

On the Idea of Beauty of Nature

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1. Introduction

When we look at the sky at night, most of us will be puzzled by the vastness of universe and then frustrated by our littleness. However, there were always talents (or fools) in history who tried to explore this world and how it worked. One reason I believe is that they have faith in the existence of some laws, principles governing the world, from tiny particles to the unbounded universe, and discovering these laws was like overcoming the world. To me, their faith is the beauty of nature: **no matter how discrepant and complicated the nature we observe, there are some simple, general structures behind explaining their occurrence.** In this paper, I will look into my view on the beauty of nature, followed by illustrations and Henri Poincaré's (1854–1912) view. Finally, the paper ended with my reflection of the existence of the beauty.

2. My view

The beauty of nature I perceive is not the physical one seen by our eyes, for example, the magnificent mountains or deep blue seas. The beauty is about the simple and elegance interaction among this chaotic material world. Although countless observations and behaviors were found very day, they are just some results or phenomena that can be explained by some general

laws or under simple structure. The beautiful part is that the seemingly messy world is governed by hidden simple rules or “truths”.

Here I have to first talk about the terms I used.

First, “nature” I specify here is the world we live in, the aggregate of things surrounding us. (From now, I use “nature” and “world” interchangeably.) However, “nature” here is free of human influence. In other words, I am not talking about the metropolis built by human but the part of world that would remain the same irrespective to presence of human. To illustrate, human discovered DNA structure; but that structure remains in creatures and human work will not change it. This specification can narrow my field of investigation and concentrate on the topic.

Second, “discrepancy” is the different observations we made in the nature, for example, various metal compounds will react differently upon heating, some emits red light, some sparks etc. Observations may come from similar events (such as the heating of them) or some apparently distant events (such as the movement of celestial bodies and a free falling of an apple).

Third, “structures” here has to be clarified clearly. They are frameworks or laws that govern occurrence of things. We may see them as “if-then” mechanism that once the condition (if) is applied, the consequence (then) will necessarily follow. For example, we cannot be certain in advance that an apple will fall once it is released. However, the concept of Newton’s physics convinces most of us that it will happen because no violations were observed under normal circumstances. Furthermore, the structure is said to be simple if the amount of deterministic parameters (if) is few enough to be helpful for us to make meaningful prediction on subjects. It is to say, if a structure specifies infinitely “if” conditions which can hardly be applied or duplicated again (an ad hoc theory) or it gives only a narrow implication that offers us no new

information, the structure is said to be not “useful” to explain and predict. Simply, that is not simple.

3. Illustrations

First, I use example in biology to illustrate. In 1953, Watson identified the 2-chain double helix structure of DNA and its role to carry genetic information to the next generation¹. This simple structure binds the four types of bases and the arrangement of these bases contributes to unique genes which give characteristics of organisms, from creatures like bacteria to species like human and mammals. We have to say the delicate structure of DNA as the key determinants of heredity is that kind of simple yet beautiful. The beauty lies on its simple but powerful structure which generates countless combinations that give birth to every distant and diversified organism we see every day. Can one find any graceful handmade material in this world that is comparable to this fine craftsmanship made by the nature which is that simple yet “infinite”?

Next, I illustrate my view with basic physical phenomena. According to Isaac Newton “every point mass attracts every single other point mass by a force pointing along the line intersecting both points. The force is proportional to the product of the two masses and inversely proportional to the square of the distance between them.”² This law explains most of the motion (except for some involving extreme high speed and mass); we can analyze the motion of a free falling stone with the force mainly between the stone and the Earth

1 See James D. Watson, “The Secret of Life”(New York, Alfred A. Knopf, 2001), Chapter 2.
2 Proposition 75, Theorem 35: p.956, I. Bernard Cohen and Anne Whitman, translators: Isaac Newton, *The Principia: Mathematical Principles of Natural Philosophy*. Preceded by *A Guide to Newton's Principia*, by I. Bernard Cohen. University of California Press 1999. In Wikipedia, The Free Encyclopedia. Retrieved 22:47, April 8, 2011, from http://en.wikipedia.org/wiki/Law_of_gravitation.

(plus some insignificant forces among ordinary, small mass objects). How intriguing it is for what matters we touch, we watch at sky, are all governed by that simple, powerful law. The complexity among many matters can be resolved into simple relationship. We can think about that no matter how many planets, stars, metros in our solar system (to avoid cosmology related to general relativity), their motion is just the simultaneous interaction of a simple law. Every single motion of the bodies is just the aggregation of behavior governed by the law!

I believe some simple frameworks can depict the infinite matters and phenomena in this world. What makes a picture complicated is the amount of objects painted but the structure of this picture can still be that simple. That is to say, **it is the numerous objects in the world that add complexity to it, but there are just simple structures!** This relationship is the beauty of nature to me, it is hard not to appreciate this delicate “operation” of the world and that the complexity of the nature we see is merely just the interaction or the transformation of simple laws.

The Unified Field Theory³ is a step further. It aims to generalize the field concepts in physics into one which explains the gravitational, electromagnetic, weak (involving radioactive decay) and strong force (involving formation of protons and neutrons from quarks). Einstein devoted his late life to establish equations for this theory⁴ and he implicitly believed that there are some general laws, which are powerful enough to analyze matter and behavior in this physical world. If it is to be constructed, it will be one giant step further

3 First coined by Albert Einstein, in “On the Generalized Theory of Gravitation”, *Scientific American* CLXXXII (4): 13–17. (1950). on <http://sami5001.buzznet.com/user/journal/10529/generalized-theory-gravitation/>.

4 See, Abraham Pais, *Subtle Is the Lord: The Science and the Life of Albert Einstein*. New York: Oxford University Press, 2005, 325.

to explore the beauty of the nature. Just imagine how elegant the world is when this entire physical world, full of countless matters and chaos can now all be drawn down to a set of equations which we can employ to explain and predict the whole world! Hardly can anyone not sigh and feel powerless when facing this fine, simple and precise structure depicting the whole world, and astonished by the intelligence of the anonymous who designed this framework.

4. Poincaré's view

To begin, I have to admit that my view on beauty of nature is strongly influenced by his work. According to Poincaré, “What I mean is that more intimate beauty which comes from the harmonious order of its parts, and which a pure intelligence can grasp . . . Intellectual beauty, on the contrary, is self-sufficing, and it is for it more perhaps than for the future good of humanity, that the scientist condemns himself of long and painful labors.⁵”, “It is because simplicity and vastness are both beautiful that we seek by preference simple facts and vast facts.⁶”

He viewed the beauty of nature as the harmonious order of nature's components and that those are intelligent enough can find this order. Here, he did not give meaning to “harmonious”. However, in the same article, he suggested that we should focus on discovering similarities hidden under apparent discrepancies and he believed that when we can go deep into these resemblances, we could find them becoming wider and wider and tending to embrace everything.

5 See Henri Poincaré, *The Value of Science: Essential Writings of Henri Poincaré*. New York:, Modern Library, 2001, p. 368.

6 Ibid., p. 369.

I interpret that his harmonious order of nature's components is the hidden resemblances of discrepancies in the world, which builds my view on the beauty of nature. He believed that there are some similarities hidden that can be used to explain discrepancies in the world if we are intelligent enough. This is similar to my view. Also, he identified simple and vast things as beautiful. To me, it is because when we trace objects to its simpler form, we can imagine that they are formed by some homogenous, fundamental components. In this way, no matter how dislike the objects are to each other, we can still analyzed them by investigating their identical, building structure. Such as we can investigate the numerous reactions of chemicals by investigating how their identical building blocks (the electrons, protons, and neutrons) behave during chemical reactions. We can find simple laws explaining the numerous chemical reactions by studying the more homogenous, fundamental atoms and their behavior. Analogously, the huge magnitude of stars and universe makes the existing comparatively small discrepancies between objects theoretically meaningless when we analyze the whole system. For example, the different shapes among planets are theoretically and practically meaningless due to their incomparable magnitudes and will not contribute difference when we analyze among galaxies. We can then generate laws without considering the underlying discrepancies.

Here, we can always decompose or project objects into infinitely small or huge magnitude to eliminate the difference and find similarities as we wish. However, one important point to note is the decomposition and projection should be in a level such that the framework built upon is not that complicated or too empty and is still useful to explain and predict. Otherwise, what is the point to build a theory as complicated as the real world or provides us with no new information after all?

5. Reflection and Conclusion

Throughout the paper, I have reiterated my understanding on the beauty of nature as the unrivaled sight of the world with numerous discrepant matters and behaviors that are governed by simple, powerful structure behind. To the very end, a question will eventually be asked. “Are we just making up those frameworks which do not exist?” or simply “**Does God play dice?**” and there is no “truth” or framework behind the world.

In my opinion, it is always the belief for scientists that the world does not come up with pure randomness. They believe that phenomena can be explained and analyzed with reasons and patterns, otherwise, why are they devoting their time and paying effort into things that occur with no reasons. Alternatively, I should say, even if the god does play dice, scientists are like gamblers who want to beat the dealer and discover how the dice rolls. As mentioned at the beginning, there were always people throughout history who wish to explore the truth of this world and look down at people in the world. This satisfaction gives birth to scientific research and ultimately reduces our ignorance to the nature. No matter truth does exist or not, after all, **who can resist acknowledging the entire physical world and becoming the person having the closest mind to the “Creator”?** Scientific development and discovery of our world will always continue and are motivated by our curiosity and instinct to explore and conquer.

References

1. Albert Einstein, “On the Generalized Theory of Gravitation”, *Scientific American* CLXXXII (4), 1950.

2. Abraham Pais, *Subtle Is the Lord: The Science and the Life of Albert Einstein*, New York: Oxford University Press, 2005.
3. Henri Poincaré, *The Value of Science: Essential Writings of Henri Poincaré*, New York: Modern Library, 2001.
4. James D. Watson, *DNA, The Secret of Life*, New York: Alfred A. Knopf, 2003.

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Teacher's comments:

Influenced by the French mathematician and physicist Henri Poincaré, the writer gives an eloquent account of his views on the “beauty of nature”, i.e. natural phenomena, however complex they may seem, are governed by simple structures behind. Ideas are clearly delineated and supported by relevant and interesting examples, ranging from the structure of DNA to Newton’s law of universal gravitation. A highly enjoyable intellectual journey is at hand. (Chan Chi Wang, Ng Wai Yin, Szeto Wai Man and Wong Wing Hung)