U-SIT And Think News Letter - 15

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.

Updates and Commentary

Dear Readers:

- Mini-Lecture_14 completed a brief discussion of the problem-solving technique pluralization. Dimensionality is discussed in this lecture.

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

3. Mini USIT Lecture – 15

Problem Solving Techniques – Dimensionality

The solution technique pluralization, involving multiplication and division, was discussed in the last two mini-lectures. This lecture will take a look at the technique **dimensionality**. These two techniques are being discussed in reverse order from that shown in the USIT flowchart. This is by intention to stress that the order of using solution techniques is your choice.

Dimensionality

While pluralization focused on objects dimensionality focuses on attributes. Attributes become tools for finding solution concepts by the simple process of activating and deactivating them (turning them on and off) to see what new functions may become accessible. The attributes of interest are those active and inactive attributes that characterize the objects in our closed world. Note that, if an object has only one attribute active and you deactivate it the object no longer exists, so remove it.

The table (p.2) shows active attributes we have thought of. These are potential consideration for deactivation. What attributes have we not thought of? These might be activated.

It is a useful exercise, at this point, to make a quick listing of those non-activated attributes we can think of. The idea is simply to list attributes you associate with a particular object. It doesn't matter whether the attribute has any relevance. Later we wrestle with relevance in the process of searching useful functions supported by newly activated attributes. This exercise (mentally wrestling with relevance) can spark new ideas. My first ideas are listed in the second table (p.3).

Attributes discussed so far are listed in the following table:

Recognized Active Attributes			
	Paper	**Ink**	**Air**
1	smoothness	surface tension	humidity
2	density	vapor pressure	temperature
3	transfer speed	diffusion rate	flow rate
4	package pressure	degree of solvation	
5	absorption	friability	
6	bond:	hygroscopicity	
7	• physical strength	viscosity	
8	• surface tension	wettability	
9	• chemical activity	contact	
10	affinity for water	bond:	
11	permeability	• wettability	
12	hydrophobic	• surface tension	
13		• chemical affinity	
14		• physical strength	
15		vapor pressure	
16		temperature (low)	
17		“smear ability”	
18		saturation	
19		wetness:	
20		• too wet	
21		• drying rate	
22		• vapor pressure	
23		• temperature	
24		• solvation	

When I wrote tear strength for paper (p.3) I was thinking of tearing out the crossword puzzle from the daily newspaper. Thinking of the process, I wondered how cellulose fibers are bonded to each other. Since paper is made from a cellulose fiber and water slurry, the surface of cellulose fibers must have an affinity for water and the adsorbed water must play a role in bonding. [28] If the outermost region of paper had slightly less than required water content, the applied ink could be involved by supplying some of its excess water, to make up the need, in local bonding of ink to paper and fiber to fiber. This would tie up some of the water and remove it from consideration for future smearing. This idea differs from paper density issues discussed in the last newsletter.

Viscosity brought to mind liquid shear rate, which triggered recall of a recent email conversation with Dr. Craig Stephan regarding thixotropic fluids – one of several non-Newtonian fluids. A non-Newtonian fluid brought to mind dilatant and rheopectic behaviors. Dilatant fluids have viscosities that increase with shear rate. [29] Compose ink as a dilatant fluid to deter its smearing except for slowly applied “smearing” type shear. A rheopectic fluid viscosity increases with both duration and rate of shear. [30] Compose ink as a fluid having rheopectic properties to deter smearing.

Ink color, as needed to contrast with the background paper’s color, is an active attribute. If deactivated, contrast would still be needed. But how could it be generated if ink had no color? An obvious solution (from the days of thermal printers) is to have the contrasting color preinstalled as a latent, thermal-sensitive attribute of paper. Then local application of heat can bring out shaped,

Inactive Attributes			
	Paper	**Ink**	**Air**
1	electrical conductivity	electrical conductivity	electrical conductivity
2	thermal conductivity	thermal conductivity	thermal conductivity
3	hardness	non-Newtonian flow	specific heat
4	texture	specific heat	
5	tear strength	color (contrast with paper)	
6	cellulose content		
7	fiber structure		
8	specific heat		
9			

contrasting characters. With the object *liquid ink* eliminated, there is none to smear. This use of thermal properties suggests an analog using electrical properties. If the ink were a colloid of ink particles in a non-wetting liquid, the liquid could be brought into contact with paper without sticking to the paper. The particles of ink suspended in the colloid could be made to move to the paper-liquid interface in the presence of an applied electric filed. The field would also assist their transfer from the liquid to the paper. The particles need to be charged or have a dipole moment. [31] Apply an electric field across colloidal ink passing between a roller having a latent image and a roller supporting the paper. Construct the latent image as an image of charges on a dielectric.

[32] Vapor pressure could be used advantageously for depositing dry ink from a colloidal suspension. Apply a thin layer of non-wetting colloidal suspension to the paper and "write" desired characters onto the paper using a laser beam. The localized laser energy will evaporate the solvent only over the area to be printed. Remaining liquid could be drained away. A pre-applied electric field across the layer of colloid would diffuse the ink particles to the paper-colloid interface.

8. Other Interests

Your solution concepts ... please.

Now that we are well into solution concepts, it would be interesting to consider yours also as we go along. This is an invitation to you to send me your solution concepts to be shared with the other readers of this newsletter. In particular, please send your concepts that you derived using the techniques discussed so far. The more different our backgrounds, the more difference we can expect to find in our solution concepts. These differences should be of interest to all.

These lectures are designed to demonstrate the tools and philosophy underlying USIT. They are not intended to be comprehensive, meaning; there is plenty of room remaining out there in "solution space" for your exploration. What have you found?