Tornadoes and TRIZ.

Using the TAO Design Matrix©™ to produce ideas for stopping Tornadoes

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Abstract

With constant requests to produce a non-technological TRIZ process, even from technology companies, I reworked the sequence of application of TRIZ tools to form the ***TAO Design Matrix***©™. This is a 7 Step iterative process which can be used for problem solving/goal searching for anything from marketing to software production.

As an illustration of the process I have applied it to solving the "Tornado Problem."

If you don't know what the "Tornado Problem" is take a holiday to Kansas!

1. TRIZ and the *TAO Design Matrix*©™

The questions raised again and again by users of TRIZ are: "How do I know when I have built my function map correctly? How many things should I put in it? How many parameters should I consider?"

It occurred to me that maybe trying to build a mind-map of the system was not the first thing to do. An easy starting point is needed. Why not simply list the "Resources" and then build a Matrix for which each of the Resources has a list of parameters (or features or attributes) which you want to consider in your design to solution process?

In order to use the process for "softer" issues like managing people, communication systems, feelings, marketing, brand value, I extend the Resources list options by splitting it into Current, Optional and Fantasy resources. This means you can be as playful as you like when creating a matrix of opportunities and may get past those psychological blocks that sit on our thoughts so heavily.

Through a number of working sessions, including problems to do with marketing and software design, I have developed the 7 Step Process which I have called the ***TAO Design Matrix***©™. TAO can simply be a reflection on "The Way" from Eastern philosophy, or you can think of it as "Thinking Around Objectives". This is explained in more depth in my book, co-authored with David Straker, "*How to Invent (Almost) Anything"*.

The 7 Steps are:

1. List all Resources: the **Current List** (what you have in the current design); the **Optional List** (what you might think of using in your new design); and the **Fantasy List** (some crazy dreams of what you might use – no rules on this list except to leave your mind free to roam).

2. Write alongside each Resource the current parameters that are in any way important. You now have a Matrix.

3. Look through the Resource/Parameter Matrix and identify which Resource/Parameter pairs are the ones which carry Primary Benefits. Highlight these.

4. Test ideas for improving Resource/Parameter Pairing by considering the Ideality equation of the current design.

Which resources should Ideally deliver which parameters, so that secondary functionality is minimised.

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5. Consider the Parameters of each Resource and test them against the TRIZ Trends of Evolution. Which Parameters are least developed in terms of these Trends? Consider developing those which are least developed and offer most in the way of easy change.

6. Now challenge the design requirements with self-generated Contradictions. Take the Parameters which are Primary and tell yourself these must be improved by a factor of 10, or 100, or 1000. Now what is happening to the other parameters if these goals are to be achieved?

7. Return to Step 1 if the Design Solution is not completed.

Note: At some point in the Process you may want to draw a Function Map. But the TAO Design Process can be worked through again and again until you are clear what your Function Map should include. A lot of times a Function Map has not been needed. The TAO Design Matrix has made all design issues clear all by itself.

The other advantages of this process are that it can easily be used for non-technological problems and can easily be changed as you proceed. It is easy to add a column or edit a word.

2. Tornadoes

My interest in Tornadoes came from watching a large Tornado moving across my TV screen. I had been working on aerodynamic issues and it suddenly struck me that I did not understand Tornadoes at all. What made the cow spin around in all that wind? The Hollywood image, and unfortunately some supposedly "scientific journals" (see www.sciam.com) portray it as a raging beast which sucks things up into itself, with all the Freudian images that go with consumption into the mouth of a monster!

But gases, of course, do not suck, they only blow. There is no such thing as negative pressure in gases, only in liquids, yet the negative pressure explanations of Tornadoes always talk about Vortices and suction.

So it occurred to me that we might apply TRIZ to Tornadoes to identify what may really be going on and to see if we could come up with a solution for stopping Tornadoes forming.

Using the ***TAO Design Matrix***©™ I created the matrix with the Resources as ground, air and local buildings.

It is not difficult to realise that the cow is moving around in circles because the air rushing in towards the Tornado is pushing against it.

It was at Step 3 that I realised that the true culprit in Tornadoes was not the near vacuum at the centre of the Tornado but the mass of air that is rushing to the small funnel the Tornado creates. The potential energy in the system lies in the mass of hot air around the tornado, not in the Tornado itself.

The Tornado carries out the function of helping the mass of air "stuck" at ground level to move to a higher level. Looking at the other resources we have around, we can ask why, if we do not want Tornadoes, might not the other resources do what the Tornado does? Maybe some buildings could act as funnels for the moving of the air?

Having flown in a glider and realised the power of the funnel effect when I got lift 1000 feet above a very small bonfire, it

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seemed to me that something was possible if we considered the Parameters of the Buildings that are currently there. If a small fire could create a funnel rising to 1000 feet then what could a tall building do?
Step 4, considering Trends, would suggest that the building shapes we have are not very advanced in terms of asymmetry or general complexity.

Could we redesign at least some buildings so that a more pronounced funnel effect could occur? We might consider the shape and also other parameters, such as the differing temperature of parts of the building. If we allowed heat to accumulate on one side of the building, would this help generate the funnel effect we are considering?

Finally, in Step 6, we seek the Contradictions. Certainly if global warming conditions are to worsen we may be needing to move hundreds of tons of moist warm air all the time. This would certainly call on us building very tall funnels in strategic places to remove air temperature and pressure inversions so that Tornadoes do not occur.

The funnels could also act as power generators, with fans inside to produce electricity. This turns harm into benefit!

Summary
I have used the Tornado example as a simple exercise in the use of the ***TAO Design Matrix***©™.

The Tornado has interested me simply because every explanation I have read on the behaviour of the Tornado is false, based on sucking gases and ideas about walls of gases - generally some of the weakest supposedly scientific explanations I have seen. Tall towers are seemingly feasible, and one is being built in Australia. Maybe modification of buildings is possible I do not know. The Tower in Australia is being built to generate electricity. In the USA it would also at least modify the impact of Tornadoes and maybe eliminate them altogether.

I have explained my ideas to meteorologists who did not dispute the logic and who even commented that it explains why Tornadoes do not hit cities!

Reference
"How to Invent (Almost) Anything", Self-published July 2002, by David Straker and Graham Rawlinson.

Tornadoes, Corys S Powell, Staff Writer, Scientific American, see www.sciam.com

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As a problem solver within educational psychology I moved to become a problem solver in business (as a consultant with Synectics™) and finally a problem solver in technology, using TRIZ, which I introduced to UK companies in 1996.
Along the way I have written television programmes and a workbook for acquiring numeracy skills, have taught in Universities, and have been a Director of Enterprise for the University of Surrey, as well as a boat driver, postman, gardener, and bar manager!

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