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:

- Mini-Lecture_11 discussed Uniqueness as a problem-solving technique with its demonstration in the smeared-ink problem. In this lecture I introduce the remaining solution techniques.

- No more trips for a month.

1. USIT – How to Invent: the USIT textbook.

2. USIT – an Overview

3. Mini USIT Lecture - 13

Problem Solving Techniques

In the previous mini-lectures I discussed the first two phases of problem solving *a la* USIT. They are problem definition and problem analysis. The third and last phase is problem solving or applying problem solving tools and techniques. You, of course, are aware that I already have discussed well over a dozen solution concepts. Add those to your ideas plus the ideas generated by the other mini-lecture readers and we should have an impressive start on generating solution concepts. You may wonder why this last phase is referred to as problem solving when we already have been finding solution concepts.

We also have been doing problem definition – at least the improving of our understanding of the problem – while supposedly doing problem analysis. And we were doing analysis while doing problem definition. Now, as you will see, we will probably find occasion to do both improved definition and analysis while we are trying to generate solution concepts. This, in my opinion, simply reflects on how our brains work (at least how my does). They jump around seemingly out of control while we keep directing them toward the intended path of logic we want them to follow – namely, the USIT flow chart. In each step along the way we find interaction between problem understanding, analysis, and solution that gives us opportunity to improve the whole picture we are generating.

I see this as a natural process of our minds and therefore prefer to encourage it rather than squelch it. That is, the mixing of the three phases as one progresses in problem solving, seems to me to produce a better product in the end. But, then why have three phases of problem solving? The reason is that it gives logical order to the overall process, keeping us on track, focused, and aware of where we are and what we have remaining to do to accomplish a thorough job. But the

boundaries between the phases are not intended to be barriers or to impede the searching processes of our minds.

Uniqueness has just been discussed as a problem-solving tool (NL_11). Yet uniqueness begins with analytical tools (spatial and temporal plots of function activity) before searching solution concepts. I think that uniqueness works logically as a transition between focused problem analysis and the application of solution techniques. Next we will look at dimensionality, pluralization, distribution, transduction, and generification as techniques for generating solution concepts. The specific point of attack each makes on a problem distinguishes them. Dimensionality focuses on attributes. Pluralization focuses on objects. Distribution focuses on function location. Transduction links attributes and functions into chains. Generification focuses on none of these initially but examines known (including just found) solution concepts to discover why and how they work, i.e., their fundamental phenomenology.

The order in which the solution techniques are applied is immaterial. If you have a faint idea of a solution concept coming into your mind's view pursue it.

It may help you to pick a solution technique to use based on what aspect of your faint concept is most obvious (object, attribute, function, or A-F-A connectivity). If you have no ideas to start with use your favorite technique first or follow the order given in the flow chart.

Since objects, attributes, and functions are interconnected in problem definition and analysis they are interconnected in problem solution. A consequence of this is that solution concepts found using a particular solution technique are not unique. The same ideas may come to mind using other techniques. Also different individual problem solvers may discover the same solution concept from different perspectives. An informative exercise is to analyze a particular solution concept and find out what other techniques might have led to the same concept.

Pluralization
Pluralization is object oriented and has two approaches to follow: multiply objects and divide objects. Pluralization puts you immediately into the thinking mode: "What could I do if I had more or less of an object that I could use differently?" This means more copies of the object (multiplication) or more copies of its parts (division). Multiplication provides copies of objects with which to distribute their functions in space or to create new points of contact where new functions can be supported. To use an object or part differently often involves turning on and off attributes in them and functions they support. Division allows also eliminating objects or parts. Having more or less, of an object, attribute, or function, should be taken to extremes of infinity and zero. Zero implies object or part removal.

Multiplication applied to the messy ink problem.
The messy ink problem, from our object minimization perspective, presents three objects to multiply: air, ink, and paper. We have seen examples of more air used in forced-air drying. Less air was used in localized vacuuming. What might we do with more ink?

As I started to follow this line of thinking it occurred to me to take an attribute of ink to an extreme. (I don't know why it came to mind here.) Wetness of ink is a causative of smearing. It enables the

property of viscosity. Hence, it occurred to me to [**20**] take wetness to the extreme of zero wetness, i.e., completely dry ink. That brought to mind to print on paper the initial characters of text or photographs in a thin layer of sticky material and then blow or dust dry powdered ink onto the sticky surface. Applying an excess of powder would enable complete saturation of "sticky" bonds leaving only a dry surface of printed ink. Excess dry ink powder could be blown or shaken off.[1]

Thinking of thin layers of applied liquid caused me to wonder what the surface of paper looks like on a micro scale. Surely it is rough. And the more micro the scale of inspection, I would expect, the more rough the surface. Then I began to review in my mind the mechanisms of drying of liquid beginning with surface evaporation. Thinking of a micro-scale brought an image of molecules of water slowly diffusing to the surface of a microscopic droplet of ink and evaporating. One obvious attribute of liquid droplets that supports their evaporation is surface-to-volume ratio. The higher this ratio the more surface there is for evaporation and the less volume through which to diffuse to reach the surface. This led to the idea of multiplying the number of surface micro-asperities to provide localized points for supporting micro-droplets of ink.

[21] In the inking process apply micro droplets of ink on a micro-roughened paper surface spaced to produce a range of grayness (or color density) from solid black to faint gray. Then roll the inked paper under pressure to smear the ink into the interstices of the asperities while flattening the microstructure of paper and ink into desired smoothness. The resulting local surface-to-volume ratio of the ink will aid its drying by evaporation.

Rational for pluralization
Dr. Roni Horiwitz, et al, developed in SIT the idea of associating multiplication with innovation in a "closed world". [2] Although the closed-world concept allows only a limited number of objects, multiplication permits even an infinite number of their copies. The rational for this is that, at least in an industrial setting, the objects in a problem situation are probably readily available in large quantities – perhaps, even at no cost. Using such readily available objects can be innovative. Whereas introducing new (different) objects into the closed is not innovative.

Nomenclature for solution techniques
Words like dimensionality, pluralization, distribution, transduction, generification, uniqueness, and others used here, are sometimes bothersome to students new to USIT. They were selected to be useful and simple metaphors for the processes they represent. You are free to select your own. However, I invite you to wait until the end of these lectures before deciding. By then you may appreciate the roles they play.

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[1] On reviewing this draft I wondered if this solution concept might already have been discussed. So I went back through the mini-lectures and found an interesting comment: [2] p2/2, NL_06. This strikes me as an example of recall of past experience induced by seeding. The seed, in this case, might have been a ramification of the idea of lots of ink or some how associated with the wetness/dryness contradiction.

[2] A brief history is given in the USIT textbook, "Unified Structured Inventive Thinking – How to Invent".

5.	Problem-Solving Tricks and Related Miscellany

6.	Feedback

7.	Q&A

8.   Other Interests

1. Several readers have inquired concerning availability of back issues of the newsletter. Please send your request by email and indicate the issue numbers you are interested in (NL_XX).

2. Chuck Cronan has solved a problem that has haunted me. Some payments for the USIT textbook arrive with too much money. Why? Chuck reports as follows:

"I don't know if you discovered the reason yet, but I know why. The book is advertised at two prices depending upon which web site the ad is viewed.

http://www.u-sit.net/OrdrngInfo.html $44.50

http://ic.net/~ntelleck/OrdrngInfo.html $84.50
and Ellen Domb's review - http://www.triz-journal.com/archives/1999/02/e/ $82 + shipping

All three of these are still active. Since Domb references the ic.net page, that's the one that needs correction."

  Thanks Chuck.

        The first url is correct (price = $44.50). The ic.net url is an abandoned address.

Please send your feedback and suggestions to Ntelleck@u-sit.net

To be creative, U-SIT and think.