U-SIT And Think News Letter - 20

Updates and Commentary

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.

Dear Readers:

- This and the next mini-lecture (or so) will be devoted to material prepared for an abbreviated USIT training module. I hope it resonates with your interests. Note that the heuristics discussed are not unique to USIT.

1. USIT – How to Invent: the USIT textbook.	$44.50
2. USIT – an Overview	FREE

3. Mini USIT Lecture – 20

USIT – an Alternative Method for Solving Engineering-Design Problems

This July in Sicily, I had the pleasure of teaching a USIT module in the NATO sponsored Summer School on "Radiation Effects in Solids". The attendees consisted of invited lecturers, scientists, professors, graduate students, and post-doctoral students from NATO and NATO related countries. These notes contain materials prepared for that audience of professional technologists. The topic of the module was "USIT – an Alternative Method for Solving Engineering-Design Problems".

Introduction

Engineering design refers to the formalized conceptualization of artifacts (man-made things). USIT is a structured methodology for addressing problem definition, analysis, and solution in the pre-engineering stages of engineering design. In this stage no engineering specifications are required; thus, focus is placed on defining a conceptual problem and finding multiple solution concepts with speed and innovation. Engineering follows the application of filters to select a particular concept for development – a post USIT issue.

Pre-Engineering

Note that pre-engineering implies pre-filtering. Hence, *during the exercise of USIT no filtering is allowed*. This is especially significant in problem solving team settings. It is a long recognized constraint for effective search of conceptual solutions.

A consequence of pre-filtering is that USIT is not an optimization process. USIT stresses ideal solution concepts. Optimization, on the other hand, requires judicious tradeoffs between ideal

solution concepts and capabilities (defined by filters). Current filters such as timing, cost, resources, manufacturability, business strategies, and others, guide these tradeoffs. Such filters change frequently according to economics, business plans, competition, and many other issues. Ideal solution concepts become a part of a corporation's intellectual property and are available for future reference. This is relevant when filters may have changed allowing reconsideration of viable concepts.

Relevance of USIT to Radiation Effects in Solids
USIT is a problem-solving methodology. The topic radiation effects in solids covers the current state of knowledge gleaned from solving a myriad of technical problems. The relevance of the former to the latter rests on the way USIT redefines a real-world problem. Definition of a problem requires *translating its real-world objects to generic names that convey their principle functions*. *Interaction of these generic objects is characterized in terms of their supporting attributes*. Thus the USIT methodology is a general methodology that is applicable wherever a real-world problem can be characterized according to USIT principles.

Some results
Students in an introductory problem-solving class are usually antsier to see a problem solved than delve into the theory of a methodology. So I'll begin with a simple problem and work into the methodology slowly.

Bar hopping
My grandfather gave to me the earliest word-problem I can remember solving. "A man is confronted with four bars on the corners of an intersection of two streets. He pays $1 to enter the first bar, spends half the money in his pocket, and $1 to leave. He crosses the street to the next bar, pays $1 to enter, spends half the money remaining in his pocket, and $1 to exit. He does the same thing at the remaining two bars, whereupon he discovers that he has no more money. How much money did he have to start with?" (You might want to pause and solve this problem before reading my comments.)

Heuristics
One thing that may help this introduction is to point out that problem-solving methodologies, all of them, consist of selected heuristics. Heuristics are the tools and tricks we use to solve problems. The first heuristic to be discussed here is *simplification*. (Several heuristics have been italicized herein to bring them to your attention.)

***Simplification* as a problem-solving heuristic**
The first heuristic for defining, analyzing, and solving a problem is *simplification*. It is one of the most important heuristics for problem definition. It especially refers to useless "fluff", or non-informative color, and to repetition, among others. A number of heuristics are included under *simplification*. One is to "*eliminate fluff*". Another is to "*eliminate redundancy*".

Fluff in the barhopping problem, for example, is "… on the corners of an intersection of two streets"; and "He crosses the street to the next bar …". The locations of the bars, their relative positioning, and the path followed to reach them are all useless bits of information. They are

simply fluff, so eliminate them. In fact, the existence of bars is irrelevant. The problem consists of four similar objects whose only attribute is a number that is modified during the process of the problem. Furthermore, the four objects can be reduced to a pattern that is repeated four times. Hence, not even the objects are relevant.

Elimination of redundancy calls attention to repeated objects, patterns, and other features. The point of this heuristic is to *reduce redundancy to one instance and solve the problem for that instance*. Then expand the result to repetitions of the instance. In our example, *eliminate redundancy* would lead us to solve the problem for one bar then consider multiple bars. A benefit of this heuristic is that the results of the barhopping problem can be expanded to N bars, where N is any integer greater t an zero.

To Be Continued in the next USIT Newsletter …

5. Problem-Solving Tricks and Related Miscellany

6. Feedback

Questions you would like to have discussed are welcome.

7. Q&A

8. Other Interests

- I hope you saw the article titled "Causes = Effects?" that was published in this months' TRIZ Journal (www.triz-journal.com). It is a slightly modified version of Mini USIT Lecture – 19.

- Regarding inquiries about ordering the book, "Unified Structured Inventive Thinking – How to Invent", details may be found at the Ntelleck website: www.u-sit.net. The cost of the book is US$44.50 plus shipping and handling. See the website for S/H charges. Send a check made out to **Ntelleck, LLC** for the proper amount, drawn on a US bank, to

  Ntelleck, LLC, P.O. Box 193, Grosse Ile, MI 48138 USA