“IT'S UNIFIED AND IT'S A THEORY, BUT IT'S NOT THE UNIFIED THEORY WE'VE ALL BEEN LOOKING FOR.”
Doing Computer Science
As Science

2 February 2009

Research Methods for
Empirical Computer Science
CMPSCI 691DD
David Jensen
What is this?
“It’s a gun”
Nominal

Of, relating to, or consisting of a name
GOLIATHON 83
Infinity Beam Projector

The advantage with this trusty wave discharger is heft. In the unlikely (but statistically probable) event of its malfunction, it doubles as a wonderful cudgel.

Goliathon 83 Infinity Beam Projector
Now Shipping! ORDER NOW!

Pricing: The Goliathon 83 is priced at NZD $1165.00 (incl GST) / NZD $1035.56 (excluding GST) US $690.00 (+ tax)

This piece is now available for ordering.

This is a limited edition of 500 pieces.

The advantage with this trusty wave discharger is heft. In the unlikely (but statistically probable) event of its malfunction, it doubles as a wonderful cudgel. Brigands and ne'er do wells will cringe when the Goliathon is brandished at them. Of course, its infra-wave undulations...
“It’s a metal object with glass and wire parts”
Descriptive

An account in words of something, including all the relevant characteristics and qualities
“It’s a steampunk thing”
Contextual

Consisting of the circumstances that form the setting for an entity, in terms of which it can be fully understood and assessed.
Steampunk (stēm-pəŋk)

• “...a subgenre of fantasy and speculative fiction which came into prominence in the 1980s and early 1990s. The term denotes works set in an era or world where steam power is still widely used—usually the 19th century, and often set in Victorian era England—but with prominent elements of either science fiction or fantasy...”

• A community of creative people engaged in collaborative efforts to construct written and technological works that are judged by internally consistent standards.
Books, journals, and websites
Societies and meetings

The Chicago Steampunk Society Inaugural Meeting (2007)

The Inaugural meeting of the Chicago Steampunk Society ... come meet other folks interested in the genre, wear your steamy finest, have a great lunch, and hopefully have a fun afternoon. :-)  

When and Where:
Saturday, December 29, 2007 at 2:00 PM
Grand Lux Cafe, Chicago, IL 60611

Event rating:

RSVPs:
Yes: 6 members
Maybe: 1 member
No: 6 members

Attendance:
It's estimated that 6 people attended.

Michelle
"Everyone was super nice and they all looked fabulous!"

Mirthful Mourning
"I thought it was nice, but I think for next time if we did more activities or had photo opportunities. It was kind of like when everyone got there we sat down and ate lunch and then everyone left."

The Salon is approaching 40 people! As we look over the list we see a number of unfamiliar names. That simply won't do! We'll be holding a Steampunk Salon "meet and greet" session at Canals Saturday, September 1st at 2:30 PM SLT. We hope to see you for at least a little while to meet their fellow group idea-seekers, and perhaps speak with your hosts Leon Susenko and Mark. Ideas for the salon, classes you might help instruct, or to just a comment.
Computing devices
Steampunk ≈ Computer Science?

• Both fields...
  • ...consist of a relatively small number of individuals who judge each others work.
  • ...communicate through meetings, societies, websites, and publications.
  • ...construct physical and non-physical artifacts that are judged by community standards.
  • ...produce goods with economic value.

• Are there essential and distinguishing characteristics of computer science?
Explanatory, Causal, or Generative

Providing control, influence, or the ability to create specific behavior or state
“Science is not science fiction. It accepts the tests of observation and experiment, acknowledges the supremacy of fact over wish or hope. The smallest experiment can crash to earth the most attractive theory.”

— Herbert Simon
Why practice CS as science?

• Scientific practice provides a limited type of external verification that grounds our work in something other than mere consensual hallucination

• Scientific practice enables more rapid progress toward things we wish to produce
  
  • *Explanations* — How does that IR system work? Why did the Internet behave in that way?
  
  • *Guidance* — What should we do if we want our data center to have a higher percentage of uptime?
  
  • *Technologies* — How can we build a better integrated development environment? What networking protocol offers the highest performance for real P2P networks?
A brief research communication...

Form No. 168.

THE WESTERN UNION TELEGRAPH COMPANY.
INCORPORATED
23,000 OFFICES IN AMERICA.
CABLE SERVICE TO ALL THE WORLD.

This Company TRANSMITS and DELIVERS messages only on conditions limiting its liability, which have been assented to by the sender of the following message. Errors can be guarded against only by repeating a message back to the sending station for comparison, and the Company will not hold itself liable for errors or delays in transmission or delivery of Unrepeated Messages, beyond the amount of selling paid therefor, nor in any case where the claim is not presented in writing within sixty days after the message is filed with the Company for transmission.

This is an UNREPEATED MESSAGE, and is delivered by request of the sender, under the conditions named above.

ROBERT C. CLOWRY, President and General Manager.

RECEIVED at

1704 E. 20th St. Paid. Via Norfolk Va
Kitty Hawk N. C Dec 17
Bishop H. Wright
7 Hawthorne St.

Success four flights Thursday morning all against twenty one mile
wind started from level with engine power alone. Average speed
through air thirty one miles longest 59 seconds inform Press
home happy Christmas.

Greville Wright E75P
Who would you expect to succeed?

- **Background**
  Renowned astrophysicist & astronomer

- **Institution**
  Head of the Smithsonian Institution

- **Research funding**
  $50,000 from the US War Department

- **Prior work**
  An unmanned steam-powered model flew 3/4 of a mile in 1891.

- **Background**
  Neither finished high school

- **Institution**
  Jointly run the Wright Cycle Company

- **Research funding**
  Self-financed

- **Prior work**
  None before 1899
What did the Wrights do right?
Reviewed what was already known
Reviewed what was already known

“I wish to obtain such papers as the Smithsonian Institution has published on this subject, and if possible a list of other works in print in the English language. I am an enthusiast, but not a crank in the sense that I have some pet theories as to the proper construction of a flying machine. I wish to avail myself of all that is already known and then if possible add my mite to help on the future worker who will attain final success.”
Reviewed what was already known

- Assistant Secretary Richard Rathbun replied with:
  - Two books
  - Three issues of the only existing journal on the subject
  - Four pamphlets
- This was "a compendium of virtually everything that had been done with heavier-than-air flying machines" up to 1896 (Jakab 1990)
Corresponded with other researchers
Constructed and tested prototypes
Constructed experimental apparatus
Conducted experiments
Gathered and analyzed experimental data
Falsified prior results
Published intermediate results

Wilbur Wright (1901). “Some Aeronautical Experiments.”
Journal of the Western Society of Engineers 6:489-508
Overall approach

1. Identify key technical challenges that were on the critical path to constructing the desired technology (e.g., control)

2. Systematically investigate the underlying principles necessary to address those challenges

3. Apply those principles to construct prototypes

4. Systematically evaluate those prototypes

5. Iterate
What didn’t the Wrights do?

• “Just build it” — Construct or modify systems without the aim of understanding the basic principles of flight

• Construct systems in rough analogy to “what’s known to already work”
“I cannot think of any part bird flight had in the development of human flight excepting as an inspiration... After we had thought out certain principles, we then watched the bird to see whether it used the same principles.

Learning the secret of flight from a bird was a good deal like learning the secret of magic from a magician. After you once know the trick and know what to look for you see things that you did not notice when you did not know exactly what to look for.”

— Orville Wright (1941)

• Science is not science fiction. We evaluate our work by correspondence to physical reality. Experiments formally evaluate that correspondence.

• Naming, describing, or giving context are less useful than providing causal explanations of underlying function.

• More rapid technical progress can be achieved by seeking an understanding of fundamental principles than by using a “just build it” approach.
Should Computer Scientists Experiment More?

Computer scientists and practitioners defend their lack of experimentation with a wide range of arguments. Some arguments suggest that experimentation is inappropriate, too difficult, useless, and even harmful. This article discusses several such arguments to illustrate the importance of experimentation for computer science.

Do computer scientists need to experiment at all? Only if we answer “yes” does it make sense to ask whether there is enough of it.

The phenomena studied in computer science are much broader than those arising around computers. They are found in the brains of programmers and computer users.