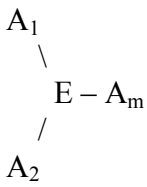
This observation brings heuristics into a new light. I can see it now – a massive effort to catalog every known heuristic into a database for future access by data mining.

My preference is to start with a theory that allows derivation of the abstract heuristics. Then problem solvers need only to understand the theory of abstract heuristics and to practice their specialized application. This leads back to the opening sentence:

A plastic heuristic has trappings that cue to applicable problems and ambiguity that preempts bias.

II. "Left-brain Right-brain Participation in Solving Technical Problems Using Plastic Heuristics"

In the last mini-lecture we saw the graphic heuristic from HSTP that shows how two attributes, A_1 and A_2, support an effect, E (unwanted, U, or wanted, F), which then supports another attribute, A_m. To be considered an effective tool for problem solving it must have trappings that quickly cue our thinking to the problem at hand. To be effectively plastic it must be sufficiently ambiguous as not to bias our thinking to a specific kind of problem.



The heart of the first sentence in the last paragraph is the attention to definitions of the symbols. This satisfies LB's need of rational thinking. The second sentence emphasizes ambiguous symbols. This satisfies RB's interest in metaphors. The second and third sentences bring out the caveat of effectiveness, which should be our major concern.

My measure of effectiveness, in this situation, is how quickly and with what multiplicity do ideas come to mind (LB and RB) when using this heuristic. I expect LB efforts to be instantly recognizable, but I don't *a priori* know how to identify RB efforts.

A simple demonstration of effectiveness of this heuristic can be made by looking at it as suggesting triplets of attributes arising from an initial pair of attributes. Pick any two attributes of objects and see what third attribute comes to mind. I tried this by first making a list of attributes. A few came to mind without effort then I decided to be sure I had attributes for each of the senses. They are listed in column A_1 of the table. These were randomly sorted and listed in column A_2 (disallowing twins). I then tried to take a pair and see what effect, E, and associated attribute, A_m, came to mind without regard for specific objects.

Attribute Triplets

	A_1		A_2	E	A_m
1	aspect ratio	18	symmetry	perception	symmetry
2	brightness	3	color	distinguish	distance
3	color	14	porosity	gauge	thickness
4	density	22	volume	estimate	capacity
5	focal length	17	smoothness	cull	quality
6	friction	20	translucence		
7	graininess	10	luminescence		
8	humidity	15	randomness		
9	loudness	8	humidity		
10	luminescence	2	brightness		
11	oiliness	7	graininess		
12	periodicity	13	pH		
13	pH	6	friction		
14	porosity	11	oiliness		
15	randomness	4	density		
16	reflectivity	21	transparency		
17	smoothness	5	focal length		
18	symmetry	19	taste		
19	taste	16	reflectivity		
20	translucence	12	periodicity		
21	transparency	23	weight		
22	volume	1	aspect ratio		
23	weight	24	conformability		
24	conformability	9	loudness		

Firstly, simply creating the list A_1 led to interesting introspection upon wondering how each attribute came to mind. Sometimes a metric came to mind and had to be replaced by its generic attribute. Other times an effect came to mind first.

The last two columns of the table are rather cryptic and not obvious except to me. I'll share my thinking on how I arrived at the first five pairings but I don't expect it to make sense to your LB logic.

On considering aspect ratio and symmetry I instantly had a spatial image of a long rectangular window being rotated while exposing a symmetrical pattern of two different icons. I found myself asking the question of whether the visible pattern changed in symmetry (rotational symmetry or mirror planes) during rotation of the window. I was convinced that it did. I assume that credit for the spatial image goes to RB while the conscious rationalization of pattern symmetry goes to LB. After thinking of the third attribute as the resulting new symmetry I decided that the effect was my perception.

When I thought about brightness and color the first thing to come to mind was the use of brightness and color in painting to separate foreground from background. The ideas of the effect and its supported attribute, being to distinguish distance, arose at the same time.

Color and porosity brought to mind coffee filters that I remove from the pot too many times a day. Put two filters in a pot, or one, and compare the final result and you see that a layer of the double filter is lighter in

color. I think of this effect as accumulating grounds in the pores of the paper. A double thickness has fewer grounds per unit thickness and appears to be lighter in color.

Focal length and smoothness brought to mind my son's new project of grinding a telescope mirror. I mentally associated smoothness with a lack of high order Fourier components of curvature that reduce lens quality. Hence, smoothness culls quality.

The remainder of the table is left blank to invite you to give it a try. My introspection is useful to me. Yours will be more useful to you.

I find it remarkable that seemingly unrelated attributes could so readily be paired to define a plausible effect and a third attribute. Do you? This is a creative process with both brain hemispheres participating.

What about multiple triplets from the same input pair of attributes? I went back to focal length and smoothness and the first idea to come to mind was smoothness of a cut and its length. When cutting foam-core, picture mounting boards it is desirable to produce smooth edges. A heuristic is to count the number of cuts made using a blade and replace the blade after a given number. Thus length of cut (sum of individual lengths) and smoothness interact *to produce* (a function, E) => *smoothness* (A_m).

Note in the above example of forming triplets of attributes how RB suspension of judgment glides over LB criticism of dropping "focal" from "focal length".

Does anything else come to mind? Yes. A contrail is smooth at first and roughens from turbulence with length. But what's the effect? My first thought was that a rough contrail was an unwanted effect (esthetically) caused by *turbulence* (A_1) interacting with *smoothness* (A_2).

---------- LB/RB Participation in Solving Technical Problems Using Plastic Heuristics will be continued. ----------

8. Other Interests

1. Have a look at the textbook, "Unified Structured Inventive Thinking – How to Invent", details may be found at the Ntelleck website: www.u-sit.net (*note*; not www.ic.net
2. USIT Resources

Publication	Language	Translators	Available at …
1. Textbook: Unified Structured Inventive Thinking – How to Invent	English	Ed Sickafus (author)	www.u-sit.net
2. eBook: Unified Structured Inventive Thinking – an Overview	English	Ed Sickafus (author)	www.u-sit.net
	Japanese	Keishi Kawamo, Shigeomi Koshimizu and Toru Nakagawa	www.osaka-gu.ac.jp/php/nakagawa/TRIZ/
"Pensamiento Inventivo Estructurado Unificado – Una Apreciación Global"	Spanish	Juan Carlos Nishiyama y Carlos Eduardo Requena	www.u-sit.net
3. eBook "Heuristics for Solving Techncial Problems – Theory, Derivation, Application"	English	Ed Sickafus (author)	www.u-sit.net
"Heurísticas para Resolver Problemas técnicos – Teoría Deducción Aplicación"	Spanish	Juan Carlos Nishiyama y Carlos Eduardo Requena	www.u-sit.net
4. U-SIT and Think Newsletter	English	Ed Sickafus (Editor)	www.u-sit.net
	Japanese	Toru Nakagawa and Hideaki Kosha	www.osaka-gu.ac.jp/php/nakagawa/TRIZ/
	Korean	Yong-Taek Park	www.ktriza.com.