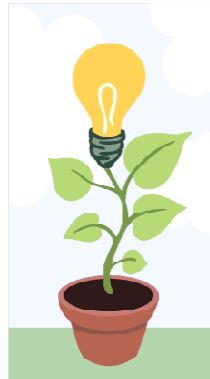


National Changhua University of Education



2013 工程創意與設計 Creative Engineering Design

工程與生活

國立彰化師範大學
機電工程學系 王可文 編Prepared by Kerwin Wang
Department of Mechatronics Engineering

工程發明的精神

- Engineering is the **discipline, art, skill** and profession of acquiring and **applying** scientific, mathematical, economic, social, and practical **knowledge**, in order to **design and build** structures, machines, devices, systems, materials and processes that **safely realize improvements to the lives of people**. -Wiki- English

• **工程學或工學**即「應用**科學**和**技術**的原理，來解決問題」。工程師通過想像，判斷和推理，將**科學**、**技術**、**數學**和**實踐經驗**應用到**設計**、**製造**、對象或程序的操作中。在學校中，將自然科學原理應用至工業、農業各個生產部門所形成的諸多工程學科也稱為**工科**或**工學**。

-Wiki- 中文版

工程發明與五明

五明（梵文 pañcavidyā）源於古**印度**婆羅門傳統，後被**佛教**接受，指五門學科。《**瑜伽師地論**》卷38說：五明是「一切菩薩正所應求」。

經云：「菩薩學處，當在五明學處。」；亦即成為一位菩薩，必須通曉五門基本的學識。何謂五明？即聲明、工巧明、醫方明、因明、內明。茲簡述如下：

聲明：語言學、訓詁學等。

工巧明：家務、藝術、科學、農業等。

醫方明：醫學、藥學乃至禁咒等，可以醫治別人色身病苦，拯救眾生。

因明：邏輯學，可以藉此辯證真理。

內明：佛法之修學，即對佛理的理解，可以幫助自己修行，亦有利開悟他人。

精通五明的學者，可以享有**班智達**的稱號。

-Wiki-



一種哲學？
一種信仰？
一種盼望？
一種……？

Creative Thinkers



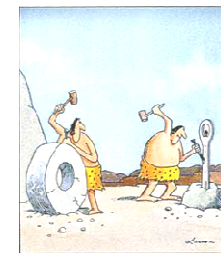
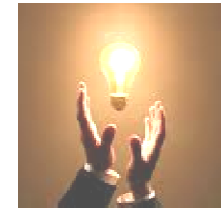
Design Philosophy



Funny Inventions

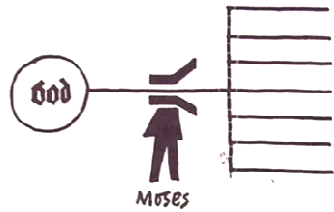


Useful Inventions





Moses
摩西



Moses acted as the loudspeaker who broadcast God's will as tight set of law that established a people and religion.

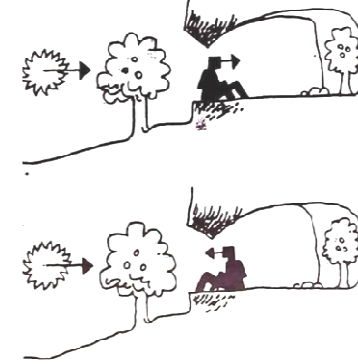


http://tw.wrs.yahoo.com/_ylt=A8tUxwnLV1dHYwYBAQlr1gt./SIG=12fbvjui/EXP=1196992843/**http%3A//tw.knowledge.yahoo.com/question/%3Fqid=1405123020680



柏拉圖

Plato

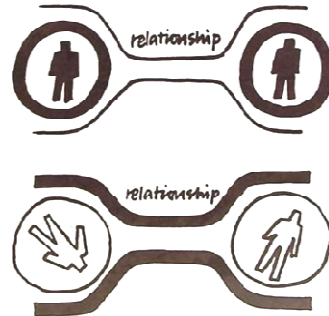


The ordinary man sits in his limited cave and sees only the shadow of reality. Plato insisted that the truth existed as true forms below the surface appearance of things. (Philosopher like to see the truth itself.)

孔子



Confucius



Confucius put all the emphasis on the relation itself. The Christian put more weight on encourage a man or woman to be right within himself/herself)

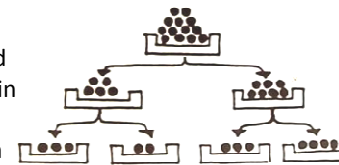


亞里斯多德

Aristotle



Aristotle classified and categorized concepts in order to extract their full meaning and form their relationship to each other.



after

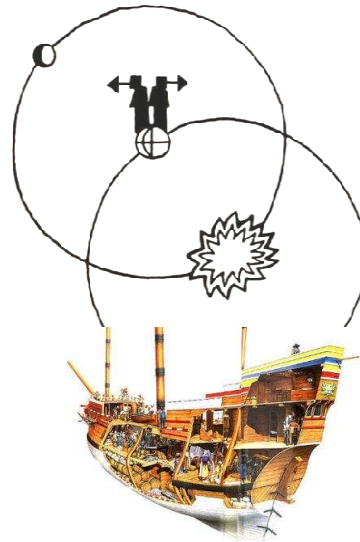


哥白尼



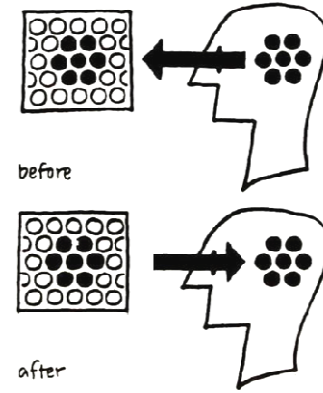
Copernicus

Copernicus set off the revolution in thinking that was to follow.



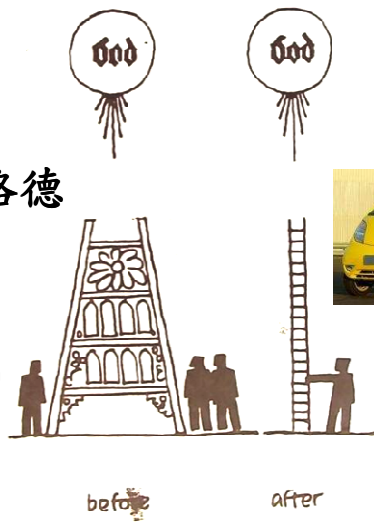
培根 **Bacon**

The truth only came from careful observation.



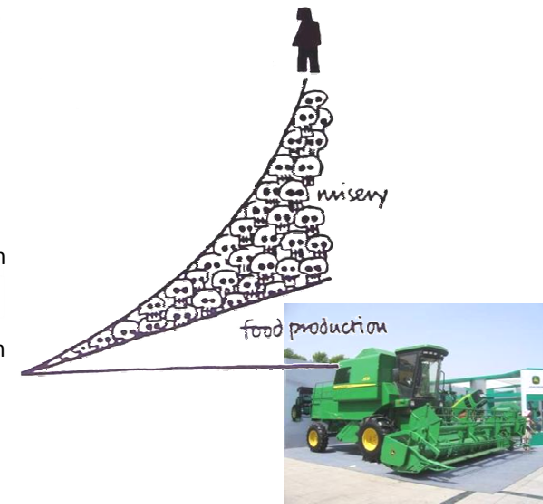
Luther 路德

Man could communicate directly and on personal level with God without the intervention of Church.



Malthus 瑪爾瑟斯

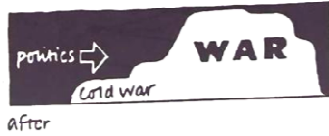
He saw nothing in nature which would halt the geometric growth of population.





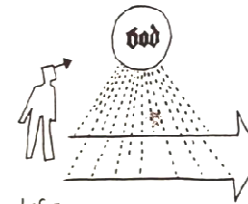
克勞維斯

The father of management science, he was interested in action not in essence.



Nietzsche

Supermen theory
Nietzsche restore man's moral fibre.
God was dead.



尼采

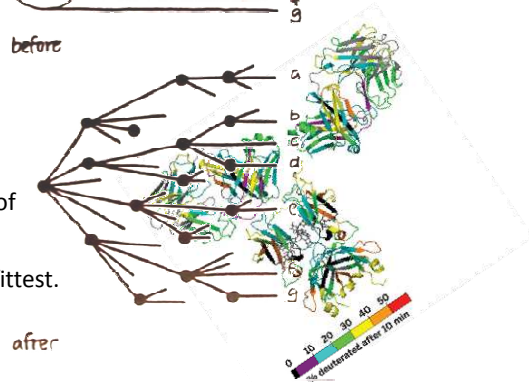


Darwin

Using Evolution to explain the

1. Differentiation of species.
2. Survival of the fittest.

達爾文

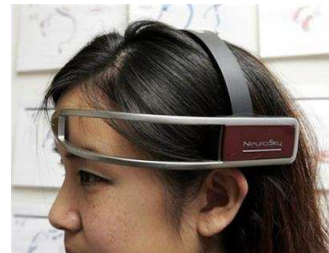
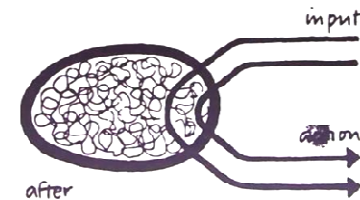
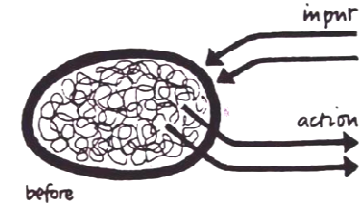


帕伐洛夫



Pavlov

Human's behavior could be controlled and predicted.

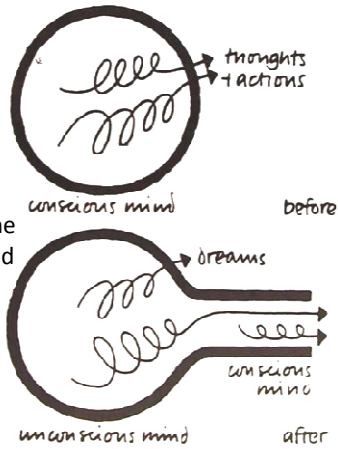




Freud

The conflicts of the subconscious mind could be seen to explain much of human behavior.

佛洛伊德



Sleep Learning

自我暗示有著驚人的力量

睡眠週期九十分鐘

睡眠學習
睡前暗示

- 創造思考 — 腦力激盪
- 創造思考 — 特性聯想
- 創造思考 — 多元關聯
- 創造思考技巧 — 形態分析
- 創造思考 - 水平 + 垂直

- IQ, Age, Education is not required to think creatively
- Brain Storming
- Combining old things is one way

觀察

資源

人際

認知

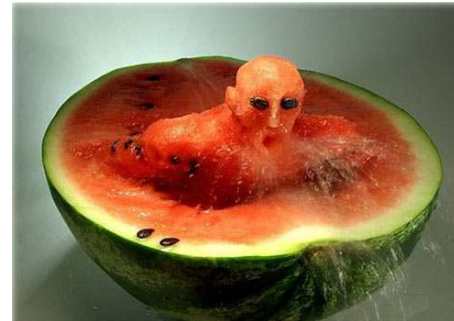
意欲

方法

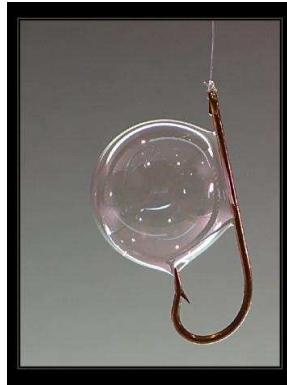
- 創造思考 — 特性聯想

REFERENCES

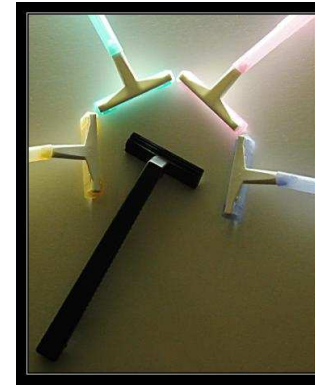
1. Weidenfeld and Nicolson, "The Greatest thinkers"
2. Beitz W. and Pahl G., Engineering Design: A Systematic Approach, The Design Council London
3. <http://en.wikipedia.org/wiki/>



• 創造思考 — 多元關聯



• 創造思考-水平+垂直



• 創造思考技巧 — 形態分析



Hi Kerwin,

I'd be honored if you would show my images to your students. My websites are:

<http://www.pbase.com/dsouzl>
<http://www.engagingimages.ca/welcome.html>

Thanks and all the best!

..Lew D'Souza..

Kerwin Wang wrote:

Dear Dsouzl,
May I show your creative images to my students in the "Creative Engineering Design" Class?
I think these pictures will give them very good inspiration.
All the Best!

Kerwin Wang, Assistant Professor
Department of Mechatronics Engineering
National Changhua University of Education
1, Jin De Road,
Changhua 50007, Taiwan



預收回信郵筒

把信裝入真正的郵筒之前，先放進這個郵筒，可以馬上看到回信。

願望實現機

不管任何願望，都能自然地幫你實現的機器。

強力扇風神

空氣抗力很大的扇子，輕輕一扇就可以扇大風。

翻譯弱點

吃下翻譯弱點，就能將日語聽成英語，或將英語聽成日語。

回憶香水

噴上回憶香水，黏著在人體身上的回憶就會散發出來。



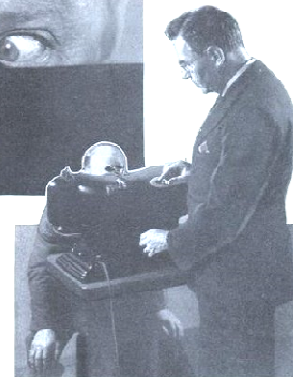
Funny inventions



This is how you look as you use the new instrument below to strengthen the muscles of the eyes

New Instrument Makes Eye Muscles Stronger

ALTHOUGH it might well be some particularly avid photographic fan having quite a bit of difficulty focusing his candid camera, the odd photograph above usually shows a patient strengthening his eyes with the aid of a new optical instrument developed recently by scientists attached to the research staff of the American Optical Company, in Southbridge, Mass. An American and French



Funny inventions



Bike Keeps Family in Stitches

CARRYING four persons and a sewing machine, the world's weirdest bicycle recently had a spin in Chicago, Ill. The two-wheeled vehicle, known as the "Cordless," is the creation of Charles Steinlauf. It carries the whole Steinlauf family. The inventive ruse at the top and guess the construction

by means of a huge automobile steering wheel. Mrs. Steinlauf sits below, operating sewing machine, while her own grand son and her daughter ride on the handlebars in front. When the odd vehicle is at rest, the propellers to the sewing machine prevent the lanky cycle from tipping over.



Funny inventions



Funny inventions



Funny Design in Japan



Funny Japanese Inventions



Funny Japanese inventions



Funny Japanese inventions



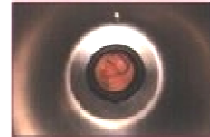
Funny Japanese inventions



Funny Japanese inventions



Funny Japanese inventions



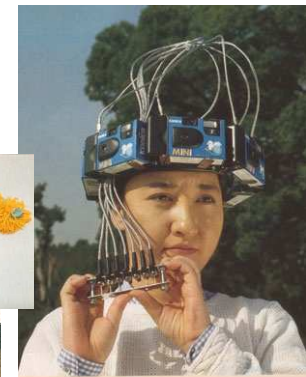
Ear Earbuds
 Forget batteries and wires. These Ear Earbuds are a pair of earbuds that use the power of a hand-held remote control to vibrate. The Ear Earbuds are a simple but, when used, a truly fun new way to listen to music. They are guaranteed to work in any circumstance. No transmitters to lose, no batteries to change, and you'll never be out of music again. They're the best thing you've never heard of.



Funny Japanese inventions



Funny Japanese inventions



Funny Japanese inventions



Funny Invention with Great Market

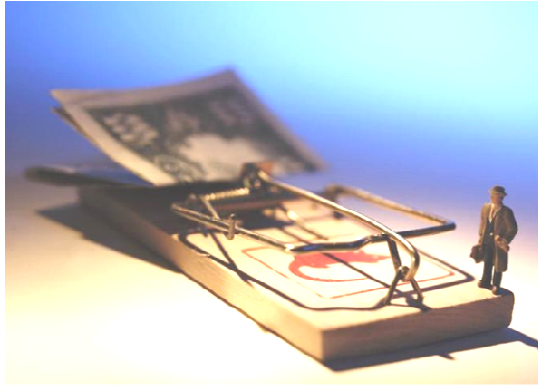


1990 中澤信子 初恋ダイエット スリッパ 初恋瘦身拖鞋

困難與挑戰

- 金錢陷阱 Money Traps
- 溝通障礙 Communication
- 文化與生活壁壘 Culture Barrier
- 知識與認知落差
- 物理極限
- 保護主義

Money Traps



Communication

Why Is It So Hard?

Coconut oil

椰子油



Communication Why Is It So Hard?

Peanut oil

花生油



Communication

Why Is It So Hard?

Baby oil

嬰兒油



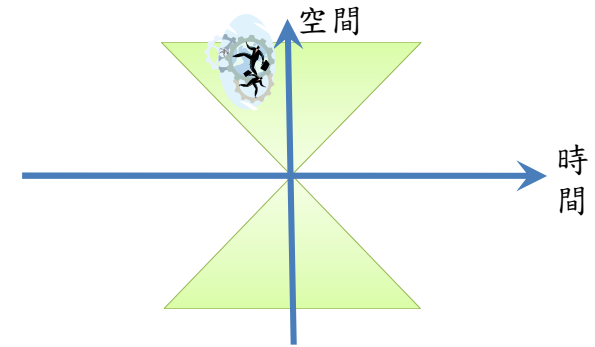
Communication Why Is It So Hard?

Cooking oil

料理油



物理極限



文化與生活壁壘 Culture Barrier



An Old Story

Good old lessons in **teamwork**
from an age-old fable



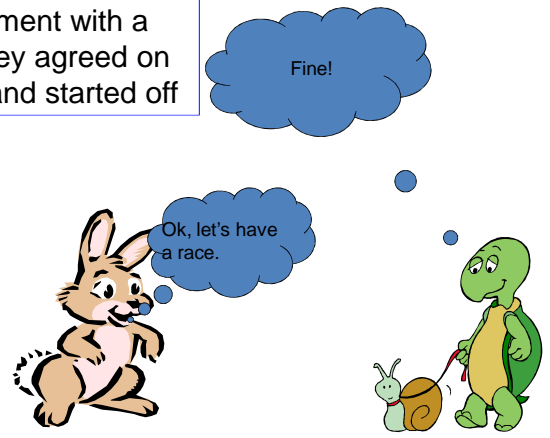
Once upon a time a tortoise and a hare had an argument about who was faster.



The hare shot ahead and ran briskly for some time. Then seeing that he was far ahead of the tortoise, he thought he'd sit under a tree for some time and relax before continuing the race.



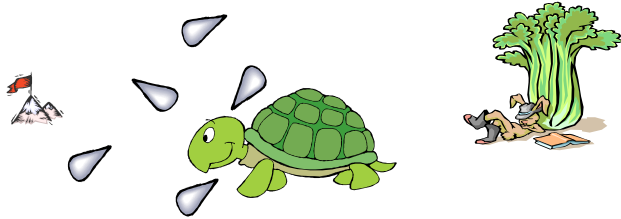
They decided to settle the argument with a race. They agreed on a route and started off the race.



He sat under the tree and soon fell asleep.



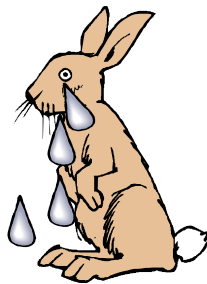
The tortoise plodding on overtook him and soon finished the race, emerging as the undisputed champ.



The moral of the story is that *slow and steady wins the race*.

This is the version of the story that we've all grown up with.

The hare woke up and realized that he'd lost the race.

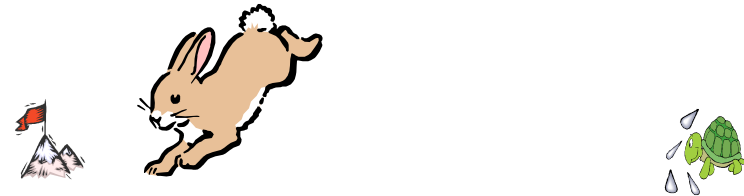


The story continues ...

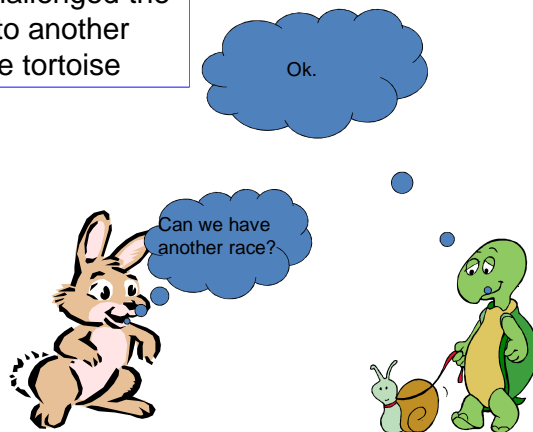
The hare was disappointed at losing the race and he did some soul-searching. He realized that he'd lost the race only because he had been overconfident, careless and lax. If he had not taken things for granted, there's no way the tortoise could have beaten him.



This time, the hare went all out and ran without stopping from start to finish. He won by several miles.



So he challenged the tortoise to another race. The tortoise agreed.



The moral of the story?

Fast and consistent will always beat the slow and steady. If you have two people in your organization, one slow, methodical and reliable, and the other fast and still reliable at what he does, the fast and reliable chap will consistently climb the organizational ladder faster than the slow, methodical chap.

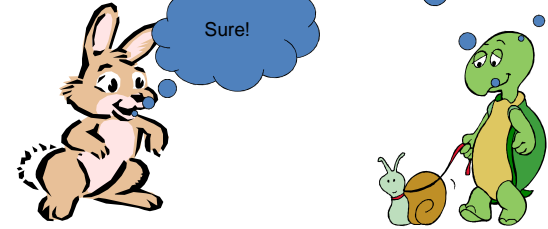
It's good to be slow and steady; but it's better to be fast and reliable.

But the story doesn't end here ...

He thought for a while, and then challenged the hare to another race, but on a slightly different route. The hare agreed.

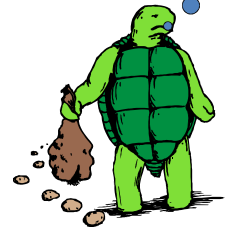
Can we have another race? This time we'll go through a different route.

Sure!



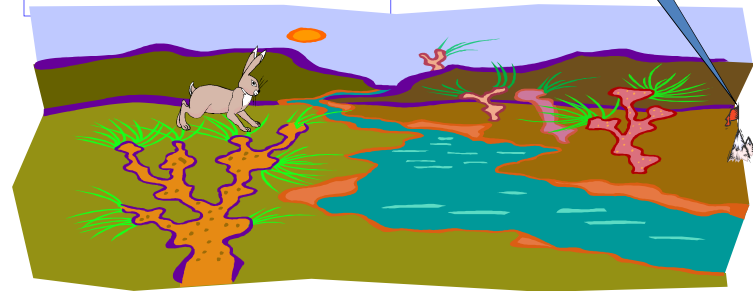
The tortoise did some thinking this time, and realized that there's no way he can beat the hare in a race the way it was currently formatted.

How can I can win the hare?

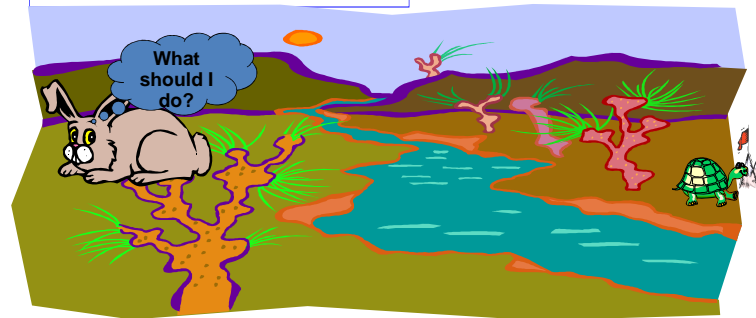


They started off. In keeping with his self-made commitment to be consistently fast, the hare took off and ran at top speed until he came to a broad river. The finishing line was a couple of kilometers on the other side of the river.

Goal



The hare sat there wondering what to do. In the meantime the tortoise trundled along, got into the river, swam to the opposite bank, continued walking and finished the race.



The story still hasn't ended ...

The moral of the story?

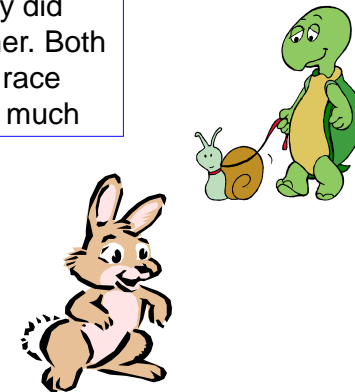
First identify your core competency and then change the playing field to suit your core competency.

In an organization, if you are a good speaker, make sure you create opportunities to give presentations that enable the senior management to notice you.

If your strength is analysis, make sure you do some sort of research, make a report and send it upstairs.

Working to your strengths will not only get you noticed, but will also create opportunities for growth and advancement.

The hare and the tortoise, by this time, had become pretty good friends and they did some thinking together. Both realized that the last race could have been run much better.



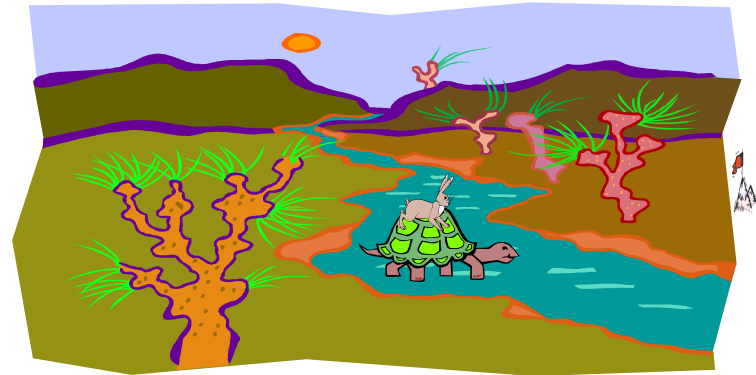
So they decided to do the last race again, but to run as a team this time.

Great! I think we could do it much better, if we two help each other.

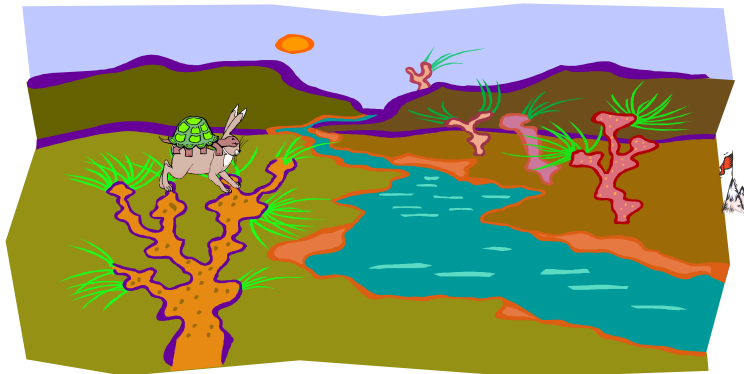
Hi, buddy. How about doing our last race again?



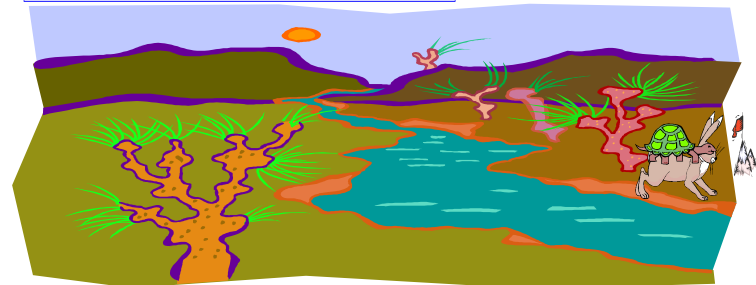
There, the tortoise took over and swam across with the hare on his back.



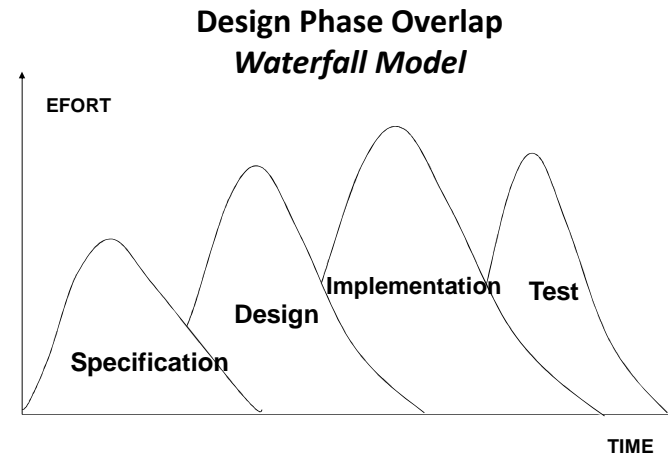
They started off, and this time the hare carried the tortoise till the riverbank.



On the opposite bank, the hare again carried the tortoise and they reached the finishing line together. They both felt a greater sense of satisfaction than they'd felt earlier.

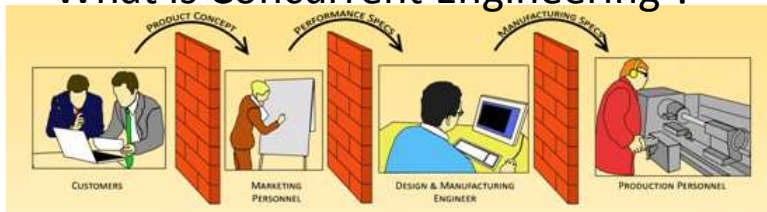


The story still hasn't ended ...



79

What is Concurrent Engineering ?



Traditional Process = Linear

Vs

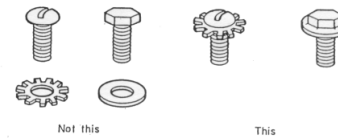
Concurrent Engineering = Team collaboration



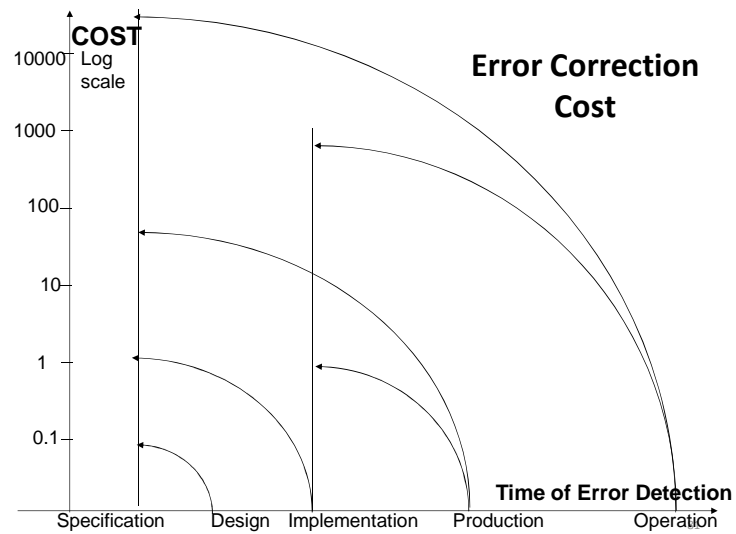
Concurrent Engineering

Reduce the Number of Components

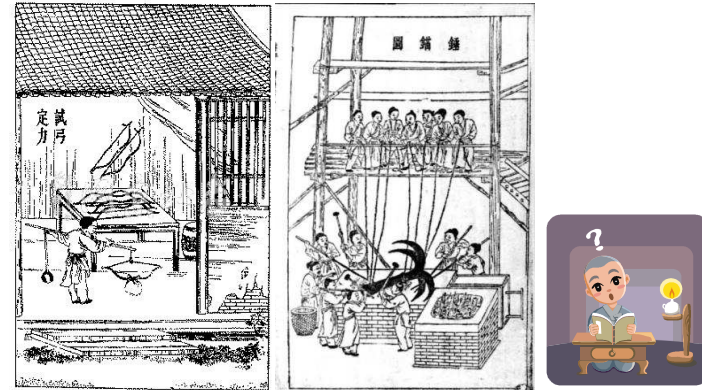
- Benefits from the Reduction
 - Shorter assembly time
 - Lower management cost
- Requirements: retaining original design functionalities.
- Side effects: increase component complexity and manufacturing cost



80



Steps In Engineering Problem Solving



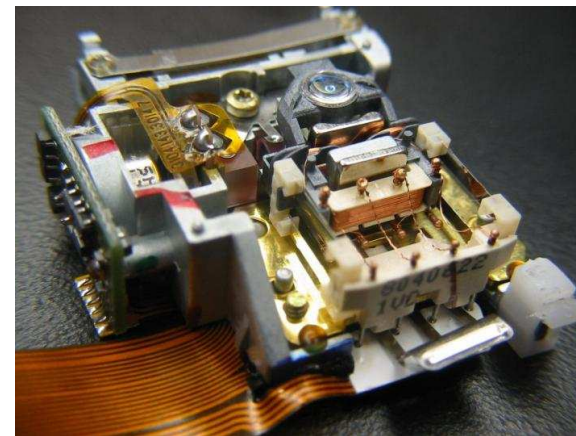
Chinese Technology in the Seventeenth Century: T'ien-kung K'ai-wu, Yingxing Song
天工開物, '宋應星' 1637

A Real Engineering Design Example

How are team members chosen?

Why do you want a particular person in your team?

- | | |
|-----------------------------|-----------------------------------|
| ✓ A close friend ? | ✗ Too challenging ? |
| ✓ Someone you admire ? | ✗ Too aggressive ? |
| ✓ Good technical skills ? | ✗ Not a team player ? |
| ✓ Good people skills ? | ✗ Too "tech-ie" and sad ? |
| ✓ Makes decisions quickly ? | ✗ Too new to the company ? |
| ✓ Experienced ? | ✗ Female / Male ? |
| ✓ Female / Male ? | ✗ Too senior for available role ? |
| ✓ Easy to boss around ? | ✗ Friend of the boss ? |



Sandstorm



March 13, 2004 - A DARPA Grand Challenge: an unmanned offroad race, 142 miles from Barstow to Las Vegas.

Green + Orange Technologies in the Future



大友克洋 1991 作品

- Let's open our mind to make this world better ~! 善用人生使用權。

