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Systematic Innovation

e-zine

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Plausible Deniability

(Or: The Point of TRIZ And How To Miss It)

According to many, the single biggest reason why TRIZ has not taken off in any kind of SixSigma like sense is because of the lack of case studies. Or, more specifically, the lack of case studies featuring quantified benefits. The purpose of this article is to explore the possibility that a) there might never be enough case studies to convince people that TRIZ 'works', and b) there might be a better way of thinking about the case studies issue.

With regard to the first of these points, we were recently involved in putting together a large proposal for an automotive company based in SE Asia. During the course of preparing the proposal, we assembled something like around 100 case studies of automotive related cases that we had either conducted ourselves, or we knew other TRIZ providers had done. Not that we were ever going to present all of them; the hope was always that after half or dozen or so, the potential client would get the point. So much for the theory. Two hours into a presentation and we're starting to get that 'wading through molasses' feeling again. The supreme moment arrives when we get told 'ah yes, but these are automotive examples from outside SE Asia. Things are different here.'

Needless to say, we didn't come away with any business. Sometimes there arrives a moment when you have to stick a white flag in the air and say, 'we surrender'. What is the point of trying to counter a suggestion like that? We could have presented a million non-SE Asian case studies and not put across the point. Come to that, we could've presented a million SE Asian case studies from a different company and still lost the game.

Painful as the experience was at the time, it did provoke a major re-think when we dragged ourselves back to the office. The start of that re-think went something along the lines, 'what if case studies was completely the wrong approach?'

Soon after that question arose we started thinking about pleasure-seeking and pain avoidance (July 04 issue) and the concept of 'plausible deniability'. Plausible deniability, if you've never heard the term before, is a phenomenon common amongst managers working in large organizations. The concept works something like this;

1) someone approaches a manager with a proposal that something should be changed
2) the manager is faced with a difficult decision; pleasure-seeking thinking points in the direction of giving the idea a try because there is an opportunity to look like a hero to superiors. Pain-avoidance thinking on the other hand points in the direction of not changing anything, because if something goes wrong, there are going to be questions along the lines 'why did you tamper with a perfectly satisfactory system?' Generally speaking, in most large organizations, pain avoidance tends to dominate pleasure-seeking, and so the manager is likely to err towards the do nothing approach.
3) The do-nothing approach, however, also carries with it the potential of pain: what if someone else (e.g. a competitor) adopts the change idea and it turns out to be a success? In this situation, the questions coming down from above will be things like 'why didn't you see it coming?' or – absolutely catastrophic if news gets out that you turned the idea down – 'what on earth caused you to reject that?'

4) In order to make sure there is a good answer to this potentially career limiting scenario, the manager, therefore needs a plausible explanation for why not adopting the change was the correct thing to do.

Finding a plausible explanation why something should not be done is what plausible deniability is all about. In the case of TRIZ, 'lack of case studies' is used very often as a plausible reason for not doing anything. Imagine the board meeting:

CEO: I've heard talk of TRIZ recently. What are we doing with it?
CTO: We've been conducting a market assessment for some time now. It is our view that there is nothing in it for us.
CEO: Really?
CTO: Absolutely. We've examined our competitors and everyone in the industry, and not one has reported any benefits. There is no evidence that it works from any of them.
CEO: Has anyone internally tried using it?
CTO: Yes. We sent a few people on a two-day workshop. Came back and said they'd enjoyed it, but we can't say we've seen any success with it since they returned.
CEO: Okay. Thanks. Suggest that you keep an eye on things. Just in case.
CTO: Will do.

Almost exactly the same conversation could have taken place between any other two layers of management. The basic idea being that the both layers are driven by the same self-preservation motives. In this kind of environment, the lack of a Jack Welch standing up and saying that they saved $9B – as he reported that GE had with 6 Sigma – is usually sufficient to ensure nothing happens. Let's run the conversation again, but this time assuming that some kind of Jack Welch evidence is out there:

CEO: I've heard talk of TRIZ recently. What are we doing with it?
CTO: We've been conducting a market assessment for some time now.
CEO: I heard that MegaCorp reported $xB in benefits?
CTO: We've been checking it out. The numbers don't seem to add up to us.
CEO: Even so, $xB is a lot of money.
CTO: We sent a few people on a two-day workshop. Came back and said they'd enjoyed it, but we can't say we've seen any success since they returned.
CEO: Hmm. So what are you saying? MegaCorp got lucky?
CTO: Well….
CEO: I think we need to do something.
CTO: But the learning curve…the time… everyone is so busy… the budgets are…
CEO: I know. But $xB. Even if it paid back 10% of that…
CTO: The budgets are committed. There is no slack to pay for…
CEO: We need to give it a proper shot. Come back next week. Give me a plan. Tell me what you need. We need to do something here.

You can perhaps see something like this conversation taking place in half the companies on the planet in relation to 6 Sigma.

Meanwhile, back in the real world, is TRIZ ever going to report such big successes? Actually there are two questions here: Is TRIZ ever going to *create* such big successes and is anyone going to *report* them?

Let's explore the first question first. Is TRIZ going to create success stories? Does it work in other words? The evidence here appears strong that it provides an extremely useful spark at the beginning of the ideation process. The method is highly likely to deliver

general solutions that will eventually trace through to the actual solution. Translating the general solutions into the specific ones, however, absolutely demands domain knowledge; someone in the organization, with a detailed knowledge of the context of the organization, its customers and its market is going to have to make that translation. Put yourself in their position (many of you might already have been there). Did TRIZ create that solution? Or was it you? The smart money is on the likelihood that the answer is that *you* came up with the solution. Take that a half-step further as the story rises up and through the company hierarchy and pretty soon it becomes 'TRIZ wasn't needed; we did it anyway'.

The only likely exception to this phenomenon is if you have something to gain by attributing the success to TRIZ – as the TRIZ consultants and champions have. In which case the first hint of a success carries with it the inevitable scent of bias and 'well, he would say that, wouldn't he'. Even if the story passes this test, when it comes to reporting the success more widely – outside the organization for example – we pretty soon hit a new hurdle: how does the company benefit by telling everyone about their success stories? Doesn't it simply alert their competitors to the fact that there is something they need to be doing themselves? Does that sound like a good idea? Or might it be better, if the method works, to try and keep the information hidden within the company? Answer: don't tell anyone; make it our 'secret weapon'.

Let's return to the 'TRIZ wasn't needed; we did it anyway' comment from the last but one paragraph for a second. Is there any truth behind that statement? Absolutely there is. The two or three or whatever number we are using this month number of patents and other successful solutions that have fed the TRIZ database all came from people who – by definition – *didn't* use TRIZ. Ergo, if they didn't use it, if the solutions came out anyway, then why do we need to bother with TRIZ? Won't the 'TRIZ solutions' come out anyway?

Yes, all the evidence points to the fact that they will. There is a 'but' however. Yes, the solutions will come out anyway, but not in a timescale that is controllable. What we have here is an extreme example of the story of giving a thousand monkeys a thousand typewriters and sooner or later one of them will recreate the works of Shakespeare. Sure 'sooner or later'. Wouldn't it be nice, though, if it could be sooner? Especially in today's competitive environment, where a 2 or 3 month lead is increasingly likely to be sufficient to deliver the all important discriminator between you and your competition.

So how about this as a thought. How about forgetting the idea of case studies as a means of 'selling TRIZ'. How about if we think about the plausible deniability issue and think of a different way of presenting what TRIZ is all about? Some facts to use as a start:

1) TRIZ is the biggest study of creativity ever conducted. Every successful innovation that has ever been can be reverse-engineered and we can show that the solution is consistent with the directions that TRIZ would have presented.
2) Innovation is a traditionally risky business.
3) TRIZ offers a systematic means of pointing us to the successful solution directions. There is, therefore, an alternative to relying solely on 'random' or 'natural' creativity.

And then a question:

If you could chose one, would you rather that you or your competitors had a TRIZ capability?

Let's take this lead and run that conversation between the CEO and CTO again:

CEO: I've heard talk of TRIZ recently. What are we doing with it?

CTO: We've been conducting a market assessment for some time now. It seems interesting, but there's nothing really tangible we can see.
CEO: Interesting?
CTO: We've examined our competitors and everyone in the industry, and not one has reported any benefits. There is no evidence that it works from any of them.
CEO: Would any of them tell us if they had?
CTO: Well... We sent a few people on a two-day workshop. Came back and said they'd enjoyed it, but we can't say we've seen any success with it since they returned.
CEO: Oh?
CTO: It seems complicated. There's a long learning curve.
CEO: What if the competition is using it? Would you see that as a threat?
CTO: Difficult. It could just be soaking up a lot of their resource. Or they could be having some success with it.
CEO: What kind of success?
CTO: Patents most likely. Some process improvement stuff maybe.
CEO: Patents? Isn't that a threat?
CTO: If they're any good, sure.
CEO: So?
CTO: We have the smartest people in the industry.
CEO: I know. But let me ask this so I can understand; if you had to put your money on our people or a competitor using TRIZ, where would you put it?
CTO: I don't know that I'd know how to make a choice
CEO: Do you think we ought to find out?

Summary

TRIZ has a chance of *really* taking off if:

The people using it and the people paying for them to use it both see how they personally benefit ('pleasure seeking')

The people using it and the people paying for them to use it are both reassured that they personally will not lose in any way ('pain avoidance')

The people paying for it do not have any reason not to try it ('plausible deniability').

Beyond The 'Yes, But…' Wall

Strategies For Breakthrough Solutions To Longstanding Problems

It is rare, but not impossible to create a breakthrough solution to a problem in one single inventive step. As previously reported, our patent research has revealed a very strong correlation between the strength of an invention and the number of Inventive Principles deployed by the inventor (Reference 1). Clearly, that research showed, there are strong solution that have emerged through the application of a single Principle, but the more mature an industry gets, the less likely this is to be the case. The focus of this article is the situation where an industry has reached this state and the single-step breakthrough has become an unlikely possibility. Our aim is to identify and attempt to identify and resolve a common psychological inertia problem that seems to occur frequently in these kinds of situation.

We start the story by extrapolating from a well-used analogy of the creative act as a shift from a present situation to a more effective new one – Figure 1.

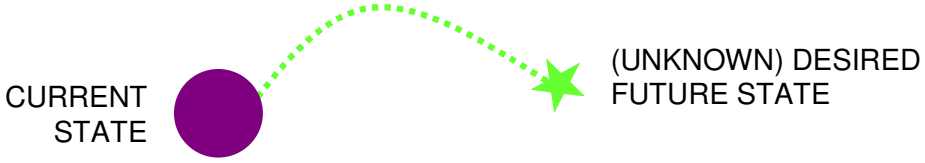


Figure 1: Creativity As Moving To A New State Analogy

When it is the first time we are making an attempt to improve a system then generally speaking the improvement ideas come relatively easily. When the system has undergone a prolonged period of such improvement attempts, on the other hand, further attempts at improvement often find themselves hitting a dead-end – Figure 2.

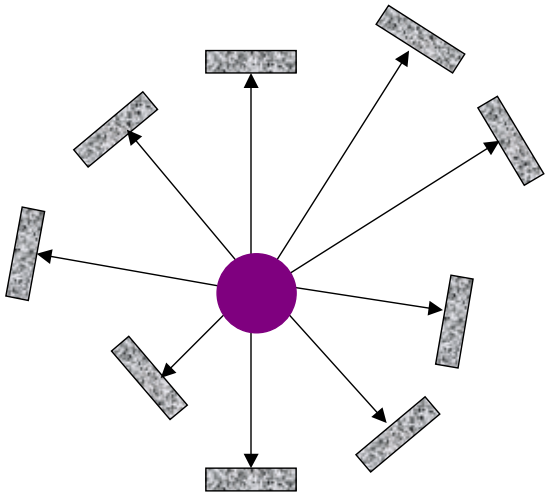


Figure 2: Dead-End Solution Directions

When we find ourselves in this kind of situation, we frequently come to believe that there are no possible solutions. It occasionally happens that if TRIZ is used for a first time during this type of situation, there may be the possibility that one of the solution directions

suggested by the method is not one that has been used on the problem before. Figure 3 presents an analogical model of this fortunate (but, alas rare) scenario – use of a solution direction finds a gap between the dead-end blocks.

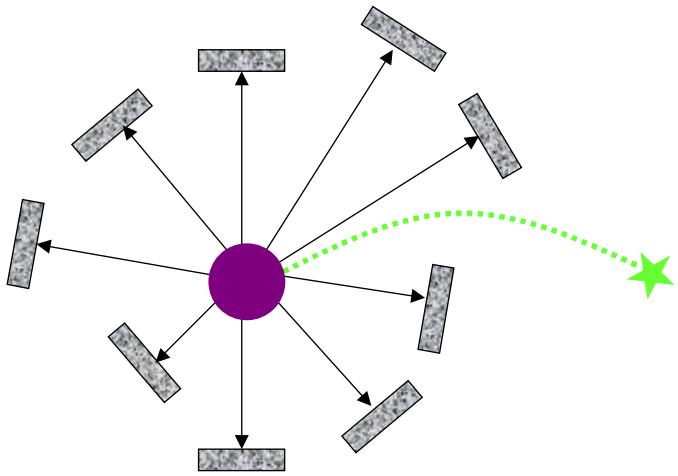


Figure 3: Possible Single-Step Breakthrough Solution Strategy

The more times that TRIZ (or any other solution generation tool) has been tried, however, the less likely it becomes that a single-jump solution will be found: The more attempts we have at improving a system, the more dead-ends we will find, until we reach a point where it feels like we are completely ringed by them. This ringed-in feeling is a common psychological inertia phenomenon. Very often these blocks are experienced as 'yes, but' moments. As has been discussed elsewhere many times before (almost to the point of cliché in some cases), 'yes, but' is one of the most potent killers of creativity. The 'yes, but' solution blocks takes on many forms. Some of the more pervasive include:

- yes, but we tried that already
- yes, but it will be too expensive
- yes, but we can't manufacture it
- yes, but it is someone else's part and we can't touch it
- yes, but we don't do things that way
- yes, but the reliability will be worse
- …and so on

Every one of these blocks may or may not be real. A second psychological inertia phenomenon – a particularly cruel one – likely to be present in these kind of 'blocked-in' situations is that we are more likely to believe the blocks to be real than not.

TRIZ has a somewhat different perspective on these blocks. In TRIZ terms, every one of them represents an opportunity. More specifically, every block we see is the start of the definition of a contradiction; yes, we would like to improve something, but something is stopping us. The psychological inertia problem is likely to tell us that there is no point in even trying. The absolutely crucial point, then, of this article is that quite likely the only way of moving forward when we perceive ourselves to be in this blocked position is to find a way of overcoming one or more of those blocks.

Breakthrough solutions to long-standing problems are very unlikely to come by making a single jump because everyone involved in the problem will have tried making such jumps. The human brain has not evolved to be creative, but it can be creative when the need arises. Unfortunately, although the brain can be effective at making one creative leap, very, very few people find that they are able to make multiple creative leaps in sequence. The strong tendency is to make a leap and see if it works. If it doesn't, then the instinct is

to come back to the start-point and try another, different leap. A far better strategy would be to see where a leap takes you, and to then try and take a second leap from that new position – Figure 4.

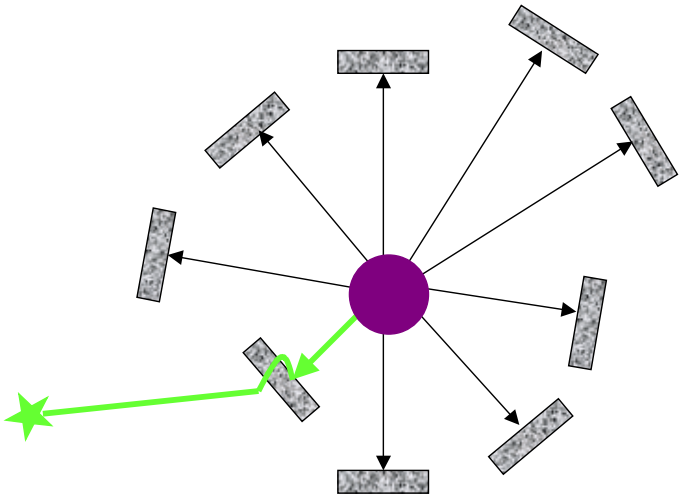


Figure 4: Climbing Over The Dead-End Solution Block

In many ways, this double-jump idea is precisely the same as the contradiction chain idea discussed previously in Reference 2 – solve one problem and another one emerges. The main difference between that chain idea and the message here is the element of time. In the contradiction chain idea, it may well be that there could be several years before there is a need to identify and resolve the new contradiction. The double-jump model described here is describing a situation in which the two jumps effectively have to happen almost simultaneously. In mature, long-standing problem situations, the double jump is probably the only remaining option. You may even need to contemplate a triple- or quadruple jump in some cases. But then that is probably getting too far ahead of ourselves.

Simple summary message number one: just because you hit a road-block, doesn't mean you hit the end of the road.

Simple summary message number two: if it is true that the strongest solutions come from deploying multiple inventive steps, then, in any event, we should try and explore multiple-jump solution strategies.

References

1) Mann, D.L., Dewulf, S., 'Updating TRIZ – 1985-2002 Patent Research findings', paper presented at TRIZCON'03, Philadelphia, March 2003.
2) Mann, D.L., 'Contradiction Chains', TRIZ Journal, January 2000.

Humour – Beer Hammer

Keen Mono-Bi-Poly trend followers may like to know about the new tool-box essential. The ‘beer-hammer’ represents a novel integration of hammer and bottle-opener. Two useful functions in one simple product. A must-have for every amateur DIY expert we feel.

Order yours at http://www.seefred.com/cgi-local/shop.pl/page=beerhammerbottleopener.htm

You know it makes sense.

Patent of the Month

Patent of the month this month relates to conductive polymer materials for application in, amongst other things, microelectronics, optoelectronics and biomedicine. US6,844,567 was awarded on 18 January 2005:

United States Patent **6,844,567**

Talroze , et al. **January 18, 2005**

Conductive polymer materials and methods for their manufacture and use

Abstract

Quantum nanowires are produced in a medium comprising ions, dopants and free electrons, wherein the free electrons are solvated by complexes of ions and dopants. Electrical ***conductivity*** of the quantum nanowires can be higher than for conventional metal conductors. Quantum nanowires can be prepared in linear or circular form, and can be used to manufacture electrical components including transistors, sensors, motors and other nanoscale passive or active devices. Nanoscale devices can be made in liquid, semisolid, or solid media. Methods are provided for the manufacture of quantum nanowires and devices made therefrom. The devices can be used in the manufacture of computers, electronic circuits, biological implants and other products.

Inventors: **Talroze; Raisa V.** (Novato, CA); **Grigorov; Leonid N.** (Novato, CA)

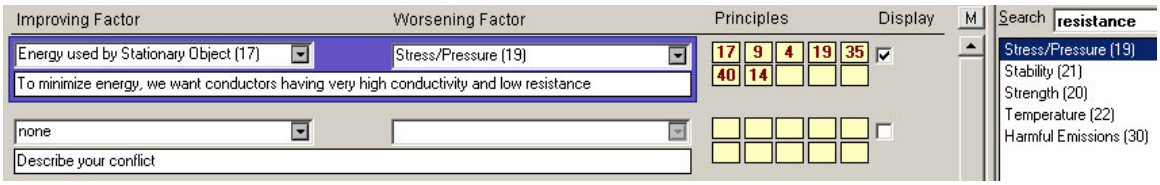
Assignee: **Quantum Polymer Technologies Corporation** (Santa Rosa, CA)

Aside from being an important invention in its own right – offering the potential to literally revolutionise a host of different applications, the invention is also useful as a means of examining how successful TRIZ might be when we shift from the macro to the nano-scale. This is important since there is frequent criticism of the method from those working in the electrical and micro-electronic sectors that TRIZ is 'too mechanical'.

The 6,844,567 invention disclosure describes the main technical issue being tackled by the inventors (and indeed by much of the electronics industry) as follows:

Electrical conductors play fundamental roles in many aspects of modern technology. Technological advances in computers relies upon conductors that have low resistance. The energy required to move electrical current through a conductor is related to the resistance. To maintain operating temperatures, resistive energy losses, including heat, must be dissipated by devices containing conductors. To minimize the energy required and the energy dissipation necessary, it is desirable to provide conductors having very high ***conductivity*** *and low resistance. Because many applications occur at temperatures near room temperature, it is especially desirable to provide conductors that have very high* ***conductivity*** *at near room temperature.*

We might map this energy versus resistance problem into the Contradiction Matrix – actually the 2003 version – as follows:



Perhaps the first thing to note from the figure is the use of the contradiction parameter identification tool at the right hand side of the picture. ‘Resistance’ is as clearly a part of the problem as it is absent from the parameters that make up the sides of the Matrix. The parameter-finder tool has been created to help make the transition from specific words to generic. As may be seen from the figure, several possible interpretations of ‘resistance’ have been identified – the most likely being the one at the top of the list ‘stress/pressure’. This indeed was the parameter then used to look up Inventive Principles in the Matrix.

The center of the figure highlights the suggested Inventive Principles for the problem at hand. The next interesting aspect of this problem comes by comparing the inventive steps made by the conductive polymer inventors and the Matrix. Principles 35 and 40, Parameter Changes and Composite Materials are both clearly present in the invention, but the most encouraging sign that the Matrix is ‘working’ in this case is that the main inventive step made by the inventors involves a shift in the molecular structure from ‘quasi-one-dimensional’ in the prior art to ‘matrix’ in their solution:

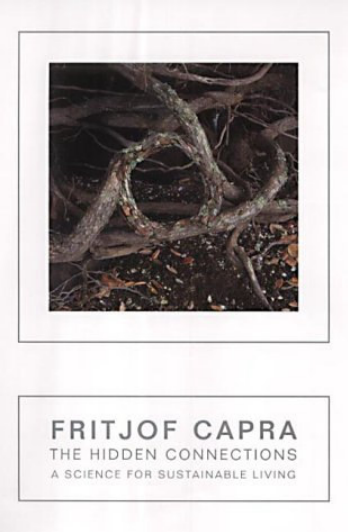
The present invention provides methods of manufacture and polymer materials that form a milieu or "matrix" in which conductive structures known as "quantum nanowires" can form. Polymers that are useful include siloxanes and organic polymers that have ionizable moieties that can form organic ions and free electrons. The invention also can include dopants, including alkali metals such as sodium, potassium and the like. The matrix, dopants and ionizable moieties can form nanoscale structures, herein termed "superpolarons" in the matrix, which include solvated electrons. The solvated electrons need not be bound tightly to the molecular ions, and therefore can be moved through the structure with very low electrical resistance at temperatures near room temperature.

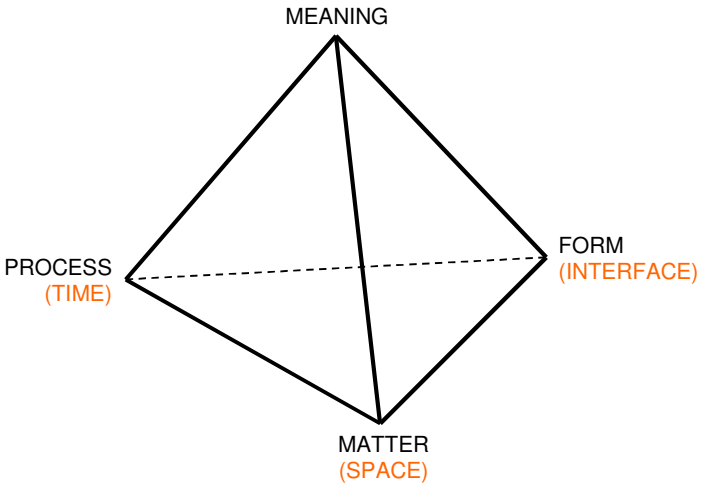
The key inventive step, in other words, involves a shift to another dimension. Or Principle 17.

One nano-scale case study does not mean that TRIZ will always work at this new working scale, but at the very least, we believe it makes a useful starting assumption.

Best of the Month

A leading light amongst the brave vanguard of researchers trying to synthesise a higher-level whole from a wide range of different specializations is Fritjof Capra. In his latest book – The Hidden Connections: A Science For Sustainable Living – he embarks on a roller-coaster ride taking in great swathes of the physical, chemical and biological sciences, human evolution, social science and politics in an attempt to demonstrate that the current way of the world is heading mankind towards the edge of a cliff. While some chapters probably veer a tad too close to a deep-ecological rant (which, however well-intentioned, will inevitably be interpreted by some as unduly biased), overall there is much to commend the structure and story.





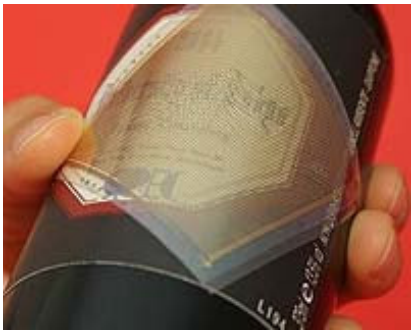
Key among the big ideas found in the book is a holistic model describing a three dimensional model that connects global and human evolution in all of its currently known forms. The three dimensions – matter, process and form – in turn, then, connect to a fourth dimension Capra labels as 'meaning'. The basic model is interpreted in the figure below. Also shown in the figure is the link between Capra's model and the space-time-interface dimensions found at the heart of the systematic innovation method. The overlap between Capra's definitions and those found in systematic innovation is quite profound, and might ultimately come to benefit both pieces of work.

While unlikely that the reader will come away from the book with any kind of 'eureka' insight into the workings of the world, it is quite possible that many will benefit from Capra's helicopter view of the workings of the world. At the very least it is often a good idea to see what such a map-of-the-world might one day look like.

Investments – Flexible Scanner Technology

An image scanner built into a piece of flexible plastic little bigger than a credit card has been developed in Japan. According to the British science magazine *New Scientist*, the idea is that you will plug the scanner into a mobile phone which will both provide power for it and act as its display and storage medium.

Because it is flexible, it will let you copy just about anything, even if it's on a curved surface such as an open book or the label on a wine bottle:



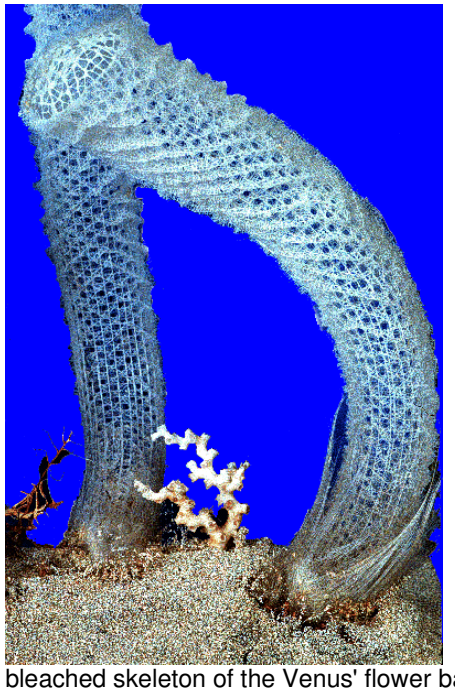
The lightweight device, unveiled at an electronics conference in San Francisco in December, is the latest development in the field of flexible organic electronics, which exploits the electronic properties of conducting plastics. Light-emitting plastics are already being used in flexible computer displays, and organic LED-based TV screens are in development. The new flexible scanner is using light-sensitive organic components instead of light-generating ones. The new device, developed in Japan by electrical engineer Takao Someya and colleagues at the University of Tokyo, comprises a polymer matrix in which thousands of light-sensitive plastic photodiodes have been deposited 700 microns apart beneath a grid of plastic transistors. Each photodiode produces a current in response to light input, which its accompanying transistor stores as a charge. This can then be read into the memory of a mobile phone and converted into an image.

Someya says it could be on the market in three years with sizes varying up to A4. A 7-centimetre-square scanner, small enough to fit in a wallet, will cost about $10, he predicts. He already anticipates making a colour version of the scanner.

This is an invention that holds open the prospect of applications far beyond those described by the Tokyo team in their discussions in the New Scientist article.

Biology – Venus' Flower Basket

Scientists say they have identified an ocean sponge living in the darkness of the deep sea that grows thin glass fibers capable of transmitting light better than industrial fiber optic cables used for telecommunication. The natural glass fibers also are much more flexible than manufactured fiber optic cable that can crack if bent too far. The glassy sponge grows the flexible fibers at cold temperatures using natural materials, a process scientists hope to duplicate; current fiber optic manufacturing methods require high temperatures and produce relatively brittle cable.



bleached skeleton of the Venus' flower basket (*Euplectella aspergillum*) belonging to the small group of glass sponges (Hexactinellida).

While it remains unclear precisely how the Venus' flower basket manages to achieve its extraordinary light transmissibility, the case does represent a useful learning device as far as the systematic innovation methodology is concerned:

Subject a system to an extreme version of a problem and, providing the extremes don't kill it, that will be the system most likely to find the best solution.

Thus, while many systems require to transmit light with a minimum of loss, it is not until you find yourself in the darkness of extreme sub-sea depths that you *really* have to come up with something special. In the case of the Venus' flower basket that 'something special' is a solution that presently defines the state of the art.

See more details on 'Ocean Sponge Bests Man-made Fiber Optics' at - http://www.cnn.com/2003/TECH/08/21/natural.fiberoptics.ap/index.html