"They (global problems) are getting worse, not better..."

-- J.F. Rischard

Project C- MDE

Matter

The Creator Unit

Data

ENS

Energy

Fusion power

High Noon

by J.F. Rischard

20 Global Problems - 20 Years to Solve Them

(The Book)

"... in fact extremely simple underlying rules - that might for example potentially be implemented directly at the level of atoms - are often all that is needed. "

"And indeed one of the things that emerges from this book is that traditional engineering has actually considered only a tiny and quite unrepresentative fraction of all the kinds of systems and processes that are in principle possible."

"...it seems likely that a system could be set up in which just one or a few atoms would correspond to a cell in a system like a cellular automaton. And one thing this would mean is that doing computations would then translate almost directly into building actual physical structures out of atoms."

-- Stephen Wolfram [1]

“Perhaps the best way to explain the difference is to say that he (Stephen Wolfram) is looking at "hardware" complexity, and I'm looking at "software" complexity. The objects he studies have complexity less than or equal to that of a universal computer. Those I study have complexity much larger than a universal computer. For Wolfram, a universal computer is the maximum possible complexity, and for me it is the minimum possible complexity.”

-- Gregory Chaitin [2]

[1] From A New Kind of Science, pages 11, 840 and 841. The book: http://www.wolframscience.com/nksonline/
[2] On the intelligibility of the universe and the notions of simplicity, complexity and irreducibility http://www.cs.auckland.ac.nz/CDMTCS/chaitin/bonn.html

Project C - MDE

Laying the foundation

Version 3.51

Project C

2003 - 2050

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Home Project C: http://www.bazaarmodel.net

Front-page picture is the Pencil Nebula, NGC 2736: http://heritage.stsci.edu/2003/16/index.html

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“The price of reliability is the pursuit of the utmost simplicity. It is a price which the very rich find most hard to pay.”

-- Sir Antony Hoare

Preface

This document will give you more details about the structure of Project C – MDE, the products that will be used and the estimated costs. The paper is in continues development. New idea's or new products, which could do a better job than the one mentioned in this paper, could be implemented as soon as they are available. For example; a quantum computer would be much more feasible than the Hypercomputer, but at this moment the Hypercomputer is the best product for producing huge amounts of calculating power. The price of the Hypercomputer is low and the hardware is much more robust compared with other non Field Programmable Gate Arrays (FPGA) super computer chips.

All the groups are to some extend intertwined, although the Energy Group may be in the first phase be the lesser one of the three groups. The organization of this project and the groups will be based on a Bazaarmodel style of organization and management. I will focus in the coming years on the ENS, as this is the backbone of a Bazaarmodel (although the Internet or GRID will be sufficient for the 'short term' ten year period).

The main thought of this document is that very simple rules (computations) are responsible for complexity in our reality. To harness these simple rules is harnessing complexity and there by being able to create anything you want. In my thesis Bazaarmodel I made the claim that these simple rules are the foundation of complexity and this kind of complexity is the core of the Bazaarmodel which corresponds for example with, but not only, the Linux Project.

At the time of writing my thesis I made the presumption that simplicity is the core of reality itself, but I didn't knew how I could utilize this thinking into something workable, like a formula or symbol style of writing which could be an input for a machine. After completing my thesis (May 2002) I knew that there would be a long road of many years to find these simple rules that could be utilized within engineering. Coincidently, I read a review about a book *A New Kind of Science* [1][2] from Stephen Wolfram. I wasn't very familiar with Wolfram's work but somehow I had this urge to read the book and after reading the review, I ordered it (August 2002).

It was March 2003 when I started to read the book and when I was finally done, it convinced me that the work of Stephen Wolfram should be the intellectual thought structure for building the Creator Unit. Very simple rules (could be utilized with the Mathematica software program) lays at the base of the Principle of Computational Equivalence which harnesses (intrinsic) randomness, universality and complexity which can be used to address many phenomena's in reality. I strongly advice to read the book to truly understand this. These simple rules lay at the heart of the Creator Unit (CU).

[1] A New Kind of Science http://www.wolframscience.com/
[2] New Thinking: Gregory Chaitin's algorithmic information theory: http://www.cs.auckland.ac.nz/CDMTCS/chaitin/

The Matter Group – *The Creator Unit*

The Matter Group focuses on building the Creator Unit. The Creator Unit will probably consists of the following parts; The Hypercomputer, Atom Lasers, Cyc(s) and Mathematica.

The Hypercomputer

The Hypercomputer [1] internals are Field Programmable Gate Arrays (FPGA) intertwined with Viva software. This forms a blended hard- and software device for utilizing huge amounts of calculating power. These systems are completely reconfigurable (more than 1000 times per second) and are able to recover from faults (instead of fault tolerance). I expect [2] that the calculating power in 2007 will be sufficient for running the rules and controlling the Atom Lasers in parallel within a simulation.

Strong:

- Low power consumption compared with the supercomputers of today.
- The system is able to sustain heavy damage while maintaining normal operation.
- Very flexible; the software (Viva) and hardware (FPGA) are one (programming means that an agent programs the hardware directly).
- These are first generation Hypercomputers, the technical limit of these machines are a few (three?) decades away, which than the quantum computers will be available.
- The programming is more graphic orientated.

Possible drawback:

- Not very familiar within the academics and industry.
- Requires a different approach of programming than which is taught today.

Atom Lasers

The rudimentary atom laser [3] was developed at MIT in 1997. This part or module, within the Creator Unit, is probably the most changeling one. Today's Atom Lasers are to big and the speed of miniaturization of the Atom Laser should be faster than the transistor chips rate (Moore's Law).

Strong:

- The first tool to manipulate matter waves.
- The start of truly manipulating the atom (nanotechnology).

Possible drawback:

- Is still very primitive.
- To big to implement within the Creator Unit. The Atom Lasers needs to be much smaller.
- Unknown within the academic world and industry.
- Truly useful Atom Lasers in about twenty years.
- Under funded; for a more rapid progression in this field an increase of funds are needed. It could speeds up the research dramatically and would give a huge boost for the nano technology field as a whole.
- Gravity. We could build (the Creator Units) and use these devices in space to escape Earth's gravity but at this time it would cost too much. Besides the goal is to have a working Creator Unit on Earth than in space. Gravity has been 'neutralized' in the pharmaceutical industry with heavy magnets, but that is too crude.

Cyc

For most of the people Cyc [4] will be the main interface to use the Creator Unit. Billions of people are illiterate so voice input is the only option for them. Cyc could be used for example in 'creating' an object (just ask what you want) or developing a new on. Developing new kinds of materials via a 3D interface [5] for projection of molecule chains or, when it is organic, matter proteins designing is also possible. The only limit is ones imagination, which Cyc lacks.

Strong:

- It is a mature product with a decent pace of development.
- Very flexible.
- “Understands” the human environment like gravity, water falls 'down', etc. So a cup without a bottom should be out of the question.
- There is a free down loadable Open Source version of Cyc.

Possible drawback:

- Not familiar within the academic and industrial world.
- The coming twenty years are crucial of the development of Cyc's view of reality. Help is needed [6].
- It is a direct competitor with a human being. The only difference is that a human being has imagination.

The Principle of Computational Equivalence

Stephen Wolfram summarization of his Principle of Computational Equivalence: *that whenever one sees behavior that is not obviously simple–in essentially any system–it can be thought of as corresponding to a computation of equivalent sophistication*. The Principle of Computational Equivalence is the intellectual 'tool' for creating any kind of object. A very simple rule or a set of very simple rules will be used to harness the calculating power of the FPGA within the Hypercomputer and the controlling of the matter waves via the Atom Laser. Mathematica [7] will be used, together with for example the voice or other kind of input via but not necessarily limited to Cyc, to create and run these rules.

Strong:

- Extremely powerful. It is applicable in biology, mathematics, artificial intelligence, philosophy, psychology etc.
- Mathematica is able to communicate with Cyc.

Possible drawback:

- It will take some time for the scientific world to absorb the Principle.
- The rules are deceptively simple and thereby camouflages there true power. Many people would think that these simple rules aren't capable of doing anything.
- The rules set is limited (at this time only rule 110 [8] does suffice, but there should be more rules of that kind).

Entanglement – quantum teleportation

Entanglement [9] of atoms is in an early stage of experimentation and in the year 2003 first experimental test at the University of Aarhus (Department of Physics and Astronomy) to entangle atoms were held. Entanglement will be useful for stripping an object apart, atom by atom, thereby recycling it completely. The atoms could be teleported back into a plasma state.

Strong:

- Precise control over the atom.
- Every object is 100% recyclable.

Possible drawback:

- At this stage unknown.

[1] Formerly known as Hyper-Algorithmic-Logic (HAL) http://www.starbridgesystems.com/
[2] "*In sheer density, FPGAs are outpacing Moore's Law"* from **Dynamically Reconfigurable Computing:**

A Novel Computation Technology with Potential to Improve National Security Capabilities by Dramatically Improving High-End Computing:
http://www.bazaarmodel.net/Project-C-MDE/DataGroup/Hypercomputer-papers/Dynamically-Reconfigurable-Computing.pdf
[3] http://www.bazaarmodel.net/Onderwerpen/atomlaser/index.html and http://cua.mit.edu/ketterle_group/
[4] http://www.opencyc.org and www.cyc.com
[5] http://www.io2technology.com/
[6] http://murl.microsoft.com/LectureDetails.asp?1032
[7] Mathematica http://www.wolfram.com/products/mathematica/index.html
[8] A New Kind of Science page 675 till 714. The book: http://www.wolframscience.com/nksonline/toc.html
[9] Quantum “Teleportation” http://www.bazaarmodel.net/phorum/read.php?f=1&i=723&t=723#reply_723

The Data Group – *The Enterprise Nervous System*

This group will be the main focus for me in the coming years. The goal is an easy (European) Grid [1] upgrade with intelligent servers (Hypercomputer + Cyc + Linux [2]). The intelligent servers could be a financial revenue source for further funding of the Project C – MDE project. When the Grid is upgraded with these intelligent servers it will be known as the Enterprise Nervous System (ENS). ENS contains immense calculating power and (Cyc) intelligence which could be used for scientific research, industrial development, learning [3], etc. The Hypercomputers are suitable for the harsh environments, like space, and for building a Solar ENS within the Solar System. Different satellites, super space telescopes [4] etc. could utilize this space network for data transport. The ENS is a knowledge fountain for everyone.

Hypercomputer

The computing power of the Hypercomputer [5] is far more than a traditional computer equipped with serial processors. The Hypercomputer HC-62 has more calculating power than five thousand Intel CPUs combined while it consumes only 900 watts maximum. The price of one HC-62 is $350.000. The Hypercomputer is also a rock solid device. To give an extreme example, when you would use a pistol and shoot at your computer than there is a high change that the computer will stop working. Shoot a Hypercomputer and the operations that it performs continues as normal. That's what is meant by fault recoverability, instead of the more traditional fault tolerance. The only weak point would be the power supply for powering the FPGAs chips.

Strong:

- Rigid system for harsh environments.
- The change of data loss is 99.99% non existent.
- The Hypercomputer is able to sustain heavy damage while continuing operations.
- Immense calculating power.
- Easy learning curve in learning to use the Hypercomputer.
- Genetic algorithms could be integrated within the hardware (“nerve cells” for Cyc).

Possible drawback:

- There is a question on how the Viva program could be intertwined with Cyc (and Mathematica?). This should be researched.

Cyc

Integrating Cyc [6][7] with the ENS would give the network 'intelligence' in a way it could monitor the infrastructure, adjust the infrastructure for optimal performance and explain the network to an (human) engineer. Cyc could explain to an engineer its own thoughts one what could be improved, if something is wrong with the network and maybe why etc. This is very important for places which are beyond human reach at this moment, for example space. Cyc could manage itself in hostile environments without waiting for instructions with time delay (a data transmission to Mars takes 10 minutes).

Cyc could also be a teacher with a vast array of tools to help explaining things in a clear graphical matter like a (holographic) 3D view of Earth within the Solar System, history, physics, mathematics etc. An agent like a human being is able to interact directly with the ENS so that is could manipulate mathematics formula's and sees directly what the results are, or why the change, explained by Cyc, is impossible to calculate.

Strong:

- Cyc could be used in an almost unlimited kinds of way, like a teacher, a juridical knowledge reservoir for the juridical world, an assistant engineer, a translator [8] etc., which makes it very flexible.
- Could be implement within a robot [9][10], or Cyc could control a robot via a cordless network to touch objects and learn from its surrounding.
- Robust and flexible, the Cyc knowledge base (the knowledge of Humanity) could be spread over unlimited amount of (specialized) agents. So there would be a physic Cyc, a material-scientist Cyc etc. Other Cycs could take over the role of their counterpart when one is damaged.

Possible drawback:

- It is a direct competitor with a human being. The only difference is that a human being has imagination. A Cyc contains much more knowledge and understanding about reality than a very highly educated human being and thereby could be seen as a 'threat'.
- The coming ten years are crucial of the development of Cyc's view of reality. Help is needed [11].

Open Source

The most important aspect to use Open Source [12] is the guaranty that the data is accessible for future generations. Secondly, there are no constraints on sharing or copying the data. Everyone has the right to use it. Open Source would also be applicable on matter (moulds) and objects created by the Creator Unit.

Strong:

- Knowledge flows freely unhindered by boundaries.
- Every agent is able to access the Open Source data (like the matter moulds).

Possible drawback:

- In a world ruled by scarcity (of materials), Open Source is an odd duck, contradicting with many established economic dogma's. Patents and copyrights could hamper the spread of Open Source (juridical battles).

Rapid Single-Flux-Quantum

With Rapid Single-Flux-Quantum [13] data devices (for example, this technology could be implemented in switches) would allow sustainable 1 terabyte per second data transmissions, or higher, to saturate the Hypercomputer with (direct chip memory) input.

Strong:

- Ultra fast communication.
- Very low power consumption.

Possible drawback:

- The lack of speed of storage devices. A new kind of data storage is needed (solution: 3D storage [14]).

[1] The EGEE Grid Project http://egee-intranet.web.cern.ch/egee-intranet/gateway.html
[2] Linux http://www.linux.org/ and http://www.kernel.org/ and http://kernelnewbies.org/ and http://www.linuxhq.com/.
[3] Education for All http://www.ics.uci.edu/~bork/papers.html – Learning for All.
[4] Darwin http://sci.esa.int/science-e/www/area/index.cfm?fareaid=28
[5] http://www.starbridgesystems.com/
[6] Romancing the Rosetta Stone http://www.bazaarmodel.net/phorum/read.php?f=1&i=326&t=326#reply_326
[7] Cyc http://www.cyc.com
[8] OpenCyc http://www.opencyc.org
[9] Human Robot http://world.honda.com/ASIMO.
[10] Open Automaton Project http://oap.sourceforge.net/
[11] http://murl.microsoft.com/LectureDetails.asp?1032
[12] Open Source http://www.opensource.org/
[13] Rapid Single-Flux-Quantum pulse http://pavel.physics.sunysb.edu/RSFQ/RSFQ.html and http://www.ewh.ieee.org/tc/csc/News/RSFQFeb01.htm
[14] For example Holographic Memory http://computer.howstuffworks.com/holographic-memory.htm, IBM: Holographic data storage: http://www.research.ibm.com/journal/rd/443/ashley.html

The Energy Group – *Fusion Power*

The prime focus for the first four years will be mainly promoting fusion energy research (budget increase for fusion research). Hopefully in the near future Chemically Assisted Nuclear Reactions [1] could supply the Matter Group setup (Hypercomputer and the Atom Lasers) with energy. Or the more promising Levitated Dipole eXperiment (LDX) could full fill this role. Hot fusion is useful for powering huge electric infrastructures like a countries industry, homes etc. The amount of energy that a Z Machine can generate is so huge that the demand of energy on this planet should increase 80 times to absorb all the energy generated by the Z Machine. Energy would be 'free' (supply 80 times greater than demand).

Unfortunately the amount of funds that is invested in fusion energy research is low compared with other types of energy research. The past year (2002) 60 billion euro was invested in fossil fuels research and 6 Billion euro in 'green' energy research (solar energy, wind turbines etc.). Only 1 billion euro is invested annually in fusion energy research. The budget for fusion energy research should increase by a factor of 30 or more to speed up the process of getting rid of the polluting fossil and nuclear industry so that mankind is able to live in a clean environment.

Hot fusion

There are primarily two hot fusion projects with a different set-up. These are the Z Machine [2] and the ITER project [3] (a third one with a much smaller set-up but maybe more practical is the Levitated Dipole Experiment [4]). The Z Machine is liquid based while the ITER project uses high temperature plasma within a magnetic donut form. Both machines are able to generate impressive amounts of energy. The Z machine is able to generate 290 terawatt (80 times the power generated on earth at any given time) or more. In our opinion the most promising setup is the Levitated Dipole eXperiment (LDX) [5].

Strong:

- Solves the world energy crisis.
- No pollution.

Possible drawback:

- The fossil fuel and nuclear industry is vehemently opposed to fusion energy research, seeing them as direct competitors instead of world problem solvers.
- The technology hurdles are enormous although the LDX setup is the most practical one.
- For safety reasons, the Z machine should be constructed in a low dense populated area. The ITER doesn't has this drawback.

Chemically Assisted Nuclear Reactions (Cold Fusion)

Cold fusion is still controversial by contradicting the laws of current nuclear theory. Nonetheless, the research in this field is growing and promising results are reached thereby being applicable within this project. Science is *Question All*, even if this means questioning the foundation of science itself when real life time phenomena contradicts established theories.

Strong:

- Is able to generate more energy than hot fusion.
- No pollution.

Possible drawback:

- Controversial within the traditional scientific community.
- The hot fusion industry sees cold fusion as a direct competitor of funds.

The Z Machine

> ...But a funny thing happened on the way to the chop shop. Maybe it was 11th-hour desperation, or some invisible bolt of providence visited on a few overworked scientists, a couple of whom lit on the simple idea of stringing the wire array, the spool-sized target at the centre of the Machine, with double, then triple, the tungsten wire. All of a sudden - Boom! Forty trillion watts! No one believed it. They reconfigured the Machine, boosting its X-ray production. Then someone, Melissa Douglas, thought to stack the arrays. Boom! Two hundred trillion watts in a single pulse! Short of a nuclear blast, it was the most energy ever released on earth, and suddenly, in 1998, after five decades of chasing the illusion of high-yield fusion, of regarding it as some far-off Atlantis or dark galaxy's edge, the Z Machine was a third of the way there.
>
> In science, if you do something once that's never been done before, it's considered a mistake. Do it twice, and it's simply a mirage. But the third time it becomes the truth. With Z's new, seemingly impossible results came the first flickering sign that some deep, unknowable power resided in the Machine. And so today, the Z Machine is considered one of the world's best hopes for achieving fusion. 'We may not understand how we get these huge pulses of power, the meaning may still elude us,' says Yonas. 'But it's still a fact.'
>
> One that Yonas himself, at first, had a hard time grasping. After he was handed the results, he remembers squinting at them, and sitting back at his desk as if blown by a solar wind. 'My God,' he said in a small voice. 'This could work. This could really work.'
>
> **-- From: A Machine called Z.**

[1] http://www.lenr-canr.org/
[2] Z Machine http://www.bazaarmodel.net/phorum/read.php?f=3&i=25&t=25#reply_25 and A Machine called Z http://www.bazaarmodel.net/Onderwerpen/A_machine_called_Z.html
[3] ITER http://www.iter.org/.
[4] http://science.slashdot.org/science/04/08/21/1838211.shtml?tid=14
[5] http://psfcwww2.psfc.mit.edu/ldx/

Appendix 1: Time line 2003 – 2012

2003 – 2007 "This has to sink in first"

The technology and the ideas are so new that at this moment only a few people truly understand the meaning of it. Because of this I must reconsider the timetable. The concepts in this document, especially the complexity field, bewilders many and stifles the spread of all the ideas. Still, the goal is to have a (primitive) working Creator Unit prototype before 2020 and a fully operation unit around 2050.

Besides, the continues improvement of the Atom Laser [1], the Hypercomputer [2] and the spread of the New Kind of Science [3] thoughts are going well. I'm certain that it is only a matter of time when somebody creates the Creator Unit in this century because we need it desperately to sustain many billions of people on this planet.

If you want to read some of my thoughts go to the High Noon Forum [4]. or *thoughts* at bazaarmodel.net.

So for the coming years there will be promoting and spreading the Project C – MDE ideas and gather a financial basket.

Status update

Data Group has started. Commercial enterprises started in:

South-America:	AtoBiz -- Operational and expanding [5]
Europa:	2Grid – Warming up [6]
Asia:	Planning phase
Turkey	Planning phase

2Grid likes

- Learning for All – Alfred Bork (Data)
- Levitated Dipole eXperiment (Energy)
- Group of Wolfgang Ketterle and Dave Pritchard at MIT (Matter)

[1] http://cua.mit.edu/ketterle_group/ and http://www.bazaarmodel.net/Onderwerpen/atomlaser/index.html
[2] http://www.starbridgesystems.com/
[3] http://www.wolframscience.com/
[4] http://www.rischard.net/forums/forumdisplay.php3?forumid=5
[5] http://www.atobiz.com
[6] http://www.2grid.com

Appendix 2: Costs

Product	Price in Dollars
Mathematica 5	2,719.50
Hypercomputer (HAL 15) (Xilinx FPGA Chip)	150,000.-
Hypercomputer (HC-36) (Xilinx FPGA Chip)	175,000.-
Hypercomputer (HC-62) (Xilinx FPGA Chip)	350,000.-
Hypercomputer (HC-124) (Xilinx FPGA Chip)	700,000.-
OpenCyc	free
Cyc	unknown
Linux	free
Atom lasers	unknown

The HAL 15 Desktop Size

The HAL 300

Hypercomputers: http://www.starbridgesystems.com/

Xilinx FPGA chips: http://www.xilinx.com/

Appendix 3: The end of Computing Science?

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The end of Computing Science?

> "The price of reliability is the pursuit of the utmost simplicity. It is a price which the very rich find most hard to pay."
>
> Sir Antony Hoare, 1980 .

In academia, in industry, and in the commercial world, there is a widespread belief that Computing Science as such has been all but completed and that, consequently, computing has "matured" from a theoretical topic for the scientists to a practical issue for the engineers, the managers and the entrepreneurs, i.e., mostly people —and there are many of those!— who can accept the application of science for the obvious benefits, but feel rather uncomfortable with its creation because they don't understand what the doing of research, with its intangible goals and its uncertain rewards, entails. This widespread belief, however, is only correct if we identify the goals of Computing Science with what has been accomplished and forget those goals that we failed to

reach, even if they are too important to be ignored.

I would therefore like to posit that computing's central challenge, viz. "How not to make a mess of it", has not been met. On the contrary, most of our systems are much more complicated than can be considered healthy, and are too messy and chaotic to be used in comfort and confidence. The average customer of the computing industry has been served so poorly that he expects his system to crash all the time, and we witness a massive worldwide distribution of bug-ridden software for which we should be deeply ashamed.

For us scientists it is very tempting to blame the lack of education of the average engineer, the short-sightedness of the managers and the malice of the entrepreneurs for this sorry state of affairs, but that won't do. You see, while we all know that unmastered complexity is at the root of the misery, we do not know what degree of simplicity can be obtained, nor to what extent the intrinsic complexity of the whole design has to show up in the interfaces.

We simply do not know yet the limits of disentanglement. We do not know yet whether intrinsic intricacy can be distinguished from accidental intricacy. We do not know yet whether trade-offs will be possible. We do not know yet whether we can invent for intricacy a meaningful concept about which we can prove theorems that help. To put it bluntly, we simply do not know yet what we should be talking about, but that should not worry us, for it just illustrates what was meant by "intangible goals and uncertain rewards".

And this was only an example. The moral is that whether Computing Science is finished will primarily depend on our courage and our imagination.

Austin, 19 November 2000

[Written for the Communications of the ACM]

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“The history of all sciences warns us that the simplest discoveries have been rejected a priori, as being incompatible with science.

- Medical anesthesia was denied by Majendie.
- The action of microbes was contested for twenty years by all the scientists of all the academies.
- Galileo was imprisoned for saying that the earth revolves.
- Bouillaud declared that the telephone was but ventriloquism.
- Lavoisier said that stones cannot fall from the sky, for there are no stones in the sky.
- The circulation of the blood was only admitted after forty years of sterile discussion.
- In a lecture in 1827 at the Academy of Sciences, my great-grandfather, P. S. Girard, considered it folly to suppose that water could be led to the upper floors of houses by pipes.
- In 1840, J. Muller declared that the speed of nerve-impulses could never be measured.
- In 1699, Papin constructed the first steamboat; a hundred years later Fulton rediscovered the possibility of steam navigation, but it was not applied till twenty years later.
- When in 1892, under the guidance of my distinguished master, Marey, I made my first attempt in aviation, I met with only incredulity, contempt, and sarcasm. A volume might be written on the absurd criticisms with which every great discovery has been received.”

-- Charles Richet, PhD (from *Thirty Years of Psychical Research BEING A Treatise on Metapsychics* page 6 and 7).