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Systematic Innovation

e-zine

Issue 12, January 2003

In this month's issue:

The Systematic Innovation e-zine is a monthly, subscription only, publication. Each month will feature articles and features aimed at advancing the state of the art in TRIZ and related problem solving methodologies.

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.

Readers' comments and inputs are always welcome.
Send them to **darrell.mann@systematic-innovation.com**

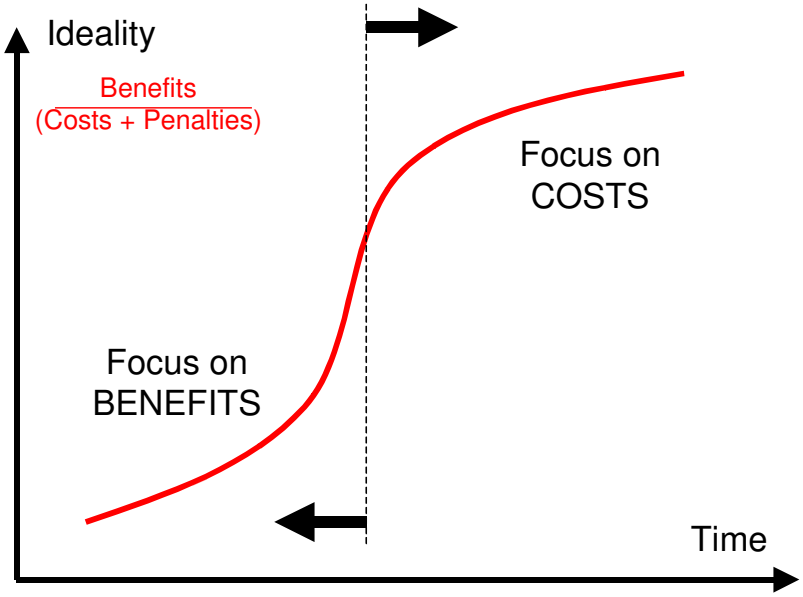
Innovating For Benefits

Introduction

Prevailing logic tells companies that as they mature it becomes progressively more difficult to deliver increased benefits to their customers, and that therefore, the way to remain competitive is to cut cost. In part this logic acknowledges some of the fundamental truths contained in the S-curves of the systems they operate within. On the whole, however, the logic is flawed. Increasing benefits are possible by changing the system.

S-Curve Dynamics

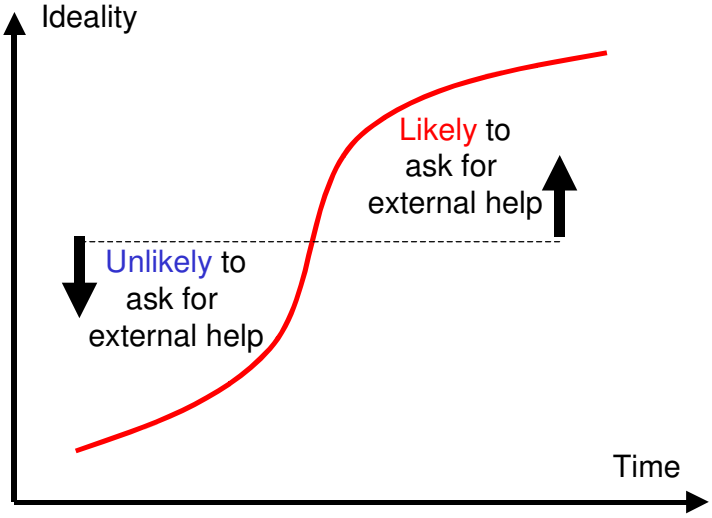
Most people are familiar with the evolutionary s-curve. Anyone familiar with TRIZ will know that it is common to plot the y-axis as 'ideality' – the measure of benefits – or perceived benefits – divided by the sum of the costs and harms in and around the system. As we examine how the focus of activities changes over the course of an s-curve it becomes clear that there are a number of shifts that take place:



The shift that takes place from the numerator of the ideality equation to the denominator is the most evident of these shifts. Put simply, as a system advances along its evolutionary path it becomes increasingly difficult to add further benefits to the system, or, if it is possible, the costs and harms associated with doing so become prohibitive such that there is no net increase in ideality. Consequently, the focus of 'improvement' activities shifts from benefits to costs.

Another characteristic shift that takes place at around the same time as this shift is the one associated with whether or not companies utilize the services of external experts or consultants to help deliver the desired increases in ideality. The first phase of the s-curve is the time when the company, if it is ever going to be successful, is being successful. Common scenarios in this phase of the life of the system are that the biggest problems faced by the company are keeping up with the flow of orders or keeping the benefit stream ahead of competitors. In either case, people know what they are required to do, and they

are so busy doing it that they are unlikely to call in any form of external advice – everything is going well, so why should they?.



In the second phase of the s-curve, where the benefit potential appears to have dried up, and the competitors are hard on the heels, and things start to look rather uncertain, that is the time when it is likely that external 'help' will be called in.

Conventionally, the help that gets brought in is well used to the scenario that the company faces and consequently is prone to offer the same sorts of cost-cutting strategies. Several of the major management consultancies and 'continuous improvement' methods, in fact, succeed by selling (and re-selling) the same sort of advice to many different clients. They often have very big names and very good reputations for successful cost-cutting, and so a self-re-enforcing circle of demand commences – it would be a brave manager indeed, for example, who would be happy to stand up in front of shareholders and declare that they had turned down the opportunity of cutting costs.

Put another way, prevailing logic in the late stages of an s-curve is that if overall performance has to increase by 20%, it is very much easier to achieve it by cutting costs by 20% rather than increasing customer benefits by 20%. The first is predictable; the second comes with the implication of significant risk and a related inability to 'prove-it'.

We mention this phenomenon because we have worked with several clients in recent months who have been the subject of this kind of self-re-enforcing circle. It is a circle that looks to us very much like a vortex of psychological inertia. The whole thing being built on the assumption that cost cutting is the right and only possible strategy in the late phases of an s-curve.

This assumption gets made because of one of two parallel assumptions; the first that because there has been so much focus on finding benefits that all of the possibilities must have been explored, and the second that it is not possible to change the system.

What we have found in every one of the case studies we have been involved in, is that both assumptions turn out to be incorrect. The assumption that a company has explored 'all' the benefit possibilities is wrong because they have not been aware of the breadth of the TRIZ tools and their specific ability to find new (and better) ways of doing things. The second is assumption is wrong – or rather wrongly perceived – because systems are

made up of a whole hierarchy of different s-curves, and ‘changing the system’ might in fact merely mean changing a sub-element of a sub-system of the system.
It is very difficult for us – as TRIZ and systematic innovation method advocates – to suggest that the big 5 management consultants are wrong, or that all of the world’s cost reduction strategies are wrong, and that we are right. All we humbly suggest is that if you find yourself in a company that is calling in external help to ‘improve the system’, don’t automatically assume that cost cutting is the right or only way forward. Very often either will serve only to accelerate the decline of the system. Nobody achieves substantial, long-term business success by cutting costs. The ideality equation has a numerator and a denominator. Effective companies keep focusing on the benefits. Even if it means changing the system (or one of its constituent parts) once in a while.

The Ideal Contradiction Matrix

The recent announcement of our collaboration with Ideation on the production of an expanded and updated version of the technical contradiction matrix plus the ongoing creation of our matrix specifically aimed at software applications plus the expanding use of our matrix for business problems has prompted a number of questions about our longer term strategy.

What we are in fact experiencing with this apparent proliferation of Matrices is one of the fundamental trends described within TRIZ – that of increasing complexity followed by decreasing complexity. Or rather increasing number of components followed by decreasing number of components (see Reference 1 for more details on why the difference between these two is important). The increasing number of Matrices, then, is simply a system in the first half of the trend – Figure 1

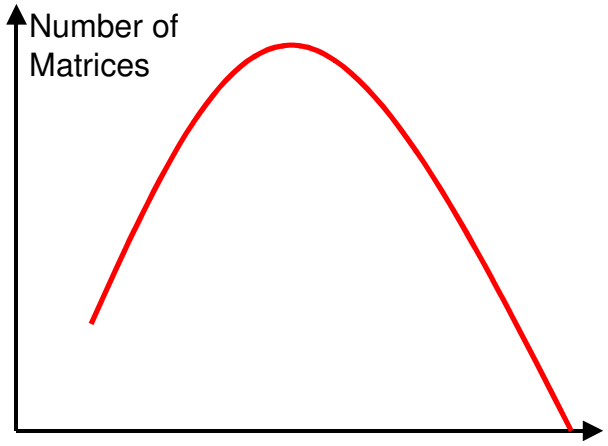


Figure 1: Number of Components Trend in Relation To TRIZ Contradiction Tools

Why do we expect this characteristic to be relevant to the evolution of the Contradiction Matrix? There are several answers to this question. The first relates to the needs and desires of users of the Matrix: for a long time, the classical Contradiction Matrix has been viewed as a 'good enough' or 'sufficient' tool (albeit some TRIZ researchers have since walked away from the concept completely). But then when the business community began to become interested in TRIZ, it very quickly became apparent that the conceptual elegance of the Matrix was not matched by its relevance to typical business situations. This phenomenon was the main spur for us to create the Business Matrix. Subsequently, we have seen similar problems in the software development sector; here too, people have been attracted to the conceptual elegance of the concept, and then disappointed when they find it difficult to relate their particular problems to the generic parameters contained in the Matrix. As a consequence, we have also taken it upon ourselves to construct a matrix tailored specifically to the needs of the software sector (Reference 2).

While not being 'new' in the same terms, we are also expecting the Matrix concept to expand further when other sectors (and in some instances, individual companies) ask us to produce a bespoke Matrix for a particular field. In the majority of cases, these bespoke Matrix tools will be subtle variants on the technical, business and software Matrix tools with parameters reframed in the terminology and jargon of a client. In other cases, we will simply be deleting lines from a Matrix in order to take-out parameters that are considered

irrelevant to a given type of situation (the legal sector, for example, has generally speaking very little interest in R&D, at least not in those words).

It is important to recognize, of course, with any of these specialized matrices, that we are not trying to filter out the ability of TRIZ to transfer ideas from one sector to another, but merely to make it easier for users to translate their specific problem into the generic problem – Figure 2. Beyond that, it is the job of the Matrix to identify the best generic solutions from across all fields that may be used to help solve the specific problem at hand.

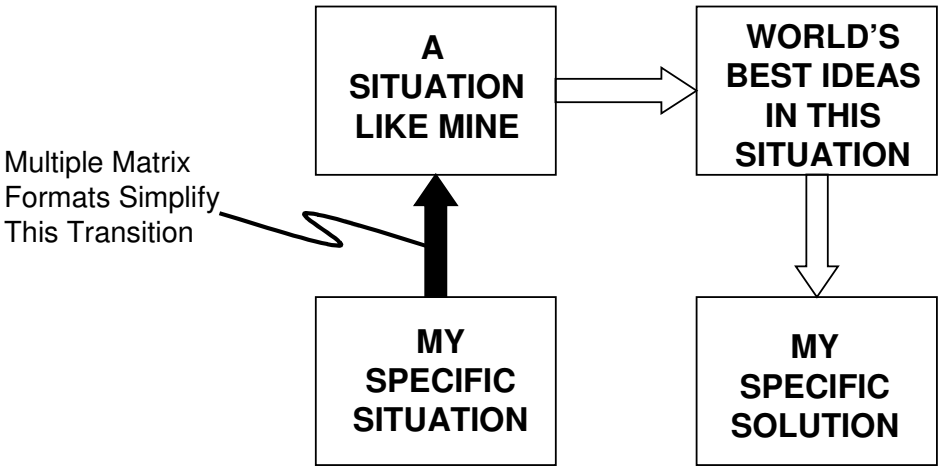


Figure 2: Multiple Matrices Help Make the Transition From Specific To Generic Problem

So then, what about the second half of the component count trend curve? What about the ideal Contradiction Matrix? The ideal Matrix is the one that presents the users with the best generic solutions without the Matrix actually having to exist at all. At least it should not exist as far as the user is concerned. In effect, the Ideal Matrix would offer the shortcut illustrated in Figure 3.

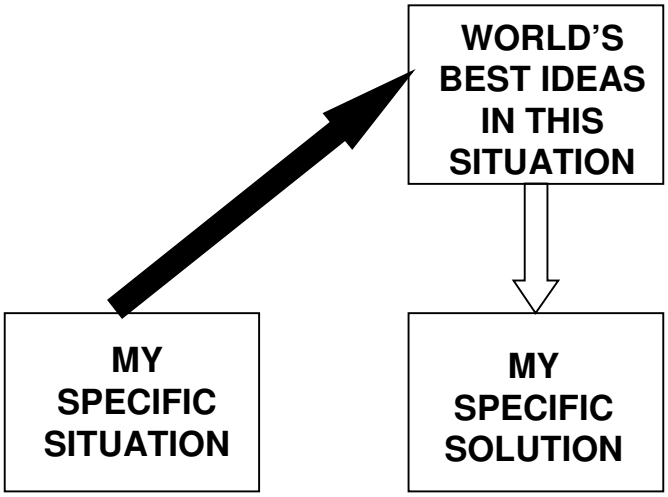


Figure 3: The Ideal Matrix… Is No Matrix

We are beginning to see the emergence of this Ideal Matrix in our 'Contradiction Finder' tool. You will find a free version of this tool on the CREAX website as well as inside the latest versions of CreaTRIZ – Figure 4.

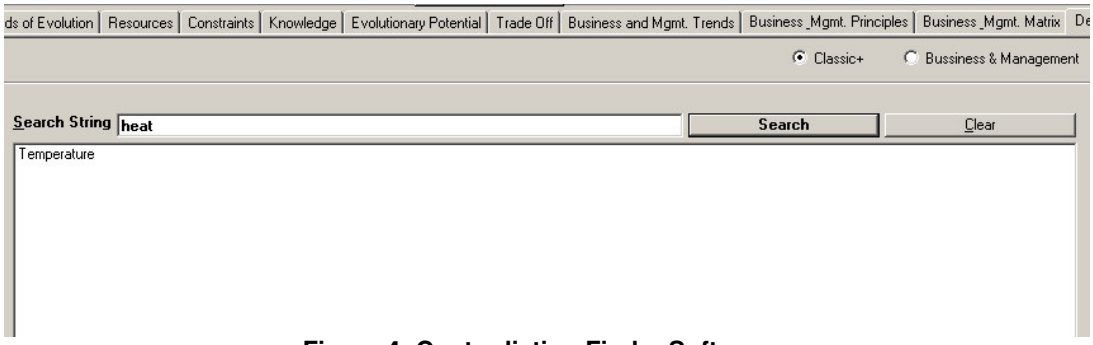


Figure 4: Contradiction Finder Software

The basic idea behind the Contradiction Finder is that eventually users of any background will simply be able to type (or by other means!) their problem in their own language and jargon and the method will provide the most appropriate generic solutions – whether they be Inventive Principles, Inventive Standards, Trends of Evolution or Knowledge/Effects.

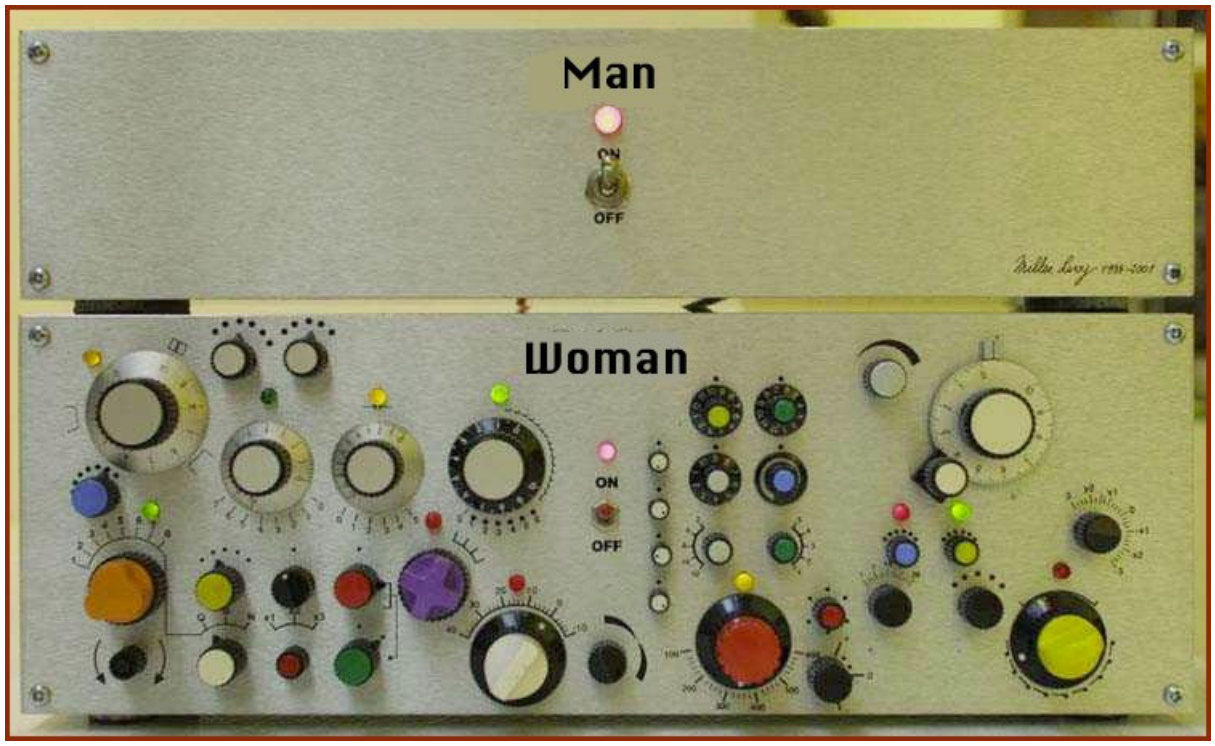
So why not just go straight to this ideal final result you might be asking? The answer lies in the fundamental phenomena underlying the increasing-decreasing complexity trend. It is simply that without working having worked out the 'right' routes from specific problem to right generic solution, it is not possible to eliminate the Matrix. Put another way, it is only by acquiring the data to populate the various different Matrices that we will acquire sufficient data to ensure we are making effective recommendations when a user types in their problem. The proliferation, to put it yet another way, is an essential requirement along the road to a more ideal system.

References

1) Mann, D.L., 'Complexity Increases And Then…', TRIZ Journal, January 2003
2) Mann, D.L., Dewulf, S., Hey, J., 'Contradiction Matrix for Software Developers', paper to be published, destination unknown at this point in time.

Humour

One of nature's more interesting examples of Asymmetry…



Patent of the Month

Not much contest this month when it came to choosing our favourite. Another patent that has emerged from research we have been tracking for some time – in this case the work of Professor Leik Myrabo at the Rensselaer Polytechnic Institute in Troy, Michigan, who's has been working on wildly alternative means of propelling vehicles into space for some considerable time now. The patent – US6,488,233, granted on December 3 – might sound a little bit too good to be true, and it would be if it weren't for the fact that Professor Myrabo has already flown scale models. Irrespective of whether the laser technology in the invention can ever be scaled up to full-size (Professor Myrabo suggests it can), we think it has massive potential for a wide variety of other roles.

The patent abstract is described below:-

United States Patent ***6,488,233***

Myrabo **December 3, 2002**

Laser propelled vehicle

Abstract

Provided is a laser propelled craft having a) a forebody or nose, b) a tapering parabolic afterbody optic or mirror, c) a shroud mounted therebetween and extending aft to define an annular space around a portion of the afterbody near its base and d) means to transmit a pulsed laser beam toward the laser craft and afterbody optic and thence to focus into the annular shroud. The laser beam is pulsed to heat and pressurize the air in the annular space to expand same and propel such craft, the afterbody and shroud being so shaped as to self center or remain in the laser beam as the craft is propelled thereby. Such craft, which is spin-stablized, can also carry a fuel insert ring mounted in the shroud around the afterbody, to be ablated by the laser beam at a desired altitude, so as to transition from an air breathing craft to a rocket craft, when the atmospheric density becomes too low, e.g., at 30 km altitude so that the lasercraft can thereafter be propelled into, e.g., low earth orbit.

Inventors: **Myrabo; Leik N.** (Bennington, VT)

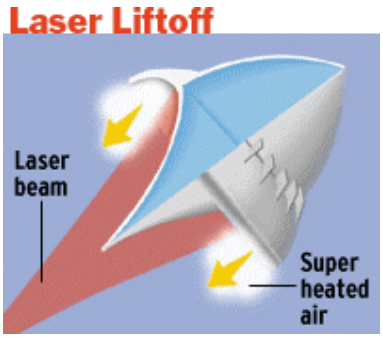
Assignee: **The United States of America as represented by the Secretary of the Air** (Washington, DC)

One of the main reasons we like the invention is that the thinking has started from a very ideal-final-result-like perspective. The thinking starts from a hypothesis that the current chemical rocket propulsion system concepts are extremely expensive (typically costing between $2,500 and $12,000 a pound to reach low-earth orbit), and that, with the best will in the world, the possible improvements to the concept are unlikely to give improvements in performance better than a factor of two.

Rather than being satisfied with this level of improvement, the laser propulsion concept emerged from a start-point based on a desire to improve performance by several orders of magnitude rather than a factor of two.

The great beauty of this kind of start point is that it forces inventors to think out of the box. In instances where the current technology is so expensive and/or so inefficient (and

chemical rockets are absolutely that – payload fractions being miniscule on craft like the Space Shuttle and Ariane), it is difficult, in fact to see the sense in incremental improvements. Focusing on fractional improvements leads to 'better chemical rockets'. Focusing on a requirement for a 1000 times improvement firmly tells us that chemical rockets cannot provide the answer. Focusing on a 1000 times improvement forces us to think about radical solutions like 'not carrying any fuel'… which is essentially what the laser propulsion system does.

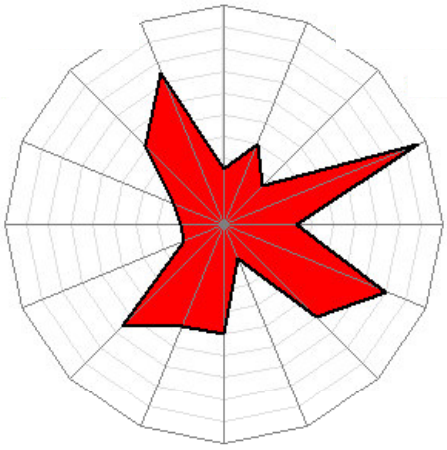


In simple terms the system works by firing a laser at a strategically shaped forebody – see Figure below – and using the heat generated by focusing the laser energy to heat air (an existing resource in the system!) which then expands out of the rear of the craft to provide thrust. Essentially the system achieves a much higher payload fraction because the atmospheric air is the propellant.

The main TRIZ learning point from the invention: If you are looking for improvements of several orders of magnitude, you can be fairly certain that the current method of doing things is not going to deliver, and that you need to be thinking out of the box.

Readers interested in the TRIZ trends will also note that the propulsion system represents a definite jump to the use of fields (always a good direction to travel), and that the laser is pulsed rather than continuous. The invention disclosure also talks about a self-stabilising system – and we always like systems that incorporate the word 'self'.

As a matter of final interest, the evolution potential plot for the design described in the invention disclosure looks something like this:-



In other words, still plenty of scope to evolve the system still further. Watch this space!!

Best of the Month

Sorry, but apart from the TRIZ and NLP article we co-wrote with Denis Bridoux in TRIZ Journal this month, we couldn't find anything that we thought warranted your time. We're ploughing our way through the excellent but highly unreadable book 'Evolutionary Trends' edited by K McNamara, but think that you might prefer to wait until we've distilled out the best parts rather than give yourself a headache.

Investments – Motion Dampening

This month we re-visit materials capable of solving physical contradictions. As previously suggested, adaptive materials – such as shape-memory alloys – allow us to solve physical contradictions by making it possible to achieve two or more different states. This month we look at electro-rheological fluids. This exciting class of physical contradiction solvers has been around for some time now without really hitting a major application. We think that might be about to change.
Electro-rheological fluids offer the potential to help in any situation where we are looking for things to be both rigid and flexible, viscous and non-viscous. The application described here is for vehicle suspension systems; we hope you can think of other possible instances where stiffness and flexibility properties would be useful.

Patent Abstracts With Claims and Drawings
Variable Motion Dampener 5,497,861
Helical Motion Dampener 5,590,746
Status of Project: Seeking Licensees
Availability of License: Exclusive
Working Prototypes: Basic two electrode rubber tube model constructed
Summary of the Technology:
This technology utilizes electro-viscous fluids to accomplish motion dampening through the direct application of electrical current. Electro-viscous fluids are fluids that vary their viscosity proportionately with an electrical current that is being passed through them. The unique approach makes use of elastomeric or flexible chamber walls in combination with electro-viscous fluid and may be combined with an electronic controller for instantaneous programmable or feedback viscosity change. The system can take on numerous custom engineered designs.
Potential applications/industries/markets/products:
Heavy off road seating and suspension systems
Over the road truck/automotive seating and cab suspension systems
Industrial machinery motion control, stamping presses
Feedback dampening control for optical benches
Active dampening for servomotor dampening (acceleration /deceleration)
Vibration testing systems
Total floor dampening for instrument rooms
Bumper systems for vehicles / parts conveying
Aircraft arresting systems
Dampening for rotating shafts
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Letter To the Editor – TRIZ and Jet Lag

[Time Travel] Experiment into Jet Lag and time zones

During my time in Canada recently I worked with a colleague in the UK for a number of days. In order to make working easier I decided to revert to UK time, to enable us to work simultaneously using the Messenger chat facility. This decision was also stimulated by my tired condition on the first day of our workings, following an importune rather late night out.

Therefore in order to change time zones I went to bed at 5:00pm local time and attempted to sleep until 12:00am. This first session of sleep was however highly interrupted with hourly glances at the clock. Upon eventually awakening I felt nearly as bad as when I had gone to bed, but I managed to drag myself up and meet with my colleague, much to his surprise, at 8:30 UK time. Despite this poor start and a number of tired stages during the day everything went pretty well. This was thanks in part to a number of tricks I played on myself during the day to fool my body into thinking that all was right in the world. These included:

- Changing all the house clocks to UK time, including my watch
- Turning all the house lights on during the supposed hours of daylight and keeping curtains closed when it was dark
- Listening via the internet to UK radio programs known to be on at certain times of the day
- Chatting to people in UK
- Eating meals on UK time
- Attempting to avoid thoughts about the actual time

Also during this period I read an article concerning TRIZ and jet-lag (CREAX October Newsletter). This suggested gradually changing the time on ones watch over a period of time to aid the transition. Following this advice, when it came to returning to local time, I altered my clock in stages changing the odd hour here and there, when I felt most active, usually towards the end of the day. This technique seems so far to have worked successfully although I still have a number of hours still to gain.

In relation to the article there are a number of comments I would like to make. Firstly, the use of asymmetry is suggested to which my experience wholeheartedly agrees. Secondly, the article mentioned only changing the clock during periods of consciousness. Although I realize that this was due to the difficulty of changing ones clock whilst asleep I would suggest an improvement. If a system could be devised which automatically changed ones clock during unconscious periods (even during right brain concentrated activities, like drawing, during which the brain has no ability to measure time, Edwards 92) the brain could be further fooled.

This, it would seem, is certainly an area the former power giants British Airways or the future owners of American Airlines might wish to consider, if they are to stave off the heavy competition from the low cost airlines who now compete in every other department. With that thought in mind, I am off to change my clock again as I am presently the only person on the planet, with the possible exception of a few fisherman, to be on Mid Atlantic time! Good day / night.

References: [Edwards 92, Drawing with the right side of the brain.]