U-SIT And Think News Letter - 16

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_15 completed a brief discussion of dimensionality as a problem-solving technique. In this lecture we consideration the distribution of functions among closed-world objects.

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

3. Mini USIT Lecture – 16

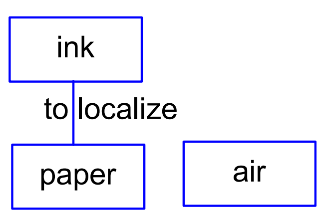
Distribution as a Solution Technique

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

Distribution of functions, as a technique for generating solution concepts, is the topic of this mini-lecture. We actually began preparations for this exercise when we constructed the closed-world diagram. There we identified the single, most important function of each subordinate object in our problem's closed world. In our continuing quest for unusual perspectives of a problem situation we now turn to distribution. Here the idea is to move the supportive functions to other objects of the closed world and see what ideas come to mind. All permutations of functions among the closed-world objects are available for scrutiny.

This exercise makes evident an advantage of having a minimal set of closed-world objects and having selected a single supportive function for each subordinate object. Consider the daunting task of examining all permutations of all possible functions of a set of objects without having reduced both the number of objects and the number of their functions.

The three objects of the smeared-ink problem, ink, paper, and air, produced this simple CW-diagram:



To use distribution for creating solution concepts we move the supportive functions to all of the other objects, one at a time. Then, in the case of the messy ink problem, we ask the questions: "How can air localize ink? And, how can ink localize ink?" Mentally wrestling with these concepts can be productive in surprising ways.

How can air localize ink?

If we simply think about this specific question and search intuitive answers we will see, one after another, complications and messes made by air blowing ink to unwanted locations. This is an excellent place to employ generification of object names. In so doing we will have immediate focus on what matters; namely, localization attributes of two fluids, one a liquid the other a gas. And we can begin to understand the phenomenology of localization. However, we will start by understanding, in generic terms, the function as displayed in the CW-diagram above.

How can a solid localize a liquid?

Examination of the attributes of the objects that support localization can be looked upon from two perspectives: specifically from that of 1) the pairs of attributes of ink and paper that support localization of ink, and generically from that of 2) the pairs of attributes of a solid and a liquid that support the localization of the liquid. Pairs of attributes that assist the localization of a liquid on a solid are listed in Table (1). (*) The desired configuration of localized liquid is a thin, patterned coating of liquid on a solid (a generic model for newsprint).

	Liquid's Attributes	Solid's Attributes	Phenomenology
1	viscosity	inertia	Viscosity supports application of liquid in a thin layer while solid's inertia reacts the normal component of fluid flow but allows lateral flow – one degree of localization.
2	dipole	dipole	Dipole-dipole interaction is the basis of weak van der Waal's force of electrostatic attraction between two molecules – one degree of localization from bonding at the liquid-to-solid interface.
3	surface tension	surface tension	Patterned hydrophilic regions, for example, on a solid can attract water molecules in a liquid forming a pattern of liquid on the solid – two degrees lateral localization. Surface tension also affects thickness of the patterned liquid as surface tension minimizes the surface free energy of the localized liquid.
4	surface tension	porosity	Porosity of solid that is accessible to liquid localizes that liquid, which penetrates the porosity – three degrees of localization (see 5).
5	viscosity	porosity	Viscosity must be low enough for surface tension to wick liquid into solid's porosity (see 4).
6	viscosity	compressibility	Pressure between liquid and solid, during application of viscous liquid, may compress the solid producing a permanent impression thereby providing "containment walls" to restrict lateral flow of liquid – two-degrees of localization.

8	surface tension	surface tension	High liquid surface tension would support formation of small droplets resting on the solid – two degrees of localization.
9	dispersion	inertia	Dispersion of small droplets on solid would minimize the area they could cover while spreading during application of pressure – two degrees of localization.

As you read the identified pairs of attributes, and discover your own, it likely occurs that solution concepts come to mind. Here are my ideas:

From Table (1.3), [33] increase the density of color particles in ink to minimize the thickness of ink needed, which speeds drying and lessens the chance of smearing at a later time.

From Table (1.4), [34] locally swell the surface region of paper prior to applying ink.

From Table (1.5), [35] use low viscosity ink to wick ink into the paper's pores and to minimize the applied thickness of ink.

From Table (1.7), [36] apply sharp impulses between ink and paper during inking (ink and paper are sandwiched between rollers during inking). And compose ink as a dilatant liquid.

From [36], [37] install a post-inking pair of rollers to apply sharp impulses after ink has partially dried.

One idea is to take spreading to an extreme and use it as an advantage. From Table (1.8 and 1.9), [38] Apply viscous ink in small droplets separated sufficiently for the pressure-spreading of ink to fill the droplet-to-droplet spaces thus reducing the amount of excess ink and shortening the drying time.

Solution concepts [34 – 37] are based on paper localizing ink. Concept [38] has ink localizing ink by being spread into contact with neighboring droplets. Optimization of this effect for minimal ink thickness is affected by applied pressure and ink viscosity. This idea occurred while considering solid localizing liquid. Now lets look at gas localization of liquid.

How can a gas localize a liquid?
Again, we try to identify pairs of attributes that could support localization of liquid. Two that come to mind are shown in Table (2).

	Liquid's Attributes	Gas's Attributes	Phenomenology
1	composition	composition	Gas could react with liquid to increase liquid's surface tension – two degrees of localization.
2	vapor pressure	temperature	Pre-heated gas could increase the evaporation rate of liquid, reducing its tendency to spread on later application of shear forces.

[39] Apply a gas having a reactive component to react with liquid and increase its surface tension to "hold liquid in place".

Note the different emphasis on attributes being used in the above tables. Earlier analyses of functions and their supporting attributes were directed toward unwanted effects. Here we search attribute pairs for beneficial functions by examining the CW-diagram. Recall that the CW-diagram assumed the system worked properly. The generic exercise enables us to unfold fundamental phenomenology that then stirs our imagination for new insights.

You may question the credibility of the phenomena suggested in the tables – I do! These ideas are sudden impressions of the moment and are recorded for the sole reason of their plausibility (to me). My theory is that we, as professional technologists, can trust our intuitions – to a degree. Therefore, we gain speed of analysis and discovery of solution concepts by rapidly recording our intuitive ideas. We apply the sole restriction of allowing no whimsical ideas; ideas must plausible to their originators. Every solution must be subjected to credibility tests after completing the USIT program. Credibility tests may require literature searches, discussions with experts, mathematical modeling, and laboratory investigations. In team applications of USIT there is a built-in advantage (or disadvantage) of immediate scrutiny of every proposed solution concept by the other team members (even though we try to throttle filtering of concepts during USIT).

The depth of analysis achieved in deducing phenomenology is a personal matter. Push your memory to its limits to dredge useful ideas, but don't worry about not knowing the names of phenomena (you can research them latter). It seems to me that knowing that a large, black, white-headed bird can flip over on its back momentarily while in flight to show its menacing talons to ospreys diving on it, while protecting their rookeries, is more useful than knowing its name to be a bald eagle. [That stunt, by the way, strikes me as a closed-world solution to an unwanted effect – smart eagle.]

(*) Attribute pairs are listed in the order in which they came to mind.

5. Problem-Solving Tricks and Related Miscellany

6. Feedback

7. Q&A

8. Other Interests

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 for the proper amount, drawn on a US bank, to Ntelleck, LLC, P.O. Box 193, Grosse Ile, MI 48138 USA

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

To be creative, U-SIT and think.