

A Beautiful Theory: the Relationship between Beauty and Scientific Truth

Brilliant shades of reds, oranges, and yellows swirl together, emanating from an intense spherical center and slowly fading through pink and purple to dark blue at the edges. The sight is breathtaking, romantic, and beautiful. There is something unmistakably powerful about a sunset; something that makes people stop and contemplate, snap a photograph, or reach for a lover's hand. Now, imagine that same sunset gracing the sky above stinking, rotting piles of garbage. The image changes, doesn't it? The scene is suddenly imperfect, causing a twist of the stomach instead of a satisfied sigh. The beauty of the sunset contrasts sharply with the aesthetically displeasing garbage leaving a feeling that something is "wrong."

The idea that beauty is "right" and "true" has been around since human kind developed abstract thought. The Latin phrase *Pulchritudo splendor veritatis* ("beauty is the splendor of truth") is thousands of years old, and suggests that beauty and truth are interrelated. Certainly it seems appropriate that something beautiful would be true, but it is more realistic to think that something hideous could also be true. Is beauty a valid criterion for truth? What is the relationship between beauty and truth? Indeed, what *are* beauty and truth? None of these questions has a simple, self-evident answer and each will probably be debated until the end of life itself. In the pages that follow I will offer my own perspective on the nature and interrelatedness of beauty and truth.

The unavoidable first step in contemplating the nature of beauty and truth is to define the indefinable. Before we can investigate the relationship between two things, we need to know what those two things are. Beauty and truth are both incredibly evasive and abstract terms that mean many different things in various contexts and in various minds. I

am not brave enough to attempt a “definition” of either of these terms, but I hope to establish a “working idea” of what they are.

Despite the incongruity of various definitions of beauty, a common element underlies them all. Beauty is not a property of objects, but an observer’s response to the qualities of objects (McAllister 18). This accounts for the disagreement among individuals as to what is beautiful and what is not. A rose in and of itself is not beautiful or ugly, but rather becomes so in the mind of a conscious observer. Therefore, the characteristics of an object cause us to say, “That is beautiful.” The difficulty in defining beauty lies in determining those characteristics.

While experiencing an object with the senses is an essential part of beauty, “beauty” cannot be limited to sensory pleasure. According to Immanuel Kant, beauty is above being judged by the senses (Tobias. . .236). If this idea is acceptable, then it is not the red color of the rose or its sweet fragrance that one finds beautiful. Rather, it would be the combination of these qualities that leads to a “judgment from a wholly different part of yourself” (Tobias. . . 236). Once again, this supports the idea that beauty is a universal idea or feeling that is aroused in an observer.

What causes a human being to make this judgment? Stendahl says, “Beauty is the promise of happiness” (Tobias. . .242). This is a wonderful statement to think about but does little to clarify the issue. There are dozens of such definitions, each equally valid, some more poetic than others. An idea of what beauty is in our culture can be determined by the term’s use in popular media and our everyday speech. Nearly everyone in our Western culture can picture a “beautiful” woman or a “beautiful” wedding cake. Of course, the woman and the cake are not beautiful in the same way, and different observers may not

find the woman or the cake beautiful at all. Consciously or unconsciously, an observer also comprehends the very different criterion that makes each of them beautiful or ugly in their own right. A list of “beautiful” characteristics might be compiled based on popular opinion, but an all-inclusive characteristic that makes an observer proclaim beauty will never be found. I maintain that beauty is an abstraction no one can fully comprehend. In his *Dreams of a Final Theory*, Weinberg comments on the elusiveness of beauty: “professionals have stopped using this word because they realize how impossible it is to define. . .you do not define these things; you know them when you feel them”(134). Perhaps the best, and only “true,” definition of beauty must be made within each person’s mind according to her own experience and understanding.

Truth may be even more difficult to define than beauty. Quite frankly, I am not going to try. Hopefully, most people have a fairly flexible working idea of what they call “truth” which will probably suffice for the remainder of this paper. However, I would like to make a critical distinction between two very different kinds of truths: relative truths and Absolute Truth.

We encounter relative truths every second of our lives. Relative truths define the reality of the world around us. For example, if I say, “John is wearing a blue shirt” I have stated a factual or relative truth. John might be wearing a blue shirt this particular day but he probably doesn’t wear one everyday, and he could wear an orange shirt if he desired to. Also, my idea of “blue” may differ from another person’s concept of “blue.” This does not mean that John’s shirt changes at all, just my perspective of it is different. In a nutshell, relative truths change with time and perspective. They are useful in experiencing the world around us, but are different for each individual.

Absolute Truth, on the other hand, is an entity which by nature must not change. Absolute Truths must be true in all circumstances, for every human being, in every case. Some people argue that no truth is Absolute, and that every thing is relative. Our western culture especially lacks any sort of absolutes, socially, morally or intellectually. Within the bounds of science, though, the Laws of Nature would be considered Absolute Truths. Gravity on earth is true for all people in all circumstances. In this light, science is the practice of using relative truths (experimental observation) to try and formulate an Absolute Truth (a natural law). A theorem is something that hopes it might be Absolute Truth, but isn't sure. As I mentioned earlier, it can be argued that Absolute Truths are found only in God or that they do not exist at all, but for the purposes of this paper it will be convenient to view science as the attempt to formulate Absolute Truths in order to better comprehend the natural world.

If we declare that science is an attempt to formulate natural laws, which are essentially Absolute Truths about the natural world, and we understand that beauty and truth are somehow related, what then is the relationship between science and beauty? Can a scientific theory be beautiful, and if so, is a beautiful theory any closer to truth? Clearly some scientists would argue that beautiful theories are closer to truth. Scientist George Thomson writes, "One can always make a theory, many theories, to account for known facts, occasionally to predict new ones. The test is aesthetic" (McAllister 7). McAllister continues on to write, "It is a mysterious thing in fact how something which looks attractive may have a better chance of being true than something which looks ugly...so often, in fact, it turns out that the more attractive possibility is the true one" (91). Once again, it seems that truth and beauty ought to be interrelated, but we will come back to this

idea later.

The idea of an “irrational” concept like beauty playing a role in scientific thought is one that causes pure rationalists to cringe. Dean K. Simonton insists, “No scientist. . . would ever be so bold as to justify a theory on so irrational a basis as beauty” (McAllister 14). Since its split with religion and philosophy, science has been predominantly rational and empirically based. Beauty, by its very nature, can never be scientifically quantitative; therefore, it presumably cannot be considered in the logico-empirical model. The criteria for the judgment of theories under this model are: consistency with empirical data, providing a novel prediction, harmony with current well-corroborated theories, explanatory power, and internal consistency. These criteria seem quite complete, leaving no room for elegance or beauty. So how can scientists like Paul Dirac uphold ideals that value beauty even over experimental evidence? (Barrow 346). Is it possible to reconcile the idea of beauty with rationalist criterion? It may be if one looks at the elements of a “beautiful” theory.

Einstein’s theory of Relativity is considered one of the more beautiful theories by many scientists, and was mentioned in nearly every text considering the relationship between beauty and science. Hans Albert Einstein says his father, “had a character more like that of an artist than of a scientist as we usually think of them. For instance, [his] highest praise for a good theory or a good piece of work was not that it was correct nor that it was exact but that it was beautiful” (McAllister 96). When determining exactly what qualities make a theory beautiful, many have looked at Einstein’s work. Paul Dirac, who studied Einstein’s theories extensively, defined beautiful mathematics as having “symmetry, economy of form, a depth of interconnection with other parts of mathematics,

and the maximum of structure from the barest of inputs” (Barrow 345). In his *Dreams of a Final Theory*, Steven Weinberg also used Einstein’s theory of general relativity as a starting point when contemplating what makes a theory beautiful. His idea of what makes a theory beautiful is elegant, and reminiscent of the logico-empirical criterion.

Weinberg defines a beautiful theory as possessing simplicity, a sense of inevitability or logical completeness, and symmetry (135). The simplicity he is talking about is not a matter of limited symbols or equations, but rather simplicity of ideas. As George Santayana concurs in his *Sense of Beauty*, a beautiful theory should have “patterns and appearances that offer sufficient novelty to arouse curiosity, but no so much that their complexity is beyond understanding” (Barrow 346). Einstein’s theory of relativity has simplicity in the central idea of the equivalence of gravitation and inertia.

A sense of logical completeness must also accompany a beautiful theory. Weinberg writes: completeness is the “beauty of everything fitting together, of nothing being changeable, of logical rigidity” (149). A sense of the inevitable surrounds the theory and one must feel like the conclusion reached is complete, with nothing lacking and nothing extraneous. As Einstein said of general relativity, “to modify it without destroying the whole structure seems to be impossible” (Weinberg 135). If any part of the theory can be changed, the entire theory is not logically complete.

The last quality of a beautiful theory is symmetry. Symmetry means that something looks the same from different points of view. A theory must not contradict itself from various view points but must have a consistency that proclaims “this might possibly be Absolute Truth.” Just as the accepted Laws of Nature are universal, “rigidity in our physical theories is part of what we recognize as beauty” (147). Just as a scarred and

distorted half of a human face destroys the beauty of the whole face, any dissymmetry in a theory undermines its beauty.

Now that we have a sense of the qualities of a beautiful theory, we can ask what the practical use of beauty in a theory might be. The logico-empirical criteria for evaluating the truth of a theory seem extensive enough, why even consider aesthetics? Of course, empirical data often gives false positives and false negatives, one of the reasons a theory is not taken as gospel truth. McAllister writes, “the problem that empirical success does not demonstrate that a theory is true or close to truth has been recognized for as long as science has been practiced” (95). He continues with the argument “if it were the case that beautiful theories are bound to be true or close to the truth, the beauty of a theory would count as evidence that it is close to the truth, and aesthetic criteria could be used to reveal that it is” (92). Aesthetics, then, may be able to point the way to truth when empirical data alone cannot. Weinberg remarks that “mathematical structures that confessedly are developed by mathematicians because they seek a sort of beauty are often found later to be extraordinarily valuable by the physicist” (53). Such a statement would have been applauded by Dirac, who maintained that seeking mathematical beauty was the only way to discover an Absolute Truth. Once again, he uses Einstein and relativity as an example: “when Einstein was working on building up his theory of gravitation he was not trying to account for some results of his observations. Far from it. His entire procedure was to search for a beautiful theory.” It may be that aesthetics can point to a true theory when empirical data fails to do so. Such an idea is hotly debated in the scientific community, certainly, but it is not easily dismissed. It leads us to back to the question we began with: what is the final relationship between beauty and truth?

When Watson and Crick first discovered the double helical structure of DNA, Watson wrote that Rosalind Franklin “accepted the fact that the structure was too pretty not to be true” (McAllister 91). Her statement corroborates the idea that beauty can be a reliable guide to truth. In his search for a “final theory” that is “of unlimited validity and entirely satisfying in its completeness and consistency,” Weinberg blatantly states that beauty will be used as a defining characteristic in recognizing the ultimate theory which will be Absolutely True. He writes, “When it turns out that mathematically beautiful ideas are actually relevant to the real world, we get the feeling that there is something behind the blackboard, some deeper truth foreshadowing a final theory that makes our ideas turn out so well...the beauty in our present theories may be ‘but a dream’ of the kind of beauty that awaits us in the final theory” (6, 17). If one accepts his statement and the idea that an Absolute Truth should be beautiful (that is, simple, logically complete, inevitable and symmetrical) then a last question is raised: why is Absolute Truth beautiful only, and what about the ugly?

There is a theory that answers that question. Here we are leaving the domain of empirical science and we are passing into the realm of philosophy. The theory is that Absolute Truth exists in an Ultimate Creator, a God, who is the source of All Beauty. The gateway to this theory is guarded by the idea that “there cannot be an ineluctable logical proof of God’s existence or non-existence. There will always be a choice about the credibility of assumptions [the out come of which will be based on] personal faith grounded elsewhere” (Barrow 365). Thus, the existence of an Ultimate cannot be proven and must be taken on Faith, or not taken at all. If one does accept the theory, ugliness, hurt, sadness and evil would be a corruption of the Absolute Beauty and would be relatively

true, but Absolutely false. Believers of the theory maintain that one day all relative truths and all relative falsehoods will fade away in the presence of the Absolute. They believe that day will be beautiful. As Dubay writes in *The Evidential Power of Beauty*: “The Glory of the Lord, therefore, is the super eminently luminous beauty of divinity beyond all experience and all descriptions, all categories, a beauty before which all earthly splendors, marvelous as they are, pale into insignificance” (45). I remind you that this is a theory that can be accepted or rejected on the basis of Faith; simply a theory, even if it is a beautiful one.

Beauty and truth are impossible to define, and must be understood largely on the basis of personal experience. As a result, beauty as a criterion for scientific truth has largely been rejected in the scientific community. However, when the elements that constitute a beautiful theory are examined, they are not so different from the logico-empirical criterion for the evaluation of a theory. It cannot be argued that beauty has played a key role in the establishment of current theories in mathematics and physics, including Einstein’s elegant theory of relativity. Like Weinberg, I believe that if, or when, an Absolute theory is discovered it could not help but be beautiful.

Works Cited

Dubay, Tomas. The Evidential Power of Beauty. S.M. Ignatius Press, San Francisco, CA. 1999.

McAllister, James W. Beauty and Revolution in Science. W. Cornell University Press, Ithaca NY. 1996.

Miller, Arthur I. Einstein, Picasso: Space, Time, and the Beauty that Causes Havoc. Perseus Books, New York, NY. 2001. (referenced only).

Tobias, Michael; Fitzgerald, Patrick; Rothenberg, David. A Parliament of Minds: Philosophy for a New Millennium. State University of New York Press, Albany NY. 2000.

Weinberg, Steven. Dreams of a Final Theory. Pantheon Books, New York, NY. 1992.