U-SIT And Think News Letter - 04

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:

- The newsletter now has 93 readers in 32 countries – well, it at least has 93 recipients (I can't speak for your actions).
- Newcomers can receive back copies by sending an email and requesting the needed issues.
- The mini-lecture in the next issue will complete the well-defined problem exercise.

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

2. USIT – an Overview

3. Mini Lecture – 04

Plausible Root Causes Part B

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

Recap: The last mini lecture, in USIT And Think NL-03, introduced the Plausible Root Causes Tool. Readers were asked to apply the tool to the unwanted effect of "ink on paper is capable of being smeared". Quickly reread the paragraph explaining the plausible root causes diagram and then read my results below.

First, my assumptions (my mental model of printing newsprint): Ink is applied in liquid form; it is applied in an offset-type of transfer from rollers (called "blankets" in the argot of printing); and paper is traveling at high speed. (Modern newspaper printers print both sides of the paper at the same time.) "Smearing" includes any form of removal of ink from its initial "printed" position on the moving paper. Ink is a suspension of color-bearing particulate in a liquid. The purpose of the liquid is to carry the particulate to bonding sites on paper – once the particulate is delivered *liquid* is no longer a needed attribute of ink (no longer active). Ink bonding includes particulate-to-particulate as well as particulate-to-paper bonds. Drying of ink includes preferential absorption of the liquid component of ink into the paper, and its evaporation into air. Since paper is partially soluble in water, any water content of ink may leach material from paper that could be useful in binding ink particulate as liquid dries. Paper is fibrous in structure having interstices where liquid can reach by wicking, but may be too small for ink particulate. Since dried ink can have dense color, ink particulate is probably smaller than ink line-width or thickness. This would allow dense packing of particulate as it dries. Most efficient drying occurs before paper reaches the cut-and-bundle stage.

Second, my plausible root causes analysis (compare with the diagram as you read this):

Unwanted effect:	**Ink on paper is capable of being smeared**.
Objects:	paper, ink, air
Plausible cause by paper:	"paper doesn't hold ink"
Plausible cause by ink:	"ink doesn't bond to paper" and "doesn't bond to itself"
Plausible cause by air:	"air doesn't dry ink"

Explanation: Paper that does not hold ink allows ink to be smeared, whether wet or dry; ink that does not bond to paper allows ink removal; ink that does not bond to itself could shear, fret, or become friable leaving part of the ink on the paper and allowing the rest to be transferred; and air that does not dry ink leaves it capable of smearing. These all came to mind as plausible causes of ink being capable of smearing. Each seemed to suggest causal attributes so I moved on to identifying *attributes*; they follow with my thinking as annotations. You don't have to agree with me or come up with the same attributes – your own analysis will be as good or better than mine (this exercise draws on personal experience and intuition).

Plausible cause – **paper not holding ink**: *Roughness* allows paper to provide "protective" *pockets* (attribute of shape) in which to partially enclose ink where *smoothness* does not. Inadequate *absorption* causes part of the ink to be secured to paper and the remainder left exposed above its surface. [Note: *roughness* and *smoothness* differ only in degree; adequate and inadequate *absorption* differ only in degree. Hence, use either one you like since we are not concerned with size of attributes (their metrics).] Inadequate *bonding* to paper allows smearing. Physical bonding, as in *wettability* (*surface tension*), gives ink further support. *Physical bonding* includes van der Waals' bonding. *Chemical bonding* between ink and paper prevents smearing. *Water content* of paper may not provide any *chemical activity* for bonding (?). Paper *density* may be too high, providing no *interstices*. Paper may be too *hydrophobic* further affecting bonding. Too high *transfer speed* may allow paper to reach a cut-and-bundled stage before ink dries and where further drying is retarded. High packing *pressure* and insufficient *permeability* of paper may prevent escape of volatile components of ink. Ink not bonding to paper or to itself suggests examining attributes of ink.

Plausible cause – **ink does not bond to paper**: Lack of *wettability* may suggest that ink dries before bonding or that ink *surface tension* is too high. The colored-particulate of ink may lack *chemical affinity* for paper. Dried ink may lack even weak *physical bonding*. *Viscosity* of ink may be too high to allow penetration into the surface *roughness* of paper. Ink *temperature* may be too low to support sufficient bond formation. *Vapor pressure* of ink may be too high allowing it to solidify before adequate wetting. *Vapor pressure* of bond-forming additives (if such exist) may be too high allowing their premature loss. Rapid loss of liquid may increase *relative saturation* and induce rapid precipitation of large particulate without adequate bonding.

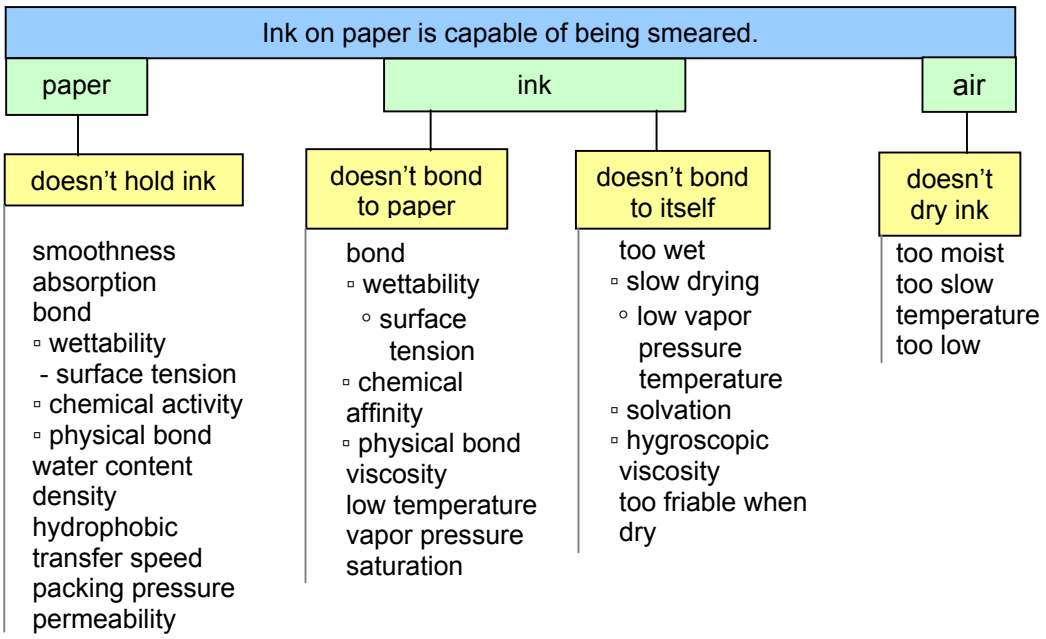
Plausible cause – **ink does not bond to itself**: Ink having too high *liquid content* may reduce collision frequency and proximity of suspended particulate for forming bonds quickly. Ink may dry too slowly due to low *vapor pressure* and low *temperature* of its liquid component. Lower *temperatures* cause lower *evaporation rates*. *Solvation* may tend to keep particulate in solution. Particulate may be so *hydroscopic* as to take on water faster than it evaporates (*deliquescence*). Dry ink may have too low *viscosity* and be easily sheared. *Dry* ink may be *friable* as a result of *weak internal bonds*.

Plausible cause – **air not drying ink**: High ambient *humidity* reduces the net *evaporation rate* of water. Evaporation tends to saturate air immediately in contact with evaporation sites. High *flow rate* and humidity of air may affect net evaporation rate. High air *temperature* supports low relative *humidity*.

The plausible root causes tree is a tool to enable quick identification of active attributes. It is in this process of building the plausible root causes tree that we begin to discover underlying phenomenology of the unwanted effect – a key start for effective problem solving. Solution concepts always occur here.

The above analysis is my effort to use my basic training and intuition to generate plausible ideas. I have no experience in paper printing. Some of these ideas may be wrong. (Please let me know.)

Nonetheless, I can proceed to analyze the problem, apply solution techniques, and generate solution concepts from this basis. (Notice the emphasis on phenomenology and lack of analytical science.) At some point, however, the ideas will need to be corroborated by authorities. In a team environment corrective suggestions occur more quickly.



7. Q&A

From Hugo Sanchez, Nicaragua:

Q) What are the main differences between ASIT and USIT?
A) I published the ebook, "Unified Structured Inventive Thinking – an Overview" to illustrate the content and organization of USIT. USIT is an offspring of Systematic Inventive Thinking, the forerunner of ASIT (vintage 1995). It's not appropriate for me to expound on ASIT; details of ASIT are available at www.start2think.com.

Q) Can USIT be useful in dealing with so called "non-technical problems"?
A) The card trick in the last newsletter is one example. I believe USIT can be applied to non-technical problems if (1) appropriate analogies are found for objects, attributes, and functions, and (2) if well-defined problem statements are created. An issue that arises in non-technical areas is that people are too willing to accept any problem situation as a well-defined problem.

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

To be creative, U-SIT and think.