

# **A Science Student's Not-so-scientific View Towards Science: Then and Now**

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Science is built up of facts, as a house is built up of stones; but an accumulation of facts is no more science than a heap of stones is a house.

— Henri Poincaré, *Science and Hypothesis*

## **1. Introduction**

It had been an awkward moment — taking this course, naively thinking I have the upper hand because of my major, not until being asked the plain question ‘What is science’ that it struck me — I had perfectly no answer. To a person who proudly declared herself as a science student, disregarded her parents’ objection in majoring a science subject, even determined to pursue a scientific career in the future, this somehow sounded a shame. Going through the passages in the course I finally gave serious thought to what science, the very theme my four years have been centered upon, really is about.

This whole time I grasped from the school curriculum my impression of science. Basically, they are solid information; facts with explanations. The reason sciences always seemed much simpler than arts to me during secondary school studies was that I needed only to take every law, every

theory as granted. It was even a tactic of mine in public examination when I didn't have much time left for study: simply accept everything, don't bother to doubt anything. Beyond question I developed a 'healthy' respect for the scientific realm, regarding each statement in textbooks, each piece of knowledge I studied as infallible. It might have been a genuine appreciation for its power, or simply an immature craving for recognition of my field of interest. At any rate, I would call myself shallow to have perceived science solely this way.

I am lucky to have UGFN1000 reshaping my vision.

## **2. Milestone I: Brand New Understanding of Science**

### **2.1 Science = Facts?**

As a start in attempt of comprehending the not-so-simple word, I tried searching its definition. Originated from the Latin word *scientia* which means 'knowledge', 'science' is termed 'the intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experiment' in *Oxford Dictionaries Online*. To be brief anyway, I prefer calling it the 'Systematic, Comprehensive Investigation and Exploration of Nature's Cause and Effects'. In essence, science would be more than a stack of knowledge; it is the process of endless discoveries, the coherent interpretation of our natural world through associating cumulative *facts*. But what are facts anyway? Stephen Jay Gould put this in a humorous manner:

In science, 'fact' can only mean 'confirmed to such a degree that it would be perverse to withhold provisional assent'. I suppose apples might start

to rise tomorrow, but the possibility does not merit equal time in physics classrooms.<sup>1</sup>

Parallel to the cave dwellers' ignorance of reality in Plato's Allegory, what we claim to know as 'facts' might only be our own perception of what is real; the Big Bang theory, the Electron Cloud Model and Mendel's laws of inheritance may be mere shadows on the walls.<sup>2</sup> We are obviously not gods, and certainly we would reach a threshold where we can know no further, restricted by our limited intelligence. Poincaré mentioned our necessity to select facts for they are infinite in number, while Schrödinger exhibited the controversial mind and matter problem which none of our experts so far can give an answer convincing enough. There is absolutely no way we can know and understand everything about truth — how do you know if the sun is the ultimate truth rather than yet another of its projection?

In *Physical Science in the Middle Ages* I witnessed a succession of physical theories: Aristotle's natural and violent motions, revised by Philoponus and Avempace, enriched by the introduction of internal resistance and specific weight, and eventually replaced by Galileo's mechanics. It must have been difficult to abandon deep-rooted beliefs and embrace new ideas instead, but truth is, science is ever-changing; there is no such point when we decide we have come up with a decisive answer. One of my favorite moments from the *Indiana Jones* series is when Harrison Ford uttered the overwhelming words

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1 Stephen Jay Gould (1941–2002), American paleontologist and writer. See Gould, Stephen Jay, *Hen's Teeth and Horse's Toes* (New York: W.W. Norton & Company, 1983), p. 254.

2 Electron Cloud Model is the modern framework of placing electrons into orbitals of an atom. See "Atomic orbital" in *Wikipedia* (Retrieved 17:32, April 23, 2011). Mendel's laws include the Law of Segregation and Law of Independent Assortment. See "Mendelian inheritance" in *Wikipedia* (Retrieved 17:50, April 23, 2011).

‘Nothing shocks me. I’m a scientist.’<sup>3</sup> Sure we have in our hands Newtonian and Einstein physics which are widely accepted and applied nowadays, and just why it would be a shock to see them being overthrown one day? Our endless pursuit *in the direction of* truth still marches on.

## 2.2 THE scientific method?

In secondary school science class we all learnt the so-to-speak invincible scientific method: observation-hypothesis-experimentation-analysis-theory. I have long been under the impression of such simple and straightforward way to each scientific discovery, but apparently this is not the case in real practice. In *The First Three Minutes* Weinberg demonstrated a problem impossible for direct experiments to be conducted. It would be irrational to believe we can spread out a ruler and measure each year the distance of each celestial body from us, and so our theory of universe expansion can only rely on inferred evidence, ultimately derived from a buildup of principles and models, i.e. so-called facts. The same applies to Darwin’s theory of natural selection when he had no way travelling back in time but barely observations across continents. Nevertheless it was a little more for the discovery (or should I say proposal?) of DNA structure. Watson, though a show-off, had excellent insight into his challenge. He and Crick were able to collect bits and pieces of testimony that appeared fairly unrelated, then logically fit them all in place into a complete puzzle— a complete breakthrough. Science, after all, cannot be shrunken into a stereotyped solution package.

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3 Harrison Ford (1942–), American film actor and producer. Starred as Indiana Jones in the Indiana Jones franchise. Quote from Steven Spielberg (director), *Indiana Jones and the Temple of Doom* (Hollywood: Paramount Pictures, 1984).

Surely not everyone may be convinced, not until they can have a bird eye's view of the universe to witness its expansion, or able to see the double-helical structure of DNA with their own naked eyes. I cannot blame them as being illogical because once again, that's what science is about. We can never be certain about anything, can we?

### **2.3 Beyond science?**

With modern science leaping forward at such amazing speed it would be customary to draw an arrogant conclusion: Science can solve anything. Wrong. As almighty and far-reaching as it is, science remains limited in scope. An important point to make is that it is purely descriptive and passes no moral judgments. It informs you of a way to use it, not whether or not you *should* use it. Darwin introduced the concept natural selection, but this doesn't rationalize eugenics. Crick and Watson suggested the DNA structure, but this doesn't give good reason for DNA recombination and human cloning. Carson clearly demonstrated to us how an improper application of science can devastate our own lives. With science we are offered with much more information thus choices, yet still, we are the ones to critically weigh and decide. What kind of world would it be when we casually throw nuclear bombs to our hearts' content, just because science taught us the mechanism of nuclear physics?

### **3. Milestone II: Brand new attitude towards science**

In his *Science and Method* Poincaré's suggestion of selection criteria for scientific facts fascinated me, for I found certain genuineness in that 'If nature were not beautiful it would not be worth knowing . . .' Thomas Henry Huxley beautifully portrayed so:

The chess-board is the world; the pieces are the phenomena of the universe; the rules of the game are what we call the laws of Nature. The player on the other side is hidden from us. We know that his play is always fair, and patient. But also we know, to our cost, that he never overlooks a mistake, or makes the smallest allowance for ignorance. <sup>4</sup>

For long I deemed science's dominant usefulness as an objective approach to solving practical problems and improving living standards, finally forgetting why I took pleasure in studying this subject in the first place. *Silent Spring* reminds me of how harmoniously each component of nature naturally interacts with each other, how orderly this complex system naturally maintains itself. My vital goal as a scientist shouldn't have been finding another of her use, but appreciating nature as what she is.

#### 4. Concluding thoughts

It had been a rewarding experience acquainting with my old friend science once more. As the famous Albert Einstein once amusingly said, 'Falling in love is not at all the most stupid thing that people do — but gravitation cannot be held responsible for it', I now recognize science's boundaries — its incapability of unraveling every mystery in existence.<sup>5</sup> I ought not to blindly accept every single scientific 'fact' laid before me for it is subjected to future changes. Science also need not be responsible for deciding how it is used, for we are. As for now, I would be keeping alive my passion for the beauty of nature whilst I carry on with my journey towards truth as a humble scientist.

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4 Thomas Henry Huxley (1825–1895), English biologist. See Huxley, Thomas Henry, *Science and Education: Essays* (London: Macmillan, 1893), p. 82.

5 See Helen Dukas and Banesh Hoffmann (ed.), *Albert Einstein, The Human Side: New Glimpses from His Archives* (Princeton: Princeton University Press, 1981), p.56.

## References

### References in English

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**Teacher's comments:**

The author demonstrates her effort not only in understanding the texts but also in connecting them together. This connection is a result of her deep reflection on the texts which has radically changed her attitude toward science. This essay is a record of this change. The episodes are well-organized so that the reader can retrace her thinking path and experience the change with her. Now she knows that on one hand science is much more than she thought but on the other hand it has limitations. (Chan Chi Wang, Ng Wai Yin, Szeto Wai Man and Wong Wing Hung)