U-SIT And Think News Letter - 03

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:

- Thank you for your encouraging feedback.
- Notice that the Q&A sections of the first two newsletters were empty. I encourage you to be inquisitive.
- Home Page of www-u-sit.net now has a window added to allow direct registration for this newsletter without going through the ebook registration. However, both work, but only one is needed.

3. Mini Lecture – 03

Identification of Plausible Root Causes – Part A

Continuation of the publisher's problem – "Ink on newsprint is messy. Fix it!"

Recap: In our last mini-lecture (NL02) we selected, as the most important unwanted effect to address, "Ink on newsprint is capable of being smeared". We minimized the objects to ink and newsprint and we had a sketch of the problem. Or did we? I promised to work on root causes, and I will. But before continuing on our way to a well-defined USIT problem, I need to clean up a few things from the last mini-lecture.

First, did you by chance notice my vacillation between use of the words "newsprint" and "paper" for the same object? What's going on? What's going on is part of the process of assembling a well-defined problem. This part has to do with setting the scene for creative thinking. Here I'm referring to renaming objects from their commercial names to their generic counterparts. While I was focused on other aspects of the problem, my subconscious, from years of experience, was trying to get me to generify newsprint. Newsprint is specific. Paper is generic. Our subconscious will generate more associations with a generic word than with a specific occurrence of it. Once you've minimized the number of objects in a problem, then generify their names. Ink is probably sufficiently generic; I can't think of an adequate substitution (ink is more than water or liquid).

Believe it or not, the purpose of generification of object names is to introduce ambiguity. You read it correctly; and cognitive psychologists agree that *ambiguity is conducive to creative thinking*.

Second, I need to create a useful sketch. It will be an aid in identifying root causes. Note that the sketch shown in the last mini-lecture addressed a symptom of the problem without showing the problem – it illustrated ink smearing. Our problem is "ink capable of smearing". Hence, we need to illustrate the instant before smearing. In fact, we need to illustrate the "point" where it could occur. At this "point" we have paper in contact with ink that is in contact with air (the two interfaces shown here in cross-section). Air may be functional before "finger" comes along to smear ink. During smearing, air is displaced and 'finger' becomes the object in contact with ink – a new interface. Notice how this sketch, showing interfaces of object-object contact, brings our attention immediately to the sites of action: where ink on paper is bonded to paper, and where ink is in contact with air which, is where it may become smeared. Now I see value in adding air

air
ink
paper

as a third object in our analysis.

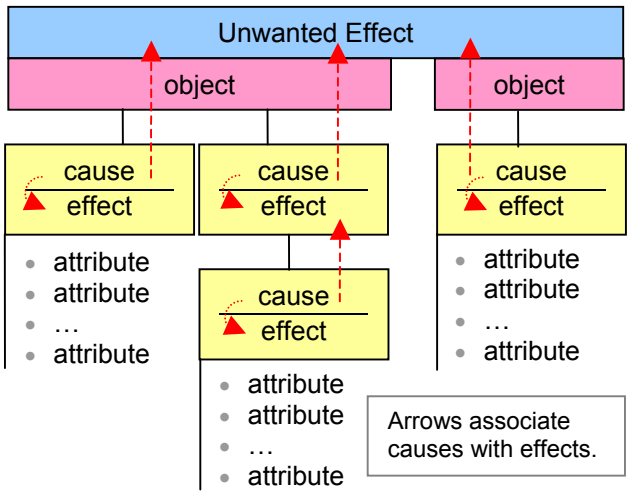
If drawing a straight line for the interface of shaped objects causes you concern that important detail may have been lost, look at it this way. A straight line representing an interface in cross-section is intentionally ambiguous allowing one's imagination to scale detail of the contact to any level: e.g., a battleship smearing water on a beach; a squeegee smearing water on a skyscraper window; a teabag smearing water on the side of a cup; a pen smearing ink on a birthday card; ridges and furrows of finger-tip skin smearing a drop of sweat on sunglasses; or a molecule of skin oil sliding on hydrophilic surface – and countless others.

Points of contact between objects (or interfaces) are where "the action is" – look here first in analyzing a problem (then look here again). Notice how the sketch of abutting rectangles becomes an abstract graphic metaphor for the three objects. It provides a generic representation of sites of action without the biases in artistic sketches – it supports ambiguity letting us search our personal depth of understanding to characterize the interfacial actions. Now we can address plausible root causes.

Plausible Root Causes Part A.

We are not given confirmed root causes so we can turn to the USIT Plausible Root-Causes Tool for help. (See the ebook: "USIT – an Overview", p15.) Root causes are essential to forming a well-defined problem, and confirmed ones are gold. Without knowing root causes a problem solver can flounder and may never produce meaningful results. This situation occurred so often in early classes that I was compelled to develop this tool for identifying plausible root causes. Otherwise little progress was made on real-world company problems in the short time of a class. Plausible root causes can be discovered quickly in class and be substituted for confirmed root causes. Be aware, however, that plausible root causes are not confirmed by this tool and remain plausible. On the other hand, identifying plausible root causes is a quick start on a designed experiment – another application of this tool.

The unwanted effect is placed at the top of a tree with the objects of the problem supporting it. Independent of the others, each object is examined as a source for possible causes of the unwanted effect. Each such cause is entered below its object and then looked upon as an effect for the next lower level of the diagram. Branches in the diagram are terminated when effects are reached having obvious causal attributes. Then potentially causal attributes are listed. Terminal attributes are defined to be plausible root causes. Each plausible root cause becomes the source of solution concepts.



Plausible Root Cause Analysis Part B will be continued in the next mini lecture. Your exercise before then is to try your hand at applying the plausible root causes tool to our example problem. You can create the adjoining diagram, and fill in the proper words, using a word processor.

4. Classroom Commentary

Identifying root causes may seem to imply the existence of some fundamental, ideal truths to which all problems can be traced. They do not. Root causes refer to the depth of our technical thinking about phenomenology (our mental modeling). Each problem solver brings personal training, experience, interest, and intuition to this exercise. It is a personal analysis of a problem intended to encourage in-depth thinking as a stretch of one's technical understanding. General science, introductory chemistry, and introductory physics go a long way in this exercise. They even encourage analysis of problems outside of one's personal expertise. One can always confirm personal ideas with an expert at a later date.

5. Problem-Solving Tricks and Related Miscellany

6. Feedback

7. **Q&A** **Where are the Mini Lectures going?**

It has been noted that the series of Mini Lectures in these newsletters was started without declaring where it is going or for whom it is intended. For this oversight I extend my apologies.

The general topic I have selected is **structured problem solving** based on the unified structured inventive thinking methodology, which is based on systematic inventive thinking (SIT) as taught in 1995 (Drs. Roni Horowitz and Yacob Goldenberg, Instructors). The history is given in the USIT textbook: "Unified Structured Inventive Thinking – How to Invent" (for more information visit www.u-sit.net). And, I expect to introduce along the way some ideas from new work I have in progress. What I mean by structured problem solving is organized thinking as used in problem solving to make the process efficient and innovative. I will try to make the Mini Lectures readable and meaningful to solvers of technical design-type problems from beginner to professional. I fully expect, but will have to demonstrate, that "technical design-type problems" will become simply "problems".

The BIG Picture: In professional engineering we have, and are given, conditions, specifications, requirements, budget, timing, business objectives, customer wants, in-house expertise, intellectual properties, tooling investment, quality assurance, warranty, and other considerations that weigh on our conscious as we go about our business of problem solving. The first step in structured problem solving is to identify these conditions and list them under the label FILTERS. Then we use these FILTERS to select a problem to address and again to select solution concepts that result, but *not in-between*. Here's the breakdown:

Structured problem solving process

Separate the process into …

- problem selection (use FILTERS)
- conceptual solution (No FILLTERS allowed)
  - problem definition (a well-defined problem for USIT analysis/solution)
  - problem analysis based on objects, attributes, and the functions they support
  - problem solution (create conceptual solutions)
- select solution concepts (use FILTERS)
- engineering scale-up (proof of concept, modeling, testing, prototype design/fabrication, production)

Be aware that a solution concept, and its engineering scale-up, generally cause new problems. And that is just fine for we problem solvers (it keeps us in business) since we have the tools to solve problems efficiently.

FILTERS terminate the use of abstraction, metaphor, and ambiguity – the core of conceptual thinking.

There is no place for filters in conceptual problem solving.

8. Other Interests

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

To be creative, U-SIT and think.