



# U-SIT And Think News Letter - 10

## Updates and Commentary

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**Unified Structured Inventive Thinking** 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\_09 got part way through the QC-graphs for the messy newsprint problem. You then completed the remaining parts. In today's lecture I'll show you my version of completing the graphs.
- Some interesting reader response is contained in the Feedback section below.

1. [USIT – How to Invent: the USIT textbook.](#)

2. [USIT – an Overview](#)

## 3. Mini USIT Lecture – 10

### Completion of “A Qualitative-Change Graph for Messy Newsprint”

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

**Recap:** In Mini-Lecture\_09 the qualitative-change graphs were filled in for “attributes of Paper”. Attributes for ink and air are considered here.

#### ML\_10:

#### Attributes of ink bonding to paper:

Lack of wettability (R) of ink (high surface tension causes liquids to prefer to form droplets, L) leaves more ink exposed to air as it tries to minimize its area of wetting on paper. This leads to more fundamental phenomena: reduction of wetted area (contact area) and reduced bonding strength to paper in the wetted area. Both contribute to smearing of ink (R). High viscosity of ink slows the flow of ink, reducing its penetration into the otherwise accessible voids of paper that would improve lock-and-key bonding (L). Ink temperature (NL\_04 and NL\_05) now seems to me to be irrelevant to forming bonds. Low vapor pressure of ink may increase its drying time leaving it subject to smearing for a longer period (R). High vapor pressure resulting from bonding accelerators (if such exist in newsprint ink – to be verified with an expert) could lead to their premature loss, lengthening drying time (L). “Rapid loss of liquid may increase relative saturation (concentration of ink particulate) and induce rapid precipitation of large particulate without adequate bonding.” (This is a stretch of my imagination.) Loss of liquid from a colloidal ink suspension could occur by too rapid evaporation of the liquid component (high vapor pressure of ink, L) and by its too rapid diffusion rate into paper (leaving the particulate behind), L.

**Attributes of ink bonding to ink:**

High liquid content of ink may increase particle-to-particle separation, thus decreasing particle-particle collision frequency and lengthening ink's particle-to-particle bonding time (R). Low vapor pressure and low temperature of ink's liquid component may slow its evaporation rate, lengthening bonding time (R and R). Solvation of ink particulate in the liquid phase could tie up some of the water content of the liquid phase tending to hydrate the particulate, thus, sustaining its tendency to hold water molecules in a state of hydration. The more hydrated is ink particulate the lower the particle-to-particle bond strength and the more susceptible it would be to smearing (an assumption to be checked). This would be equivalent to low viscosity of ink particulate with non-hydrated water removed – a nominally “dry” state. This “dry” ink with hydrated particulate supporting low viscosity would have a shorter drying time than the case of non-hydrated particulate. Hence, high degree of solvation increases probability of smearing (L). Dry, but hydrated ink, could be susceptible to smearing by crumbling due to low hydrated-particle bonding – high friability (L). Hygroscopicity of liquid ink allows its adsorption of water molecules from air, thus slowing drying and lengthening time for smearing, L.

**Attributes of air for drying ink:**

High ambient humidity increases the density of vapor phase water at the ink's surface, thus increasing condensation rate and lowering evaporation rate (L). High air temperature supports high humidity, slowing drying (L). High flow rate (speed) of air across liquid ink reduces humidity near the surface of ink, thus improving evaporation and shortening drying time (R).

The above observations are summarized in the following qualitative-change graphs. No attempt is made to eliminate redundancy or repetition of ideas in different wording. The argument for this is that different expressions for the same effect may induce different recall of past experience.

**Design-of-experiment issues:**

A common problem for industrial technologists trying to apply USIT occurs in formulating a well-defined problem, which requires root causes. The common problem is that they often reach this point in their problem analysis without having determined real root causes. As a result of facing this situation in too many USIT classes, I developed the Plausible Root Causes tool (NL\_03). It identifies plausible causal attributes while QC-graphs identify their trends. This is just the beginning needed to execute an effective design of experiment, which could be used to verify and rank the plausible root causes as real root causes.

**Application of USIT solution techniques:**

We move now to the application of USIT solution techniques, to be taken up in the next newsletter. A little introspection on your part should reveal that grouping solution techniques as a final phase of structured problem solving is a bit unrealistic. The reason is that your mind is so quick at recall and generating ideas that you have actually been generating solution concepts all along. However, this organization is useful for developing an overview of the methodology.

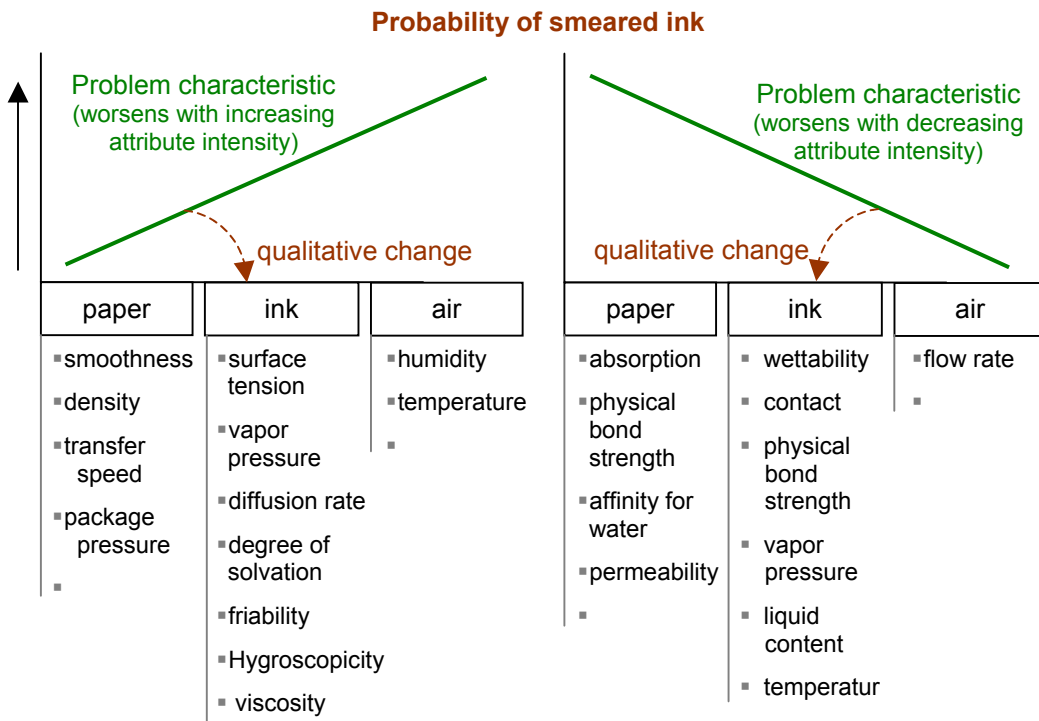


Figure: Two QC-graphs showing attribute trends of paper, ink, and air, supporting the probability of ink being smeared.

4. Classroom Commentary
5. Problem-Solving Tricks and Related Miscellany
<b>6. Feedback</b> This from News Letter reader (M.S.): “You assure us there will be no test on QC graphs. That’s not what I’m worried about. I’m worried there will be a vocabulary or spelling test of “words used in recent newsletters”... prestidigitator??? There’s one you don’t see every day... In fact, I’m sure I’ve never seen it before. Looked it up though. Now I can be sure I at least learned one thing from this issue of the SIT newsletter... :-) I’m laughing, in case you’re wondering. Just couldn’t pass this one up. Seriously, thanks for your work in putting these out. It is helping me to learn.”  <b>Response:</b> A word of explanation may be in order (by way of apology). Prestidigitation with cards is a hobby of mine. <b>A note:</b> I started to be cute and call M.S. a “gruntled” reader, as opposed to being a “disgruntled” one. Then I discovered that my English dictionary hasn’t heard of “gruntled” – so, I learn too. <b>[Update:</b> My two-volume Oxford English Dictionary does have gruntle – “1. To utter a little or low grunt. Said of swine, occassionally of other animals; rarely of people.” Now I’m embarrassed. I think I’d better drop it.” ☹ ]
7. Q&A
8. Other Interests

Please send your feedback and suggestions to [Ntelleck@u-sit.net](mailto:Ntelleck@u-sit.net)

**To be creative, U-SIT and think.**