

# Thomas Kuhn and The Structure of Scientific Revolutions

The implications of the story so far is that science makes steady progress

- ☞ That the process of science cycles round and round from Induction to Deduction . . .
- ☞ Adding fact on fact, and accumulating true knowledge.

But in practice it does not work that way.

- ☞ This is because of the flaw of induction, *"You can only see what you are looking for . . . "*
- ☞ Each cycle reinforces the theory at hand.
- ☞ The theory looms larger and larger, guiding expectations and observations.
- ☞ Soon the theory has a life of its own . . .
- ☞ And individual scientists who have spent years studying under the theory have a vested interest in it.

But no matter how well vested the theory is, or how much it seems to explain, it is still based on induction and deduction . . . which are flawed (as the To and Fro model makes clear).

- ☞ And the more scientists have invested in the theory the more biased they are.

One of the great “discoveries” of science was a way to break out of this loop.

- ☞ Getting caught in a loop has been the plague of all belief systems, leading to more and more dogma.
- ☞ It is true that sometimes extraordinary individuals can break out of the loop, but it is rare for them to make lasting changes in the system.
- ☞ And when lasting changes do occur, it is usually precipitated by some accompanying historical shift, often resulting in the destruction of the old system.

The invention of science is a methodology which leads to periodic destruction of old ideas . . . without destroying science itself.

*Thomas Kuhn* in his 1969 book The Structure of Scientific Revolutions revealed the true historical nature of science, and the way science develops.

- ☞ Kuhn argued that the development of scientific ideas is an alternation of . . .

**NORMAL SCIENCE ⇒ REVOLUTION ⇒ NS ⇒ R ⇒ NS**

Normal Science is what most scientists do most of the time.

- ☞ *Puzzle Solving* - finding detailed answers to already known ideas
- ☞ *Mopping Up Operations* -

These activities are guided by a Paradigm

**PARADIGM - UNIVERSALLY RECOGNIZED SCIENTIFIC ACHIEVEMENTS THAT FOR A TIME PROVIDE MODEL PROBLEMS AND SOLUTIONS TO A COMMUNITY OF PRACTITIONERS**

That is, a World View

Or, to state it another way.

- ☞ Paradigms guide normal science until unresolvable problems presented by nature cause a crisis and the formulation of an alternate paradigm (i.e. a revolution) to guide future research (i.e. a new state of normal science)

Why is it like this?

- ☞ Because everyone agrees on what they know.
- ☞ They agree because the education system inculcates them in what they are supposed to know - which is the current paradigm.
- ☞ To be a science all the practitioners must agree on the problems which exist.
- ☞ Kuhn argues that a science does not come into being until all practitioners accept a paradigm.
  - > **ADVANTAGES?** - in a very complex world it guides what you choose to look at. Without this, fact gathering is random, like classical induction.

- > **DISADVANTAGES?** - restricts what can be believed or what is possible (like a religious creed).



But the second great insight that Kuhn had was how paradigms break down and lead to revolutions.

- ☞ Revolutions are not precipitated by some maverick, inside or outside the discipline.
- ☞ Revolutions are usually precipitated by the most knowledgeable and experienced scientists in the current paradigm.

As Normal Science progresses, anomalies arise in observations and experiments.

- ☞ These are facts which do not fit the paradigm, so, of course, people do not know what to do with them. They cannot be explained.
- ☞ The importance of an experienced practitioner steeped in the paradigm is that they are the ones who are best prepared to recognize the anomaly for what it is.
- ☞ But these anomalies are at first ignored because no one knows what to do with them.

In time, however, anomalies accumulate, and become so blatant that they cannot be ignored.

- ☞ Precipitates a revolution when some brilliant, young practitioner just entering the field, but not blinded by the paradigm recognizes that the anomalies are anomalies to the paradigm because the paradigm is wrong.
- ☞ Leads to breakdown of old paradigm - a revolution.

Historically this is a very messy time.

- ☛ Nature herself starts to say, "Your ideas do not work."
- ☛ But it is very hard to give up the security of the known paradigm and dive off into the unknown.
- ☛ Much resistance exists because it requires a complete breakdown with the past and reexamination of everything that is known.
- ☛ Some people will never go along, and sometimes the revolution is not complete until the old guard has all died.

But when the shift comes to a new paradigm it is usually suddenly.

- ☛ A cognitive shift, like a Necker Cube.

It is in this way that Mythical Truths enter science.

- ☛ The paradigms are mythical truths - they are true because they are said to be true (in textbooks and classrooms).

What is uniquely different about science is that the method of science, pitting inductive and deductive logic against each other, eventually leads to destruction of the myth, in spite of its universal acceptance and power.