1980

A Study of Goethe's Philosophy of Science

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A STUDY OF GOETHE'S PHILOSOPHY OF SCIENCE

Submitted by Colleen A. Evans in partial fulfillment
of the requirements of the University Honors Program

May, 1980

While Johann Wolfgang von Goethe was universally proclaimed as one of Europe's greatest men, as well as Germany's greatest poet, the magnitude and diversity of his other achievements should also be examined. Not only was he a poet but also a painter, scientist, statesman, philosopher, critic and theater manager. Goethe was viewed by the world as the last universal man who pursued an unprejudiced search for truth. He endeavored to become a truly united man. Goethe came closest to being a complete man in the modern age of "dissociated and frustrated human fragments."[1] Although the dualistic thought, which separated mind from matter and flesh from spirit, surrounded him, he believed ultimately in the unity of man as an individual and in the unity of man and nature. His life stood as a constant challenge to modern man "to strive toward a society of more complete integrated human beings."[2] Goethe believed that the two realms of man and nature are governed by the same universal laws of growth and direction. Man works with, not against nature.

The many avenues of study which Goethe pursued were not simply 'false starts' occurring before he found his specific niche in society. All his activities, whether in drawing, science, mining, or agriculture, were diverse parts of his interests that were united in the individual, Goethe. His activities were modification and variations of one profound and central impulse, i.e. the impulse to form, the term <u>form</u> meaning the discovery of the pattern or order of nature.[3]

Another concept Goethe associated with nature was that of polarity. He thought opposing forces were necessary elements of the universe. Polarity was exemplified by many forms in the universe: day and night,

life and death, and summer and winter. These opposites complemented one another, thus creating unity instead of opposition.[4]

Goethe was born into a work of static form. Sciences of the day represented the phenomena of moving forms of sense experiments by abstract mathematical formulas. Goethe disliked translating natural phenomena and processes into mathematical values. He rejected this treatment of nature because it ignored the experience of nature through the senses. Goethe incorporated in his philosophical concepts of unity, form, and polarity into his scientific inquiry.

The Duke of Weimar, a form student of his, invited Goethe to join a circle of intellectuals attached to his court at Weimar. Goethe's first nature studies at Weimar were in botany. During his first winter at Weimar, Goethe spent hours riding through Thuringian forest, learning the identities of the trees as well as their uses and habitats.[5]

Goethe's botanical studies were well documented because he wrote his own botanical history in autographical form. In his enthusiastic study he fervently studied Linnaen botany. However, he found this approach unsatisfactory because Linne' catalogued vast numbers of plants as to morphology at a specific point in time. Goethe, on the other hand, considered plant life, not a static, but a dynamic form. Goethe was so in tune with the natural processes that he realized that nothing persists or remains at rest. He described the movements of nature with respect to time when he warned, "seize the fruits of the earth in haste, for the harvest time is scarcely over when the new shoots spring; with every shower to rain thy valley is changed and in the selfsame stream thou wilt never swim again."[6]

Goethe left Weimar after seven years to take a vacation to Italy. While journeying across the Alps, he began formulating this theory on the metamorphosis of plants. The diversity of the parts of a plant became strikingly apparent when he visited the oldest European botanical garden of Padua. He was particularly fascinated by a palm (Chamaerops humilis L.) which consisted of a gradual series of leaves from the primitive "first lanceolate leaves to the complex mature form and then the sudden transition to the spathe and inflorescence."[7] He began developing the idea of the origin of these diverse structures. From the observation of the palm leaf series, he concluded that the flower parts were comparable to the foliage parts and could be condensed into one concept. A gardener gave Goethe a specimen of the palm leaves, which Goethe kept throughout his life to remind him of his inspiration. The actual palm which Goethe examined dated back from 1564 and lived into the twentieth century.[8]

When Goethe arrived in Sicily, he refined an idea which involved a study of the origin of lateral appendages of plants. Some organ undergoes modification to produce such appendages as foliage, petals or stamen. As he said, "when the plant vegetates, blooms, or fructifies, so it is still the same organ which, with different destinies and under protean shapes, fulfill the part prescribed by Nature."[9]

In order to publicize this idea, Goethe authored Versuch die Metamorphoses der Pflanzen au erklaren, published in 1790. He was not the first to suggest that all parts of a plant were modified leaves. Marcello Malpighi (1628-1694) and Nehemiah Grew (1641-1712) studied the individual parts of a plant as well as plants as a whole. They recognized

that there were intermediate stages between foliage leaves and scales. Grew also realized the foliar nature of sepals and petals. One hundred years later C. F. Wolff suggested that stamen and pericarp segments were modified leaves.[10] Goethe was unacquainted with the work of Grew or Wolff. Unfortunately, he was rarely aware of the details of the work of others in the area he studied. Goethe purposely did not pursue specific details recorded by others because he believed that the value of his work lay in reaching a general conclusion about a phenomenon. As he said, "To pursue botany further into details is not in my line. I leave that to others who far surpass me therein. My only concern was to trace back the separate phenomenon to a general and fundamental law."[11]

When searching for the fundamental law of metamorphosis, Goethe observed only annual plants instead of all plants as he implied in the title of his treatise. He studied the shoots of the annuals without regards to their root system. Although Wolff had suggested that the flower was a type of foliage, Goethe refined and furthered the concept by introducing the term "type appendage" or "organ". These terms named a structure apart from the leaf. He sometimes referred to the type appendage as Blatt or leaf which was unfortunate because this associated the type appendage with foliage only. In developing his theory of metamorphosis, Goethe followed the progressive growth stages from cotyledons to the flower. He found an example of each part of the plant where at least one time in its life cycle that particular structure was foliar in nature. He concluded from these observations that all parts of the plant developed from the same organ. Goethe only used annuals in his observations but concluded a fundamental law for the entire plant kingdom.

After Goethe wrote his treatise on metamorphosis, he had difficulty getting it published. His usual publisher refused to publish the treatise after having consulted a botanist. The treatise was finally published by a company that wanted the right to publish his literary works. The theory was accepted neither by botanists nor his friends. The theory was such a revolutionary one that even a recognized botanist would have met opposition. It followed that the author of Werther would encounter resistance. Goethe remained calm about the rejection by botanists. He clearly explained his reaction to his critics when he said, "an energetic nature feels itself brought into the world for its own development and not for approbation of the public."[12]

Eventually, Goethe's theory achieved some acceptance among botanists. However, the scientific community did not accept all his theories. His theory of colors particularly drew violent attack from the physicists of the day.

Of all of Goethe's works, he considered the four volumes of Versuch einer Farbenlehre his most important. Later in his life at Weimar, he was noted as saying, "as for what I have done as a poet I take no pride in it whatever. Excellent poets have lived at the same time with myself; more excellent poets have lived before me, and will come after me. But that in my century I am the only person who knows the truth in the difficult science of colors of that, I say, I am not a little proud."[13]

He first became interested in the phenomenon of color while studying painting. His fascination with the subjection was caused by his own absence of talent for painting. He theorized about painting because he

wanted "by reason and insight to fill up the deficiencies of nature."[14] His initial investigation of color entailed discussions with a painter friend in Italy. His friends could only provide vague ideas from which Goethe could not develop a concrete theory.

He turned from the artistic viewpoint to attack the problem with the scientific method. Since he had no formal background in the sciences, he turned to physicists for direction in his investigation. Physicists referred him immediately to Newton. If Goethe actually did look at Newton's Optic, he would have found the mathematical treatise beyond his comprehension.

Professor Buttner lent him prisms and optical instruments for his experiments. Goethe procrastinated in using the equipment for so long that the Professor sent a messenger after them. Goethe insisted the messenger wait so he could look through the prism at the white wall in his room. Goethe expected to see the entire wall covered with color as he had interpreted Newton to mean. Instead Goethe observed only the edges of the wall surface appearing colored as Newton had actually predicted. With little meditation and no background in physics and mathematics, Goethe pronounced Newton's theory false. Spurred by his own enthusiasm and encouragement from his influential friends, he proceeded to plunge into experimentation. Artists and poets hoped Goethe would find the truth about light and dethrone Newton.[15]

After extensive experimentation and observation, Goethe concluded that light was a pure, homogenous substance which could not be subdivided into a spectrum of color as proposed by Newton. He reasoned that a

colorless entity could not be the parent of dark colored light. Darkness was an opposing entity of light, not simply its negation. Color was produced by an intermingling of the two separate entities of darkness and light. When a semi-transparent media is brought between darkness and light, the resulting contrast created color. The purest color produced by light passing through a slightly dense medium was yellow. As the volume or density of the media increased, the color became yellow, then red, then ruby. The highest degree of darkness through a semitransparent medium was blue. As the density of the medium increased, the color became paler. Darkness as seen through a media, darkened as the media became more transparent. At a point just short of transparency, deep blue became violet.[16]

Although the facts which Goethe collected were accurate, his theory cannot be accepted as a clearer and fuller explanation of the light phenomenon because he based his theory on false assumptions: light was an inseparable unit and darkness was its opposing force instead of the absence of light.

The Newtonian physicists ignored Goethe's theory of colors completely. Since many of Goethe's past theories had been rejected by the scientific community, their reaction spurred him on instead of discouraging him. Goethe believed that optics was not a part of mathematics. Goethe felt Newtonian physicists distorted natural phenomenon by using scientific instruments and mathematical calculations. He explained the phenomenon of color from a sensational point of view since the only way individuals

perceive color is through the senses. However, Goethe's mistaken opinion of mathematics is understandable because he had no training in mathematics or experimental science.[17]

Goethe's contributions lay not in his discoveries, but in his methods. He created the science of morphology, which he defined as a systematic study of formation and transformation.[18] He applied the method of morphology to all of his studies, whether of clouds, colors, plants, or animals. He perfected the art of observation and experimentation in developing his theory of colors, and his detailed drawings and models in his work concerning plants were excellent examples of his scientific method. Goethe did not oppose analysis or quantitative approach to science, however he did object to the dominance of analysis in scientific thought. He believed scientists should alternate between the opposing methods of synthesis and analysis in order to understand nature to the fullest.

END NOTES

1. Elizabeth Mary Wilkinson and Leonard Ashley Willoughby, Goethe Poet and Thinker, (London, 1962), p. 10.
2. Ibid., p. 11.
3. Victor Lange, ed., Goethe: A Collection of Critical Essays, (Englewood Cliffs, N. J., 1968), p. 68.
4. Wilkinson and Willoughby, p. 14.
5. Agnes Arbor, The Natural Philosophy of Plant Form, (Darien, Conn., 1970), p. 40.
6. Wilkinson and Willoughby, p. 12.
7. Arbor, p. 42.
8. Ibid.
9. Ibid.
10. Julius von Sachs, History of Botany 1530-1860, (New York, 1890), p. 163.
11. Arbor, p. 41.
12. George Henry Lewes, The Story of Goethe's Life, (Boston, 1872), p. 280.
13. Ibid., p. 255.
14. Ibid., p. 280.
15. Ibid., p. 281.
16. Ibid., p. 285-286.
17. George C. Taffe, Two Centuries After Goethe, (Port Washington, N. Y., 1929), p. 75.
18. Lewes, p. 282.

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