U-SIT And Think News Letter - 12

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:

- Mini-Lecture_11 discussed Uniqueness as a problem-solving technique with its demonstration in the smeared-ink problem. In this lecture I digress from the smeared-ink problem to discuss some overview issues.
- NL_13 will be a week or so late because of another vacation. ☺

1. USIT – How to Invent: the USIT textbook. ***See** 8. **Other Interests** ⇓

2. USIT – an Overview

3. Mini USIT Lecture - 12

This edition of the News Letter is devoted to a Q&A discussion with my friend Professor Toru Nakagawa who is translating the mini-lectures into Japanese. I am grateful to him for raising these questions and for his permission to publish the questions and answers here. If you desire further discussion on these or any other points in the mini-lectures, please write.

Dear Ed,
On January 29, we have uploaded the Japanese translation of your Newsletter No. 3 and No. 4, though no announcement is shown in the English pages.

Thanks, Toru, for the update, and for your continued interest in USIT. I realize that translating these newsletters is a major commitment on your part. I'm sure your readers appreciate your efforts.

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(1) I am interested in the Card Puzzle and have added the following at the end of our Japanese version: Some extension by Toru Nakagawa (Jan. 27, 2004)

Reading the explanation above, we understand that the number of cards in n + 3n is not essential in the problem. Thus we can generalize the initial problem in the following way: "Given a deck of a certain number (say M) of cards, and taught that a certain number (say n) of them are faced up and the others are faced down. Then, you should divide the deck into two groups of cards, where the two groups have an equivalent number of face-up cards. -- Do this in the blind or in the dark room."

We have a solution to this problem: "From the whole deck of M cards, take n cards out in any manner and make them into a separate group, and just turn over the separate group as a whole." The reason that this works is: Assume that the number of face-up cards in the separate group is x, then we find that n-x face-up cards are left in the original group. Since we have turned the whole separate group afterwards, in the separate group we now have x face-down cards and n-x face-up cards. The extension here shows that the "simplification" of a problem can be obtained not only by "reducing/minimizing" the problem but also by eliminating extraneous concrete conditions (such as 13 cards and three times of 13 cards) (after reaching some insights or partial solutions). This latter case can better be expressed with the term "to make things clear". Even though generalization and abstraction make things look somewhat more difficult, once we have overcome it, we understand the essence of the problem easy and simple. (Just a comment stimulated with Ed's interesting explanation.)

Yes, to your comments.
I, and others, have used the same algebraic derivation for around-the-table discussions of the puzzle. I chose to leave it out in the newsletter because my experience is that this level of understanding comes only after having already solved the problem intuitively, or having seen the solution. As always, mathematics makes a nice, concise, logical presentation – after the fact. (As another example, see the simple tabular solution format at the end of this newsletter.) But, in my opinion, it is not the way we initially attack a problem. I solved it intuitively the first time using scaling (by minimizing repeated objects – a practice I frequently use on puzzles). Being scalable implies that specific size is unimportant and leads to mathematical generalization.

There is more to the reason for my choice: it is that in the mini-lectures I'm trying to describe and illustrate the use of a structured, problem-solving methodology, while, at the same time, trying to portray the mental process involved (mine in particular – being the only one I can examine). I view USIT as a method of sparking mental cues to recall and not as a rigorous algorithm.

There is an overbearing problem in trying to teach structured problem solving. It is that the theory is neat and logical but the mind is not. During the process of following prescribed structure our minds skip around jumping at each new idea that comes to mind. I believe this spontaneity should not be hindered. Solutions arise from beginning to the end of a problem-solving session. The same is true of how we analyze a problem following a prescribed structure – analysis is attacked with satisfying results and we move on. However, we soon find ourselves redoing the analysis with new insights. All parts of problem definition, analysis, and solution become a jumble of iteration, and more iteration, with constant improvements following new insights. I have exposed my own iterative attempts to improve the "messy ink" problem both in the definition and the analysis stage. More iteration will surely come during problem solving.

Out of these experiences, I choose to use USIT as a useful but not binding structure and encourage my mind to find every opportunity to be creative. In other words, I think students tend to make USIT and other structured systems too restrictive in the belief that obedience to method is a necessary condition. This leads to the unfortunate condition of looking to the method as an algorithm for producing answers rather than using the method as an aid to jogging one's mental abilities for recall. Hence, you will find in the mini-lectures that I talk about three distinct phases of problem solving while seemingly jumping back and forth between them (without proper respect).

I started USIT without distinguishing the three phases (definition, analysis, and solution) as major title headings in the methodology, even though this is practiced in the literature. I soon learned that students need and look for meaningful outline titles to simplify their mental organization of what they are learning. So, I changed. Yet, students are still looking for magic to happen by following a recipe.

(2) I would like to ask you a question. Could you please reply to it sometime later after finishing your story, because I do not want to disturb you.

This is no disturbance. Other readers may be raising the same questions in their minds. If such issues can be clarified, as the mini-lectures progress, perhaps all readers benefit. Your insightful questions are very important to me, so much so that I would like to devote an issue of the newsletter to them – with your permission, of course.

Your description of the "Plausible Root Causes Analysis Tool" is very interesting. But I am wondering if you are already stepping into the Problem Analysis stage especially when you are listing up a large number of Attributes. You say "Root Causes" are one of the essential requirements of the "Well Defined Problem", and they are necessary for making a focus of problem solving. Is it natural to list up so many attributes at the stage of the Problem Definition?

Yes. Plausible root causes is an analytical tool for identifying plausibly causal attributes. If one has difficulty identifying causal attributes needed to validate the root causes to be included in a problem statement, this tool is helpful. If you employ the tool you will also find yourself doing some identification of attribute trends to validate you assumptions. This is further analysis that will be addressed more thoroughly using the QC-graphs. My experience shows that using the plausible root causes tool here helps in problem definition. It further shows that if you do use it here you seem to learn even more when you apply it thoroughly for QC-graphs. Furthermore, I always find some solution concepts when using this tool in problem definition.

Your description about the "FILTERS" is also very interesting and clear. There you explain how to "select a problem" and then "how to define a problem". In this context of the "Messy Newsprint Problem", what is the "problem selection" stage and how is it done? And what is the "Problem Definition Stage" and how is it done? And then there is the "Problem Analysis Stage". I feel the boss of the publisher selected the problem intuitively and just ordered the problem solver (team) to solve it. Then the team is working to "well define" the problem. When the team came to the idea that "Ink's Capability of smearing" is the essential problem, I think they have reached the "Plausible Root Causes" of this problem. More detailed consideration with your "Plausible Root Cause Analysis Tools" should probably be done in the "Problem Analysis Stage" just as an optional step of the QC graphs (or as an optional initial step in the Closed World Method). (Or we may say that the four effects in the figure are the "Plausible Root Causes".)

First let me mention that this problem was my invention. I wanted to begin the mini-lectures using a parallel problem for demonstrating ideas in the lecture (and for suggesting exercises). I also wanted to pose what, from my own experience in industry, is a realistic situation a problem-solver may be presented. Mangers usually confront their technologists with a challenging problem that they have carefully worded. From management's perspective the challenge should clearly define the problem, the limitations of timing, the resources the technologist can expect to use, a list of contacts for further information, and a due date for results. Management's and a technologist's perspective of a well-defined problem usually are quite different. Although well intended, management's perspective tends to be a mix of facts, anecdotes, and hyperbole designed to generate enthusiasm. Thus, I chose, "The ink on our newsprint is messy. Fix it!" This statement provided a realistic setting for leading the reader-technologist into the issues of problem definition. It is also from an area in which I have little experience. This enables me to make new discoveries with each mini-lecture, including need to improve previous deductions, and to look forward to writing the next mini-lecture. I might add that if a well-defined problem has been constructed with a "single" unwanted effect, and then it is discovered that the effect can be broken down further, the original was not a well-defined problem (*a la* USIT) and needs another iteration on definition.

"What is the "problem selection" stage and how is it done?"

Problem selection is a process of establishing the best issue for addressing problem-solving resources. After assembling relevant information, the formal problem selection stage begins when the team, or individual problem solver, sit(s) down and writes a problem statement as it was first presented. Then follows the process of unraveling the information in search of a single, fundamental problem to address. Process:

1) write a problem statement; the first one can be rather elaborate, but will be reduced later;
2) draw a sketch;
3) unravel the problem statement in to as many unwanted effects as possible;
4) rank them and select the most important one;
5) try unraveling this one;
6) quit when a single, unwanted effect has been found that cannot be further unraveled.

What is the "Problem Definition Stage" and how is it done?

Problem definition means to formulate a well-defined problem. Process:

1) having found the problem to address, adjust the sketch;
2) minimize the number of objects to just those needed to contain the selected, single unwanted effect;
3) identify root causes.

As I tried to describe earlier, the three phases (definition, analysis, and solution) are only distinct in the formal presentation of the methodology. In practice of the methodology they are sequential but not distinct. Much iteration between them takes place to constantly update and clarify one's thinking. The process of updating is one of changing the wording of the problem and altering the associated sketch to record each improvement in understanding. A team, or individual, should keep the verbal and graphic renditions of the problem statement and sketch in front of them during the entire process of problem solving.

Best wishes, Toru Nakagawa

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And my good wishes for you, Toru.

I know I have not answered your questions completely. But don't give up. Give me your reaction to the above comments and I'll reconsider mine. The above are simply my reactions as I thought through your questions. And thanks again for the queries.

Perhaps some readers will comment also – that would be most welcome.

Thanks again for your insightful questions. Ed

Simple tabular format for illustrating a solution sequence to the deck of cards problem.

	Given …	Stack #1	Stack #2
1	n face-up cards in N total		
2	n cards are removed from N to form a second stack of up and down cards	N - n	n
3	Thus, the number of up-cards in each stack is	n - u	u
4	Inverting #2 yields		d = n - u

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.