

## An historical perspective of how breakthrough innovators come to know

**Patriarchs of contemporary innovation: Newton & Goethe****The conflicting views of two giants provide perspective on the knowing characteristic of innovation**

*in which it has been banished (by Newton), in order to restore it to dynamic flow of life and action. In other words, the abstract mathematics of optics completely fails to do justice to experience of color in everyday life.*

*To Goethe, the Newtonian approach to color was rather like describing a rose in terms of a collection of uniformly grey subatomic particles, it completely ignored the essence and beauty of flower.*

*(Goethe) was more concerned with physiological aspect of color and not physical aspect of color. His main concern was perception of color. He wanted instead to classify the different conditions under which color is produced and to assess their reality in terms of ordinary experience."*

In the end, while there appears to be general consensus that Goethe's approach had validity in its own right, there is an equal sense that it really was not what we consider science today – that is, physical science practiced by Newton.

**T**wo giants; the exemplar physicist and the exemplar poet. Their names are inextricably linked due to conflicting views of – of all things – optics. And, notably for this series of essays, the views they represent illustrate the two predominant approaches to how we come to know in contemporary innovation.

**Newton, Goethe and a clash of titans**

Contributing significantly and multiply to the emergence of science from natural philosophy – development of calculus, the laws of motion, and a theory of light – Newton was the quintessential Enlightenment scientist. Born in 1642, his most productive years as a scientist were in the later part of the 17<sup>th</sup> century, marked by the publication of *Principia Mathematica* in 1687 and *Optiks* in 1704.

Recognized as being among the most significant poets and novelists, most notably for his rendition of the German legend *Faust*, Goethe lived one hundred years after Newton. Goethe represented a more personal, emotional, almost unarticulable view of the world, in stark contrast with Newton. That his work was valued and set to music by no less than Mozart, Beethoven, Schubert, Schumann, Brahms, Wagner and Mahler validates his literary greatness, his ability to perceive and then write in ways unmatched by others.

Upon discovering what he took to be an error in Newton's work, Goethe engaged the by-then long-dead Newton regarding his understanding of optics. In doing so, he brought the differences between these two giants and their views of the world into sharp contrast:<sup>1</sup>

*"Scientists analyze color and artists manipulate color. Goethe was the artist and Newton was the Scientist.*

*(Goethe's) aim was to rescue color from the (mathematical and scientific) restriction and isolation*

*"To Goethe, the Newtonian approach to color was rather like describing a rose in terms of a collection of uniformly grey subatomic particles, it completely ignored the essence and beauty of flower."*

**The tribes of Newton and Goethe**

"Well, this is all really nice, Bruce, but what does it have to do with contemporary innovation?" you appropriately might ask. Let's construct two lists, one for the characteristics of each of Newton and Goethe, and then see what we can learn from them:

**Newton**

- mathematical description (color is external to us)
- experimental, detached observation of color
- reduce color to its elements
- objective, dispassionate

**Goethe**

- how we perceive color (color is internal to us)
- experiential, personal observation of color
- experience the essence and beauty of color
- subjective, emotive

The pattern that begins to appear is that Newton and Goethe are prototypical representatives, "patriarchs" of the two dominant "tribes" of contemporary innovation: technology-based innovation (analytical thinking) represented by Newton and industrial-design-based innovation (design thinking) represented by Goethe. ➤

Having posited, and observed patterns that suggest, this “genealogical” connection, let’s explore it bit deeper before moving on to what we might learn from it relative to innovation.

In his influential, *The Two Cultures*,<sup>ii</sup> C.P. Snow contrasted the arts and humanities on one hand with the natural sciences on the other. Of note for this essay is Snow’s assessment of the enmity between these two cultures, a fracture that arose with the emergence of science as practiced by Newton and the new-found specialization, and specialized concepts and language, associated with it.

*“A good many times I have been present at gatherings of people who, by the standards of the traditional culture, are thought highly educated and who have with considerable gusto been expressing their incredulity at the illiteracy of scientists. Once or twice I have been provoked and have asked the company how many of them could describe the Second Law of Thermodynamics. The response was cold: it was also negative. Yet I was asking something which is the scientific equivalent of: Have you read a work of Shakespeare’s?”*

*“I now believe that if I had asked an even simpler question — such as, What do you mean by mass, or acceleration, which is the scientific equivalent of saying, Can you read? — not more than one in ten of the highly educated would have felt that I was speaking the same language.”*

Yet, it’s not just a gulf of specialized concepts and language that separates the sons and daughters of Newton from those of Goethe. In *Loving to Know*,<sup>iii</sup> my friend Esther Meek,<sup>iv</sup> describes an entire set of contemporary epistemological dichotomies that track closely with those I describe above. She goes on to assert an insight for which I share her passion: that we have a defective, unarticulated, default way of knowing that is, in some way, incomplete and in need of what she refers to as “epistemological therapy”. And that incompleteness today, in the West, tends to define itself by the dichotomy represented by Newton and Goethe.

## Implications for innovation

A recent anecdote<sup>v</sup> illustrates how the offspring of Newton approached the problem of optimizing – in this case accelerating – the distribution of checked baggage. An engineer developed an algorithm to reduce the distance between arrival gate and baggage carousel. Yet, as the airline learned – after implementing this “solution” – that this did anything but please passengers, as the wait associated with a nearby carousel was found to be more annoying than a longer walk! Had an individual with empathy for passengers – a child of Goethe, perhaps – been involved, this might have been avoided.

Now, I don’t want to leave you with the idea that I believe that one or the other approach always is right or wrong – far from it. My point is that some challenges are best addressed by the tribe of Newton and others by the tribe of Goethe, and, most importantly, that discernment is necessary to understand which are which. Further, as I will explore in my next essay, some are best addressed by massing the force of both, working as – or in – one, to extraordinary, disproportionate impact. ■

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<sup>i</sup> While developing this essay I happened across a blog, written by N. S. Gangakhedkar, entitled, *Chromatic Notes: Understanding Science and Technology of Color* (<http://drnsg.wordpress.com/>). Of particular interest is his April 26, 2013 post entitled, “Cause and Effect of Color,” which explores the conflicting views of Newton and Goethe. The quoted material is from this post.

<sup>ii</sup> Snow’s 1959 Rede Lecture presented at Cambridge University. The quoted material appears on pp. 14-15 of the Cambridge University Press publication of his lecture. See “Across the Great Divide” in *Nature Physics* 5, 309 (2009) for additional insight.

<sup>iii</sup> Esther L. Meek, *Loving to Know: Covenant Epistemology* (Eugene, OR: Cascade, 2011), p. 8ff.

<sup>iv</sup> Esther is a philosophy professor at Geneva college ([http://www.geneva.edu/object/faculty\\_esther\\_meek](http://www.geneva.edu/object/faculty_esther_meek))

<sup>v</sup> Dan Ariely, “Is Listening to a Book Same as Reading?,” *The Wall Street Journal* (August 31 – September 1, 2013), p. C12.

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*“On the Epistemology of Innovation: How Breakthrough Innovators Connect the Dots” is a series of brief, occasional essays addressed to executives, managers, and technologists responsible for innovation in industry. Its purpose is to challenge readers to reflect broadly and deeply on the practice of innovation – in particular on how innovators come to know what to do today – in order to succeed commercially in the future. Essays are available without charge at the University of Illinois’ digital archive at <https://www.ideals.illinois.edu/handle/2142/27667>. The discussion group at <http://epistemology-of-innovation.com> is a place to provide feedback and dialog with the author and others regarding these essays, as well as to register to receive notice of new essays as they are issued.*