

Science, Faith and the Student

What connects a theoretical physicist, a pure mathematician and a marble sculptor? My answer would be: the pursuit of *beauty*. All three will encounter beauty, albeit in different places: the physicist in the laws of nature, the mathematician in abstract systems and structures, and the sculptor in a block of marble.

Beauty does play a role in the sciences, especially in mathematics. As an example, I find the *Arzelà-Ascoli theorem* from *functional analysis* to be supremely beautiful. The theorem tells us precisely when a collection of continuous functions is *compact* – a fundamental mathematical notion of 'smallness'. Not only is the result profound, giving us deep insight into the underlying structure of continuous functions, but it is immensely practical with numerous applications. The theorem's proof is also remarkably short, with several ingenious steps and 'aha!' moments, which are almost as satisfying as the result itself. The fact that the theorem is so striking vindicates the mathematician; it gives confidence that our various mathematical notions are, in some sense, 'right'; that we have not gone seriously astray at some point.

The renowned pure mathematician G.H. Hardy captures this feeling in *A Mathematician's Apology* (1941),

“The mathematician's patterns, like the painter's or the poet's must be beautiful; the ideas, like the colours or the words must fit together in a harmonious way. Beauty is the first test: there is no permanent place in this world for ugly mathematics.”

This idea of using beauty as a 'test' does not seem to be restricted to just pure mathematics either. In a breathtaking speech, the Nobel Prize-winning physicist Paul Dirac (1939) made similar remarks regarding the application of mathematics to physics. He discusses how the dominating idea behind the application of mathematics has shifted from *simplicity*, dominant in the Newtonian era, to *beauty* in the modern era. As an example, he gives the theory of relativity, which was adopted despite its lack of simplicity, *“The theory of relativity introduced mathematical beauty to an unprecedented extent into the description of Nature.”* He later goes on to make the even more bold claim, *“It often happens that the requirements of simplicity and of beauty are the same, but where they clash the latter must take precedence.”*

So we have a mathematician and a physicist both describing how beauty can serve as a guiding hand in our study of science. Any scientist reading thus far should not be surprised: after all, for many the motivations for doing science in the first place are the feelings of awe and delight evoked by nature's elegance. So what does this have to do with faith? In my opinion, quite a lot. The beauty we find in science, on its own, is somehow 'incomplete'. Human experience tell us that our feelings of awe and beauty are more than pure imagination, or genetic predisposition. Why should it be that our universe seems to reward us for choosing beautiful theories over ugly ones? Why can we expect to find beauty and delight as we study nature's laws?

As Christians, we can say, *because this is the nature of our God*; he is meticulous; preferring beauty to ugliness and delighting in his creation. Psalm 19 (ESV) begins, *“The heavens declare the glory of God and the sky above proclaims his handiwork.”* The beauty in science is God's beauty and the glory in nature is God's glory. Without God, we are left, as Tom Wright (2006) said, with a sense of longing that is *“exquisite, yet leaves us unsatisfied”*.

Now I want to argue an even stronger point: not only does scientific beauty find its fulfilment in God, so too does the scientific process itself.

In the speech quoted above, Dirac (1939) begins by describing how the physicist studying nature's laws can make progress: either through the process of experimentation and observation, or by mathematical reasoning. Dirac then makes the astonishing remark that there is *no logical reason why the latter method should work*. There is no inherent reason why the physicist, sitting in her armchair, should be able to infer the results of experiments which have not yet been conducted. It merely seems that from experience this abstract method *does* work. Dirac ascribes this fact to some inherent “*mathematical quality in Nature*”. Isn't this startling? A Nobel Prize-winning physicist starts a speech by remarking there is no logical reason why he should be able to do science!

What Dirac is saying, of course, is that there is no reason within scientific materialism.

C.S. Lewis (1976) expands on this point: if our brains simply depend on biochemistry, which ultimately follows from the meaningless quantum behaviour of atoms, why should our thoughts “*have any more significance than the sound of the wind in the trees*”? After all, if you were to find pebbles on the beach spelling out “ $E=mc^2$ ” by chance, you would not assume they were describing an underlying law of nature. And then, even the existence of nature's laws themselves – what Dirac calls nature's inherent “*mathematical quality*” – can't be explained within pure scientific materialism.

As Christians, we have an explanation readily at hand. God, a rational being, created and sustains the universe as an ordered system, and we, humans, are created in his image. Like clouded mirrors we are able to reflect some of God's rationality and creativity, enabling us to do science, albeit imperfectly; limited by the finite nature of human minds. God is a solid foundation for doing science in the first place, and the reason why our science is so effective at describing the universe.

To sum up, as students of science, we must have faith. We believe in the existence of consistent, mathematical laws at work within the universe, which are accessible through our scientific endeavours. We believe that we can understand these laws and discover beauty within them. And as we delight in what we find, we should not cease to give glory and praise to our beautiful, unchanging, eternal God.

References

Dirac, P.A.M. (1939), The Relationship Between Mathematics and Physics, *Proceedings of the Royal Society (Edinburgh)*, Vol. 59, Part II, 122-129, retrieved from <http://www.damtp.cam.ac.uk/events/strings02/dirac/speech.html> .

Hardy, G.H. (1941) *A Mathematician's Apology*, Cambridge University Press, quote obtained from <http://www-history.mcs.st-and.ac.uk/Quotations/Hardy.html> .

Lewis, C.S. (1976) *The Weight of Glory*, 139, New York: HarperCollins.

Wright, N.T. (2006) *Simply Christian*, 35, SPCK Publishing.