Philosophy of Science useful for Scientists?

Shigeyuki Aoki*
*University of Aizu
School of Computer Science and Engineering
Aizu-Wakamatsu, 965-8580 Japan
aoki@u-aizu.ac.jp

The theme on which I am expected to talk :

"Cooperation between scientists and philosophers"

Of course, there are various fields in sciences and philosophy.

Professional Philosophers:

- ✓ Anglo-Saxon (English-speaking) Tradition : Empirical – Analytic
- ✓ German Tradition : Idealism, Transcendental Philosophy
- ✓ French Tradition : (Post-)Structuralism, Phenomenology, Post-M
- ✓ Indian Philosophy
- ✓ Chinese Philosophy
- ✓ Japanese Philosophy (esp. modern period after Meiji Era) …

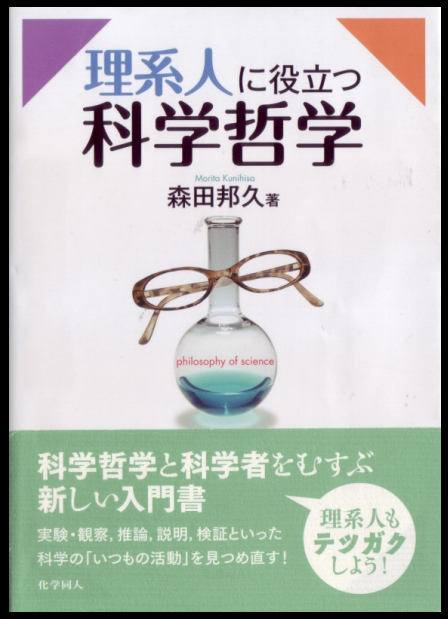
Note: my following talk reflects this English-speaking tradition.

A good point to start with

Recently published Japanese book,
Philosophy of Science useful for Scientists (2010) by Morita Kunihisa

He has a unique academic career. He once was a student of condensed matter physics and got his Ph.D at Osaka Univ.

He shifted to philosophy of science and has published a various papers on philosophy of science, esp. on scientific explanation and philosophy of quantum mechanics.



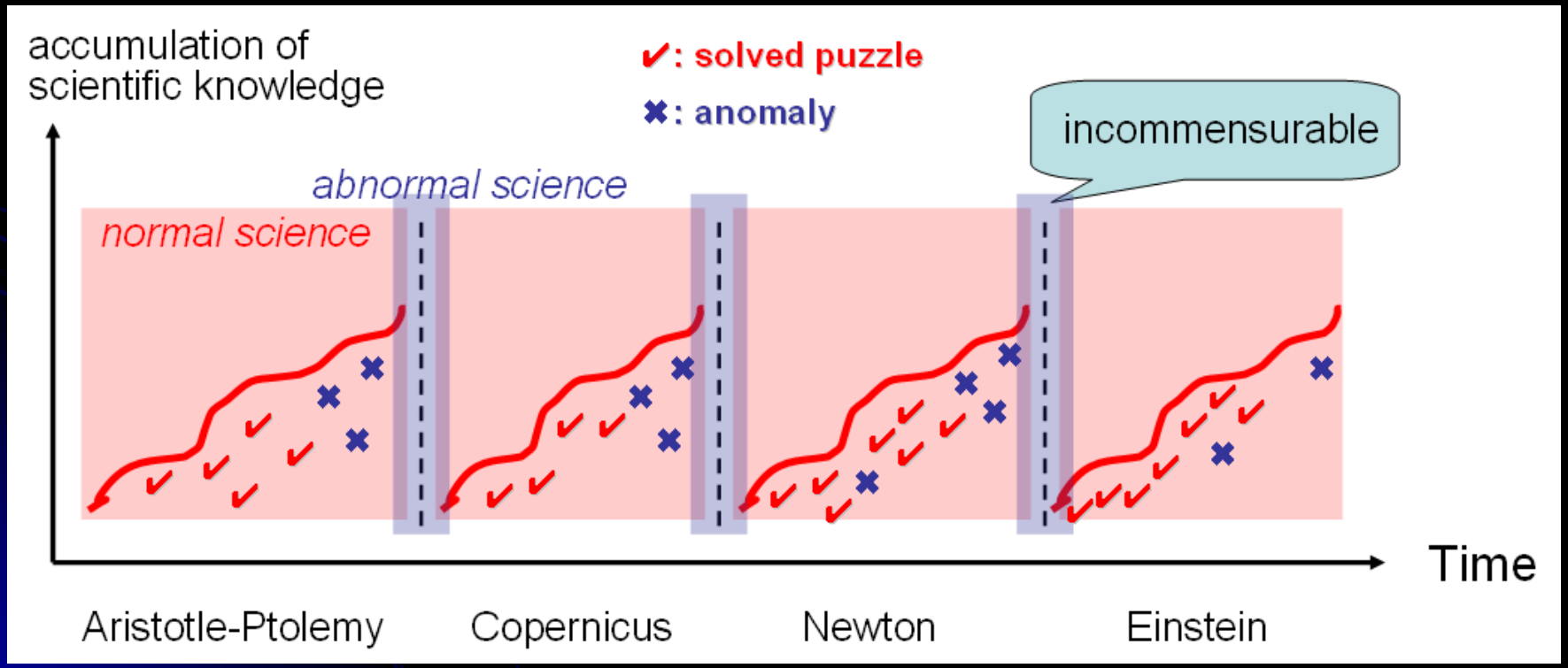
This book covers almost all sphere of PS, written clearly and neatly.
As a book which stands as a textbook of PS, this book is undoubtedly one of the best ever written in Japanese.

However…
There has been a strong opposition to PS from scientists:
"Philosophy of science is no more useful for scientists than ornithology (study of birds) to birds."

Scientific progress : a Kuhnian model

In order to think about the possible better cooperation, I suggest we need to remember that science has various stages.

Here is a Kuhnian qualitative model of scientific progress.
(Note: this chart is based on *early* Kuhnian idea which first appeared in 1962)



Scientific progress : a Kuhnian model

This Kuhnian model closely matches another quantitative research on scientific lifecycles.

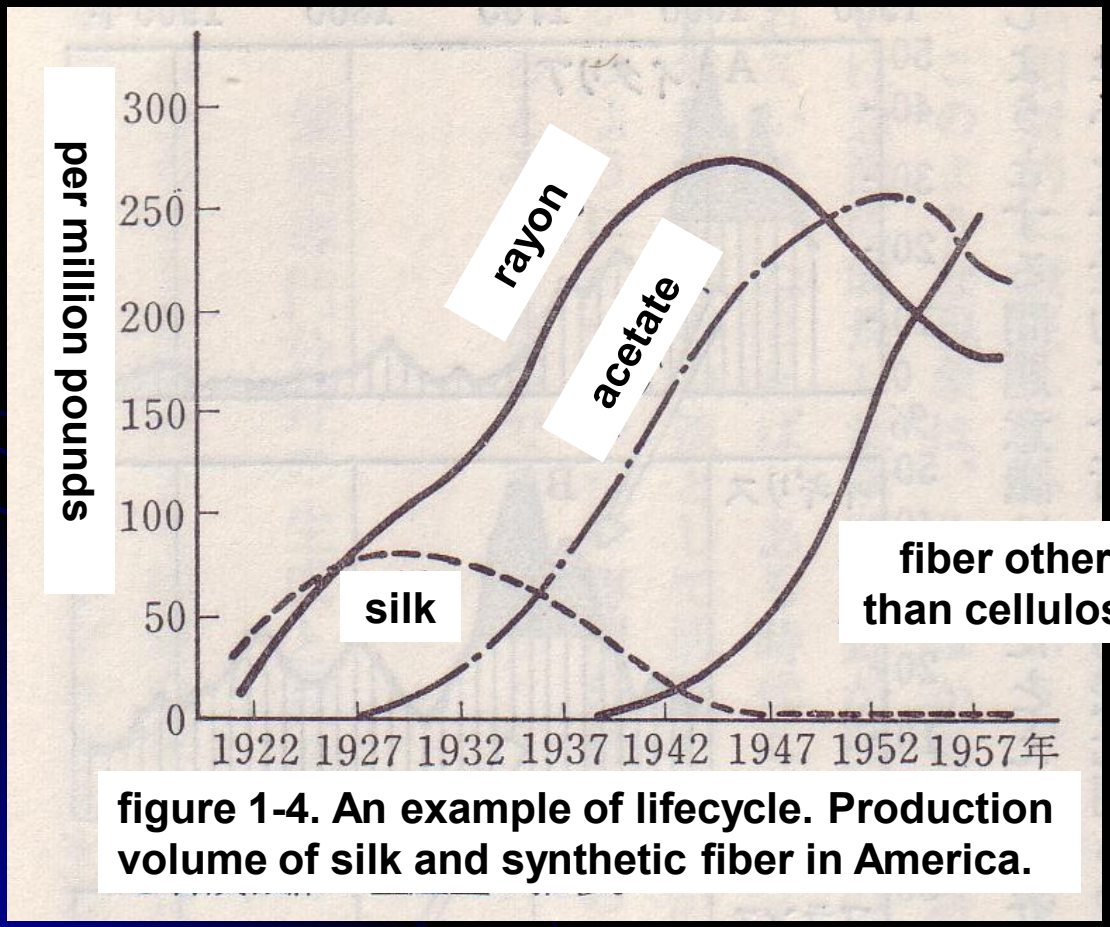


figure 1-4. An example of lifecycle. Production volume of silk and synthetic fiber in America.

This graph is based on research by a team of scientists (Hayashi & Yamada 1975).

In the following pages we find an explicit reference to Kuhn's work, while they complain

that Kuhn's model based on history of science is rather narrative. [p.25.]

normal / abnormal science

What concerns us at the moment is Kuhnian demarcation between normal science and abnormal science.

Sign of mature science through normal scientific practice:

- ✓ The field has classics associated with big-name founders
- ✓ The field has been highly standardized by textbooks
- ✓ The field is characterized by specialists (who are often indifferent to other fields of the discipline)

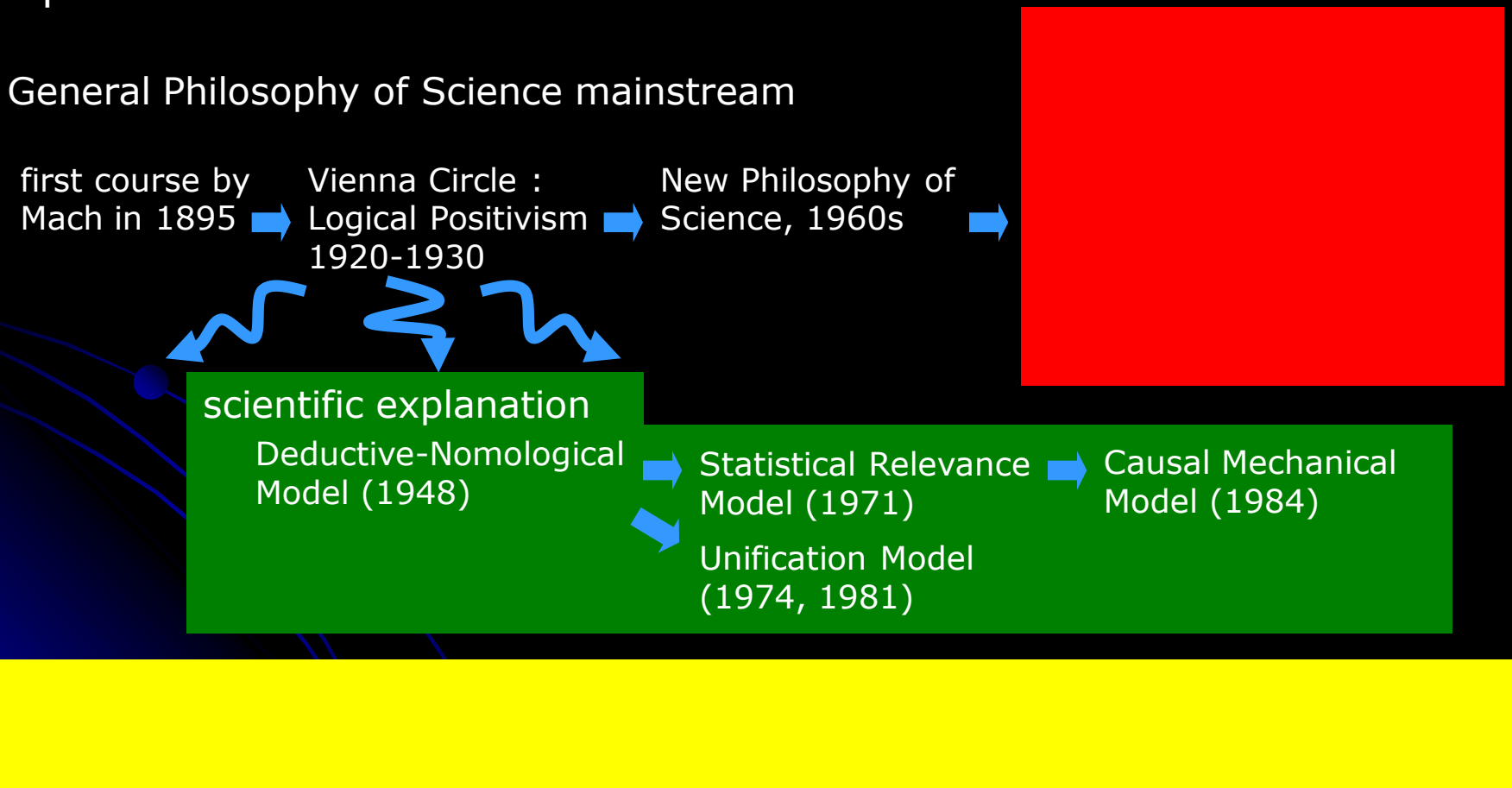
In normal science stage, philosophical discourse makes little contribution to sciences; it is just a noise.

On the contrary, in abnormal science stage, foundational questions arise such as “what is (good) science?”, “what is proper scientific method(ology)?”, “what is the aim of science?”

→ the chance of cooperative research is high.

PS itself is now in quasi-normal science stage

However, we must realize that PS itself, although not a branch of science, has been standardized in textbooks and divided into specialties.



Simple application of PS to real sciences won't work.

While sciences and PS have been thus highly specialized, the discrepancy between "two cultures" seems to have grown too big to be bridged ; especially their *interests* are so diverse!

General Philosophy of Science mainstream

first course by Mach in 1895 ➡ Vienna Circle : Logical Positivism 1920-1930 ➡ New Philosophy of Science, 1960s ➡ Scientific Realists / Anti-Realists, 1980s-

Ernst Mach	Hans Hahn Moritz Schlick Hans Reichenbach Rudolf Carnap Otto Neurath Kurt Gödel
mathematicians, scientists	

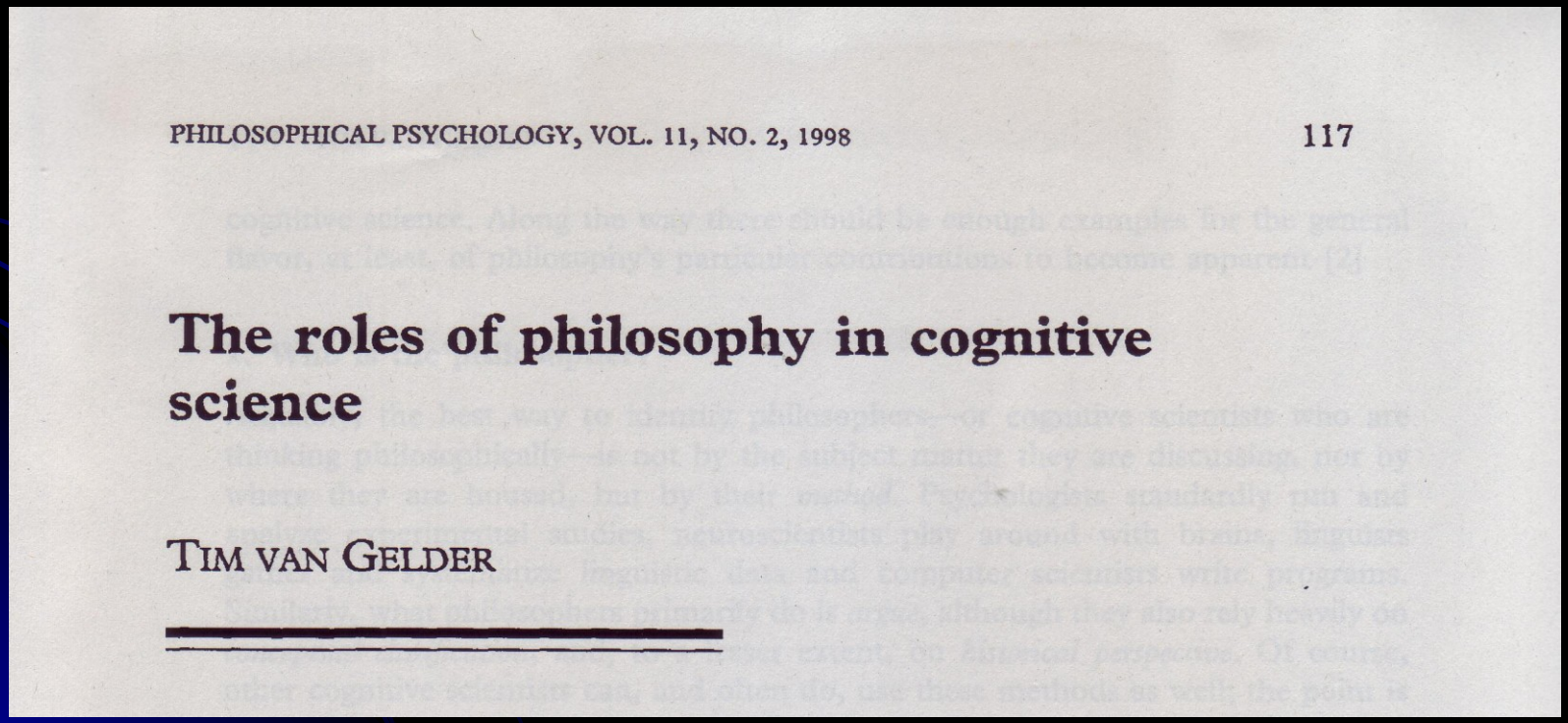
Norwood R. Hanson Thomas Kuhn Imre Lakatos Paul Feyerabend Larry Laudan	Hilary Putnam Bas van Fraassen Ian Hacking Harry Collins John Worrall
professional philosophers	

Some failures of philosophers-scientists cooperative research

- ✓ concept of "model", "observation"
- ✓ introduction of new experimentalism

The roles of philosophy in cognitive science

Then, how PS (or philosophy) can cooperative with sciences?
Here is a hint from van Gelder's frequently cited paper.
In it, he argues that philosophers can play various (perhaps positive and negative) roles in *embryonic* cognitive science.



PHILOSOPHICAL PSYCHOLOGY, VOL. 11, NO. 2, 1998 117

The roles of philosophy in cognitive science

TIM VAN GELDER

Who are philosophers? What can they do?

According to it, philosophers are those who are skilled with

- ✓ formal/informal *argument* methods
- ✓ *conceptual* analysis
- ✓ *historical* perspective

Philosophers play the following roles in cognitive science

- ✓ Pioneer – "tackle problems that nobody else knows how to handle yet, in the hope of transforming them into scientifically tractable questions."
- ✓ The building inspector – "it is not obvious that such [cognitive scientist's] assumptions are correct or unproblematic, and they deserve to be carefully scrutinized."

(continued)

- ✓ The Zen monk – "a figure supported by the community to ponder those imponderable issues that everyone thinks should be thought by someone, but for which nobody else has time or patience."
- ✓ The cartographer – "one role of philosophers is understanding and describing how all the various elements of cognitive science fit together (or conflict, as the case may be)."
- ✓ The archivist – "the philosopher, more than anyone else in cognitive science, is expected to be the repository of accumulated wisdom."
- ✓ The cheerleader – "most major movements in cognitive science have had their share of philosophical cheerleaders; these include AI intelligence, connectionism and computational neuroscience."
- ✓ The gadfly – "philosophers often advance positions that are so strongly and provocatively stated that other cognitive scientists feel compelled to respond."

assessment of van Gelder's view 1 - earth scientist's use of PS

Miyashiro Akiho's *What is Scientific Revolution* (1998)

Miyashiro is an internationally known geo-scientist, whose major contribution includes physical-chemical analysis of rock formation in high pressure in the subduction zone, which analysis (1961) backed up the then newly formed plate techtonics (1967-).

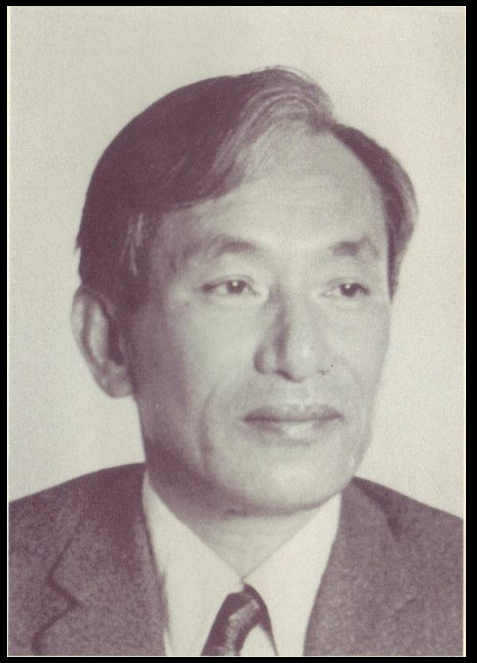
In this book, he criticized other Japanese geologists who refuse physical-chemical analysis in favor of a version of geosynclinal theory which was interwoven with extra-scientific *psychologies* and/or *ideologies*.

assessment of van Gelder's view 1 - earth scientist's use of PS

Miyashiro Akiho's *What is Scientific Revolution* (1998)

"Even when two competing theories are incommensurable, Lakatos thought that there is an objective superior/inferior judgment between them, which makes it possible to explain the progress of science in rational manner."

"Geosynclinal theory produces no prediction; on the contrary, plate techtonics has been a greatly progressive research program."



Here, Lakatos is portrayed as

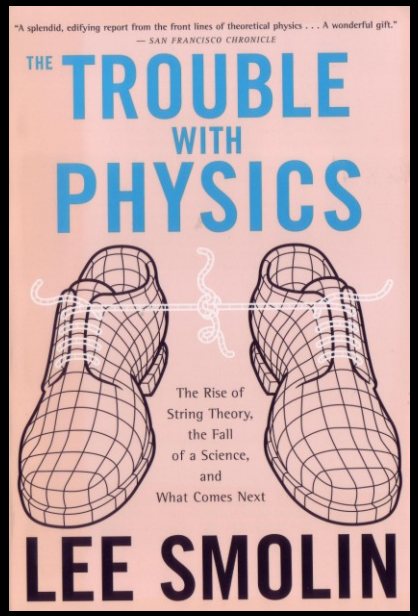
✔ The cheerleader (of plate techtonics)

✔ The archivist (of past superior theories)

assessment of van Gelder's view 2 - physical scientist's use of PS

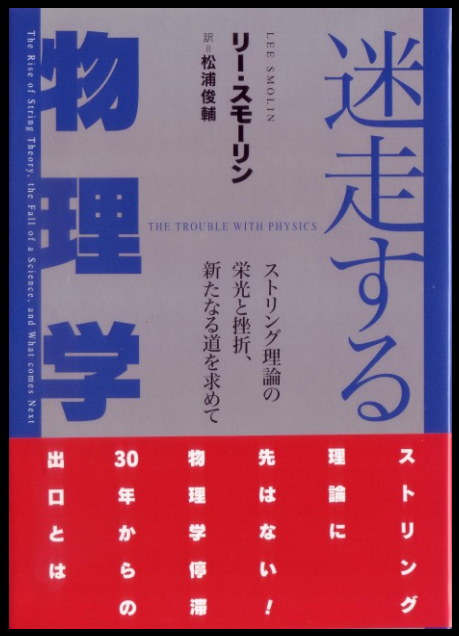
In *Trouble with Physics* (2006), L. Smolin points out that the string theory has been stagnant for 30 years.
There are seven drawbacks, he thinks, of the field:

1. *tremendous self-confidence*
2. *an unusually monolithic community*
3. *sense of identification with the group*
4. strong sense of *the boundary between the group and other experts*
5. *disregard for and disinterest in* the ideas, opinions, and work of experts who are not part of the group
6. *interpret evidence optimistically*
7. lack of appreciation for the extent to which a research program ought to involve risk



assessment of van Gelder's view 2 - physical scientist's use of PS

In the chapter "What Is Science?", he talks of the episode that he actually met Paul Feyerabend:
"in the few minutes he gave me, he offered an invaluable piece of advice."
"What I also learned from Feyerabend is that no a priori argument can tell us what will work in all circumstances. What works to advance science at one moment will be wrong at another. And I learned one more thing from his stories of Galileo: You have to fight for what you believe."



(Japanese translation)

Here again, Feyerabend emerges as
✔ The cheerleader (of methodological anarchism)
✔ The archivist (of past scientific episode)

When do scientists need philosophy, and how?

So far, we have examined two more uses of PS in special sciences, as well as in cognitive science. Of course, you can pick up more uses…

However, there are already interesting points which emerge from these case studies:

- ✓ In all cases, they refer to philosophers in the context of *abnormal science* (aside from everyday, normal, science)
- ✓ *Almighty philosophy does not exist*; scientists need Lakatos in some occasions, and in others they need Feyerabend. (Note that Lakatos and Feyerabend are like oil and water.)
- ✓ It seems that "*scientific change*" discussed by Kuhn, Lakatos, Feyerabend… turns out to be more useful for scientists than "scientific realism", "scientific explanation" or others.
- ✓ Why are there more roles of philosophy in cognitive science? Because the problem of cognition itself is philosophical (and therefore philosophers have much more to say on the topic).

My assessment of van Gelder's view

based on my contact experience with those who work in earth and planetary science (which is a *mature* science), when they try to establish a new field – *science of science* – from the viewpoint of earth's evolution.

→ note that this is the *extension* of their view: they already have a clear vision and expect philosophers to share it.

The following are my assessment:

Pioneer ---- ✔ (How to tackle this problem?)

The building inspector ---- ✖ (They don't care of "foundation")

The Zen monk --- ✖✖ (Philosophical arguments won't work)

The cartographer --- ✔ (How to put together?)

The archivist --- ✔ (Who preceded us? What did they argue?)

The cheerleader --- ✔✔ (How important this project is?)

The gadfly --- ✖ (Philosophical objections will be ignored)

Summary of my talk : good/failed cooperations

As a result, my talk will be summarized as rule of thumb as follows:

good cooperation	failed cooperation
・in abnormal science	・in normal science ・simple application of orthodox PS (intro. of "experiment")
・scientific change	・scientific realism scientific explanation
・philosophical topic (e.g.cognition)	・mature science
・cheerleader, archivist	・inspector, Zen monk, gadfly

But above all "*Almighty philosophy does not exist.*"

Thank you for your attention!

Please feel free to send me any comments, questions, etc.

aoki@u-aizu.ac.jp