

18 Nov 2004

Physics and War

Sanjoy Mahajan

Cavendish Laboratory and
Corpus Christi College, Cambridge

<http://www.inference.phy.cam.ac.uk/sanjoy/>
sanjoy@mrao.cam.ac.uk

Ceci n'est pas une microwave oven



Qu'est que c'est?



Qu'est que c'est?



Scientists will start testing the weapons on goats and humans soon...

'People-zapper fires microwaves at the enemy', Observer, 18 March 2001.

More researchers needed!

But researchers are hoping to miniaturize it, Karcher said. Air Force officials want to work with the prime contractor, the Raytheon Corp., to design a version that could be mounted on a military transport plane so its beam could cut a broader swath on a battlefield.

What for?

Marine Capt. Dan McSweeney, a spokesman for the Non-Lethal Weapons Directorate, pointed to "instances in Iraq where crowd situations have unfortunately ended in violence" and death.

[Marine Col.] Karcher and other military officials are trying to alleviate fears that the device might be misused to harm civilians or converted into a torture machine that leaves no marks. "To use this as any sort of torture device would be in direct violation of" the Pentagon's definition of nonlethal weapons, [Karcher] said. "Nor, as professionals, would any of us sign up for it."

In an attempt to anticipate how the world would greet the new weapon, the Air Force this month asked social science graduate students at the University of Minnesota and other colleges for help. Researchers were offered \$12,000 to spend the summer reviewing literature and assessing how Americans and other cultures might react to its use.

['Invisible beam tops list of nonlethal weapons', Sacramento Bee, 1 June 2004]

Division of labor

In example above:

- Scientists study microwaves
- Capt. Dan McSweeney speaks publicly about the good uses
- Col. Karcher alleviates fears, declares his professionalism
- Universities, and social science postgraduates, develop propaganda

Division of labor permits great crimes since no one entity is responsible for the whole enterprise. In the words of an expert:

Division of labor

In example above:

- Scientists study microwaves
- Capt. Dan McSweeney speaks publicly about the good uses
- Col. Karcher alleviates fears, declares his professionalism
- Universities, and social science postgraduates, develop propaganda

Division of labor permits great crimes since no one entity is responsible for the whole enterprise. In the words of an expert:

In the progress of the division of labour, [man]...generally becomes as stupid and ignorant as it is possible for a human creature to become....Of the great and extensive interests of his country he is altogether incapable of judging...

Division of labor

In example above:

- Scientists study microwaves
- Capt. Dan McSweeney speaks publicly about the good uses
- Col. Karcher alleviates fears, declares his professionalism
- Universities, and social science postgraduates, develop propaganda

Division of labor permits great crimes since no one entity is responsible for the whole enterprise. In the words of an expert:

In the progress of the division of labour, [man]...generally becomes as stupid and ignorant as it is possible for a human creature to become....Of the great and extensive interests of his country he is altogether incapable of judging...

[Adam Smith, Wealth of Nations, Book V, Ch 1, para 178]

Intellectual experience

Hans Bethe:

The ideas we had about triggering the H-bomb were all wrong but the intellectual experience was unforgettable.

[Brian Easlea, *Fathering the Unthinkable*, p. 125]

Teller and Ulam



Astonishing breakthroughs

In what Teller wrote, there is no mention at all of Ulam's iterative scheme -- not the staging, supercompression, or the rest -- nothing positive, just Teller's impatience with Ulam. An astonishing breakthrough was at hand, but where were the signs of his elation?

Bengt Carlson:

Los Alamos was the most inspiring and hard-working place I ever knew.

...Ulam had more to do with the success of the H-bomb than did Teller.

We owe much to the genius of Stan Ulam, the man with the back-up plan.

[Bengt Carlson, 'How Ulam set the stage', Bulletin of the Atomic Scientists, July-August 2003.]

A priority contest of the insane! It goes on only because people compartmentalized their problem-solving from their social responsibility.

The results: Hiroshima

Only color photograph taken of the Trinity explosion:



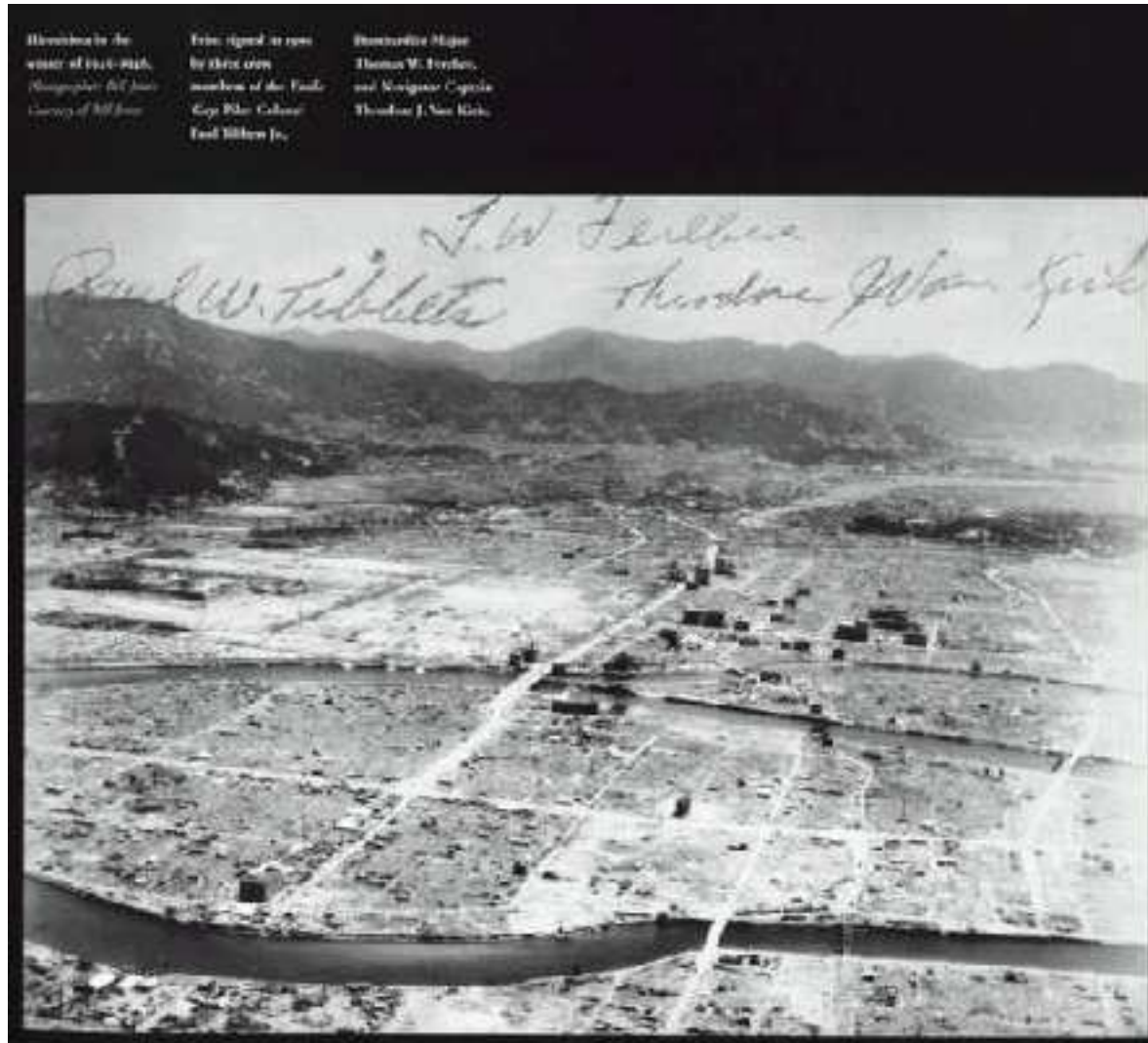
Hiroshima

Hiroshima, 600 feet east of ground zero:



Hiroshima

Hiroshima in the winter of 1945-1946:



Print signed by crew members of the Enola Gay. In 1990!

Bad news from Hiroshima?

Who said this, after hearing the news from Hiroshima?

He entered that meeting like a prize fighter. As he walked through the hall there were cheers and shouts and applause all round and he acknowledged them in the fighters salute -- claspng his hands above his head as he came to the podium.

Bad news from Hiroshima?

Who said this, after hearing the news from Hiroshima?

He entered that meeting like a prize fighter. As he walked through the hall there were cheers and shouts and applause all round and he acknowledged them in the fighters salute -- claspng his hands above his head as he came to the podium.

Robert Oppenheimer



General science-war connection no secret



Total Information Awareness



Some of their projects:

- Foreign language machine translation and speech recognition
- Entity extraction from natural language text
- Collaboration and sharing over TCP/IP networks across agency boundaries

Motto: *Scientia est potentia* (knowledge is power)

Meanwhile back in England

They are unfairly perceived as socially inept "anoraks" given to hunching over Bunsen burners and computer games, skulking in libraries, and having dubious hygiene.

But physics, chemistry and engineering students...were yesterday given a much-needed incentive. Under Conservative proposals, they - and some linguists - would be eligible for GBP 2,000 bursaries.

Guess which linguists:

Meanwhile back in England

They are unfairly perceived as socially inept "anoraks" given to hunching over Bunsen burners and computer games, skulking in libraries, and having dubious hygiene.

But physics, chemistry and engineering students...were yesterday given a much-needed incentive. Under Conservative proposals, they - and some linguists - would be eligible for GBP 2,000 bursaries.

Guess which linguists:

Maths, physics, chemistry and engineering students are the most likely to be rewarded, together with those studying languages such as Arabic, for which there is a need but just 120 students each year.

[‘Tory GBP 2,000 offer to attract more science students’, Guardian, 13 Nov 2004.]

Specific: Superconducting Supercollider

War Department evaluation of the Superconducting Supercollider (SSC) just before Reagan approved its funding:

Specific: Superconducting Supercollider

War Department evaluation of the Superconducting Supercollider (SSC) just before Reagan approved its funding:

The SSC project will have many spinoffs for the DoD, especially in technologies required by the Strategic Defense Initiative, including particle beams, information processing, computer control, pulse power sources, and high energy accelerators.

The nuclear weapons community will benefit from the fundamental research on the building blocks of atomic matter. The SSC will provide a valuable resource of scientific personnel. Many of the scientists now in the [Department of Energy] nuclear weapons laboratory complex received their training while working on particle accelerators.

[Charles Schwartz, 'Social responsibility in physics', *Social Responsibility*, vol 2(1).]

Pure physics

Project on 'The interaction of electromagnetic radiation with solid materials':

The objective of the proposed program of theoretical research is an increased understanding of the interactions of electromagnetic radiation, particularly infrared, with matter. To be studied are the infrared absorption in the Drude tail, ...the inelastic scattering of light from a plasmon coupled to localized vibration modes in semiconductors...

[Jeff Schmidt, *Disciplined Minds* (Lanham, Maryland, 2000), pp. 73--74.]

Pure physics?

War Department evaluation:

The infrared optical properties of these materials are important to the development of infrared detectors and coherent sources [and to understanding] the interaction of materials subjected to laser beams.

[Schmidt, p. 74.]

Longitude Act (1714): Money, science, and war

Prize: GBP 20,000 for accuracy of 30 miles in trip to the West Indies

Board of Longitude:

lord high admiral of Great Britain, or the first commissioner of the admiralty, the speaker of the honourable house of commons...the master of Trinity-house, the president of the royal society, the royal astronomer of Greenwich, the Savilian, Lucasian, and Plumian professors of the mathematicks in Oxford and Cambridge, ...

One impetus for the Act

Vice-Admiral Cowdisley Shovell's fleet ran aground (1707).

- Returning home with 2000 sailors on 4 ships after victory in Gibraltar
- A sailor suggested they were lost -- Shovell hanged him on the spot.
- Ships soon hit the rocks 20 miles from home
- One survivor: the admiral
- Washed ashore on a small island, killed by a woman for his huge emerald ring

Poetic justice.

Stanford's choice

Frederick Terman, professor of engineering at Stanford:

We will either...create a Harvard [of] the East, or we will drop to a level similar to that of Dartmouth, a well thought of institution having about 2 per cent as much influence on national life as Harvard.

[letter, 29 December 1943]

His plan: Do not waste time with the undergraduate programs...for they never pay big dividends...Instead put the effort into the graduate departments where national reputations are forged.

[Stuart Leslie, *The Cold War and American Science* (New York, 1993), p. 45]

Universities, and people, have choices. Stanford sold its soul to the war machine in order to increase its reputation. Why that method?

Willie Sutton (1901-1980)



Willie Sutton

Q: Why do you rob banks?

Willie Sutton (1901-1980)



Willie Sutton

Q: Why do you rob banks?

A: Because that's where the money is.

Science and Violence

Among recently graduated physics bachelors working in science or engineering: one-half worked on war projects (1986).

[Schwartz, op. cit.]

State and Violence

Max Weber's definition of the state:

A human community that (successfully) claims the monopoly of the legitimate use of physical force within a given territory.

State and Violence

Max Weber's definition of the state:

A human community that (successfully) claims the monopoly of the legitimate use of physical force within a given territory.

Randolph Bourne (1918):

War is the health of the state.

US spending on war (Fiscal year 2002)

$\$ \times 10^9$	<i>Where</i>
344.4	War Department itself
138.7	Portion of interest on national debt due to past wars
50.9	Department of Veterans Administration
18.5	Defense-related parts of the Department of Energy budget
17.6	State Department and international assistance programs related to 'defense'
17.5	Agencies later incorporated into Department of Homeland Security
8.5	Other homeland security
<i>596.1</i>	<i>Total</i>

[Robert Higgs, 'The Defense Budget Is Bigger Than You Think', <<http://www.independent.org/tii/news/031222Higgs.html>>.]

Science and domination

Henry Oldenburg (secretary of the Royal Society in 1662) sought:

suitors with boldness and importunity [who could] penetrate into
Nature's antechamber to her inner closet.

Francis Bacon, called the founder of the scientific method:

You have but to hound nature in her wanderings... [and] enter and
penetrate into these holes and corners when the inquisition of truth
is [the] whole object.

State and domination

(Colin) Powell doctrine: Use overwhelming force. Examples

- Grenada (1983): Air Force 0
- Panama (1989): Air Force 0 (?)
- Afghanistan (2001): Air Force 0
- Iraq (2003): Air Force 0

Science and law

To this day fundamental physics remains the ideal of science. Everything flows from the Standard Model. In it are the laws of physics. The whole of life is based upon chemistry, which rests upon physics and therefore upon the Standard Model -- the governing rules of the universe. Every branch of physics has laws governing its area of application, a Standard Model in miniature. Still, the theoretical physicist admires most the unity of the Standard Model and the beauty and harmony of its organisation.

Science and law

To this day fundamental physics remains the ideal of science. Everything flows from the Standard Model. In it are the laws of physics. The whole of life is based upon chemistry, which rests upon physics and therefore upon the Standard Model -- the governing rules of the universe. Every branch of physics has laws governing its area of application, a Standard Model in miniature. Still, the theoretical physicist admires most the unity of the Standard Model and the beauty and harmony of its organisation.

The Roman Empire was a State that to this day remains the legists' idea... Everything gravitated towards Rome From Rome came the laws... The whole life of the Empire went back to the Senate -- later to the Caesar, the all-powerful, omniscient god of the Empire. Every province had its small portion of Roman sovereignty to govern every aspect of daily life. Even now the legist and the authoritarian still admire the unity of the Empire, the unitarian spirit of its laws and the beauty and harmony of that organisation.

[Peter Kropotkin, *The State: Its Historic Role* (London, 1897).]

Whewell on why teach mathematics

William Whewell, master of Trinity (1841-1866):

Mathematical doctrines are fixed and permanent; no new system of geometry can supersede the old... Not only so, but even the old books remain in use...[The student] is led to...a docile and confiding disposition towards his instructor.

Whewell on why teach mathematics

William Whewell, master of Trinity (1841-1866):

Mathematical doctrines are fixed and permanent; no new system of geometry can supersede the old... Not only so, but even the old books remain in use...[The student] is led to...a docile and confiding disposition towards his instructor.

Whereas in Europe, teaching philosophy had given students:

vehement and general hostility to the existing institutions of their country ...[which] naturally flows from an education which invokes the critical spirit and invites it to employ itself on the comparison between the realities of society and the dreams of system-makers.

[William Whewell, 'On the Principles of English University Education' (London, 1837), pp. 46,49,52.]

Science and centralised authority

The Sun God, the symbol of centralised power, became the model of perfection for all human institutions... In all innocence, astronomy and celestial mechanics laid the foundations for a more absolute order, political and industrial...

The association of the new astronomy with ... centralised political power is no mere accident... The greatest Western monarch of the 17th century, Louis XIV, dramatised his authority by calling himself Le Roi Soleil, the Sun King.

[Lewis Mumford, *Pentagon of Power* (New York, 1964), p. 30.]

Science and the state: Parallels

Science and the state: Parallels

Violence

Science and the state: Parallels

Violence
Domination

Science and the state: Parallels

Violence

Domination

Law

Science and the state: Parallels

Science

Violence

Domination

Law

Science and the state: Parallels

Science

weapons

Violence

Domination

Law

Science and the state: Parallels

Violence
Domination
Law

Science
weapons



Science and the state: Parallels

Violence

Domination

Law

Science

weapons



string theory

Science and the state: Parallels

Science

State

Violence

weapons


Domination




Law

string theory

Science and the state: Parallels

	Science	State
Violence	weapons	Weber def.
Domination		
Law	string theory	

Science and the state: Parallels

	Science	State
Violence	weapons	Weber def.
Domination		Powell doctrine
Law	string theory	

Science and the state: Parallels

Violence

Domination

Law

Science

weapons



string theory

State

Weber def.

Powell doctrine

rule of law

On Voluntary Servitude

Martin Luther King

A nation that continues year after year to spend more money on military defense than on programs of social uplift is approaching spiritual death.

[Declaration of Independence from the war in Vietnam', 4 April 1967, Riverside Church, New York, NY.]

Etienne de la Boetie, On Voluntary Servitude (1548):

The fundamental political question is why do people obey a government.

His answer (like Hume's): People enslave themselves (e.g. Stanford).

So people can free themselves.