

# TRIUNE

## NEWSLETTER FOR SHAPING A NEW FORM OF UNIVERSITY

- ❖ The cultivation of a living, imaginative thinking as the fundamental aim in teaching and research – the inseparability of science and art.
- ❖ Goethean-style phenomenology as orientation in relation to all faculties; awakening the eye of the spirit.
- ❖ The university as the expression and practice of the threefold social life.

**EDITOR: Nigel Hoffmann**

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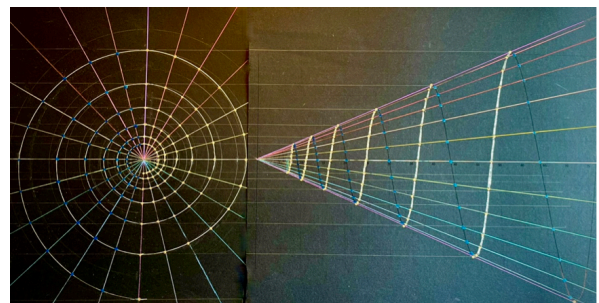
## PROJECTIVE GEOMETRY AS A TRUE LIFE SCIENCE

Sophia Montefiore

“To see a World in a Grain of Sand  
And a Heaven in a Wild Flower,  
Hold Infinity in the palm of your hand  
And Eternity in an hour”.

William Blake

Recently I was asked a very interesting question: ‘How would one go about engaging with projective geometry in a new, free university?’ I found this to be a wonderful question, and it gave me an opportunity to focus on what might possibly be my dream occupation – a moment to imagine what it would be like to have sufficient time to share the exploration of projective geometry with others.

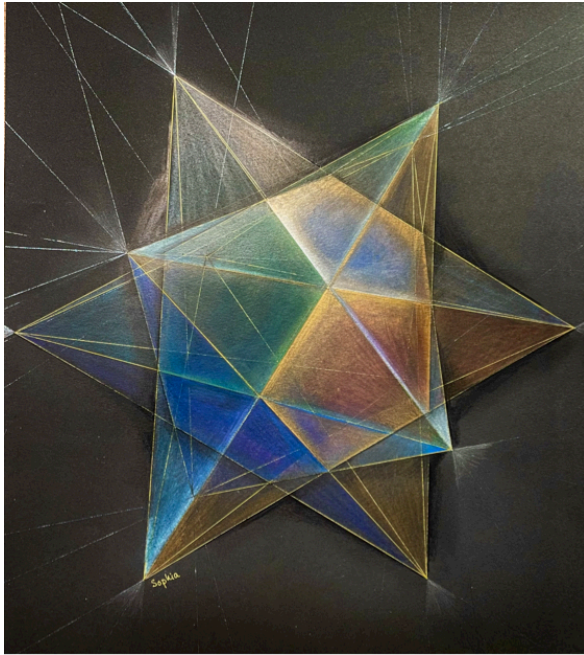


*Here I made the exciting discovery that this is a composite function based on a sine curve, where the amplitude is a linear function and the period is a geometric series.*

How would I structure the course? Inevitably I would aim for an immersive experience of head, hands, and heart (in the style of a Waldorf school) and include the elements of Goethean observation, study, and conversation.

The Austrian philosopher Rudolf Steiner (1861-1925) promoted the study of projective geometry as a key element for attaining new insights in a wide range of professional

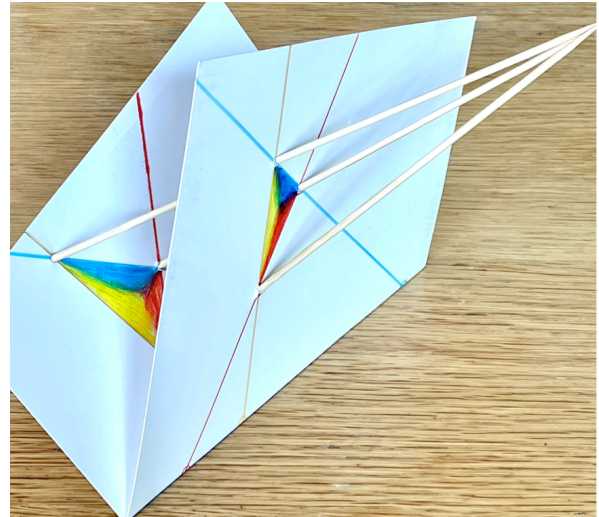
development practices. Following Rudolf Steiner's indications training courses were conceived to enhance conscious access to the spiritual worlds for architects, medical practitioners, therapists, biodynamic farmers, astrophysicists, priests, teachers, and eurythmists. All of which incorporated projective geometry experiences - and in many places this indication is still observed.



*Projective lines forming a dodecahedron*

Undoubtedly, a new, free university would wisely integrate projective geometry into its curriculum. Steiner identified the all-encompassing qualitative properties of projective (or synthetic) geometry.<sup>1</sup> He describes the unique way in which projective geometry leads us toward imaginative consciousness and spiritual research as compared with the limitations of traditional analytic geometry. When we move out of mere analytic geometry into projective geometry, we get a sense of how the curve contains in itself the elements of bending, or rounding, which analytic geometry describes only externally. Thus we penetrate

<sup>1</sup> R. Steiner, *Anthroposophy and Science* — Lecture V (GA 324).



*A model illustrating the "axis of perspective" (fold line) and the "point of perspective" of Desargues's Theorem*

from the environment of the line, the surroundings of the spatial form, into its inner configuration. This gives us the possibility of taking a first step along the way from purely mathematical thinking — of which analytic geometry is the prime representative — to Imagination.

To be sure, with projective geometry, we do not actually have Imagination yet, but we approach it. When we go through the processes inwardly, it is a tremendously important experience — an experience which can actually be decisive in leading us to an acknowledgment of the imaginative element. Also, this experience leads us to affirm the path of spiritual research, inasmuch as we can form a real mental picture of what the imaginative element is. With so much to recommend it, how is this profound experience of projective geometry shared in a learning environment?

A projective geometry course at a university would ideally be structured to include a generous foundational module and optional extension topics to complement individualised study pathways. Working with geometers, mathematicians, and newcomers to projective geometry, a head, heart, and hands style



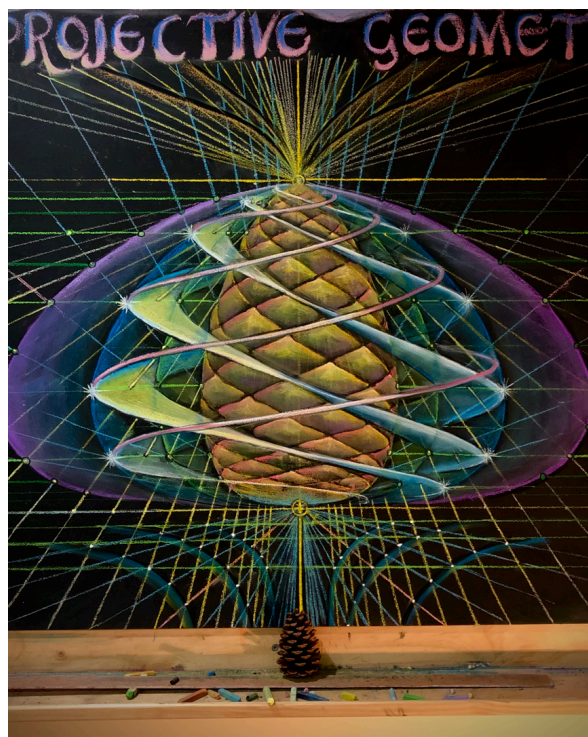


***Using the intersections of circles and horizontal lines (both in "growth measure" proportions) to create the conic section curves.***

presentation would allow the foundational module of a university projective geometry course to accommodate the different experiences of the participants. Adults come with an even greater diversity of learning styles than teenagers (due sometimes to school experiences that have negatively impacted on their relationship to drawing or mathematics). For this reason, the lectures should present general, inspiring pictures of the significance of form in geometry as a true life science.

Lectures should show how projective geometry works very specifically with transformation and movement of points, lines and planes in a fascinating way that includes the concept of infinity. The lectures should explore how this geometry gives a new flexibility to our understanding of geometry as well as mirroring the more hidden processes of nature and cosmic concepts of space and counterspace.

Projective geometry involves high level thinking, careful construction processes, and promotes an artistic relationship to the world around us. It was developed in Renaissance times by the French mathematician Girard Desargues (1591-1661). His contribution came near the beginning of our Consciousness Soul Age (begun in 1413 CE). We are currently only one-third of the way into this developmental era. The British mathematician, Arthur Cayley (1821 –1895), apparently said, "all geometry is projective geometry," describing a field of geometry that incorporated, rather than simply extended, all other forms. The English researcher of mathematics and science, Olive Whicher (1910-2006), described projective geometry as having "a clarifying effect on thought as a whole."



***Model of the Path Curve of a Pinecone or Bud form. The pine cone profile is created through the interaction of two different growth measures. This model imitates the beautiful form of a pinecone and is created through the interaction of two horizontal logarithmic spirals rotating in opposite directions.***

In the seminar there would be time to explore

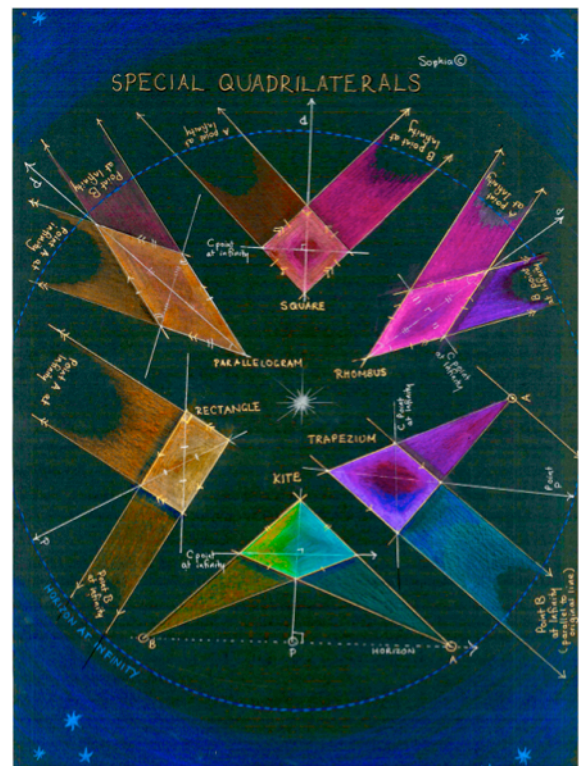
ways of thinking, seeing and creating - theorems, history, philosophy, art; time to learn and relearn the foundational projective geometry constructions; to create models, share inspirations, observe natural phenomena, discover new connections; to create depth and breadth of understanding. All of this with each person learning in their own unique way and sharing their journey.

Elements of philosophical discussion draw people in and allow them to contribute from their own understanding. Goethean observational exercises could include studying the shadows of simple shapes from different perspectives, real-life examples of translational symmetry in the mineral kingdom, rotational symmetry in the plant kingdom and bilateral symmetry in animals through sketches, discussion, and journal reflections. Heart-forces are engaged by using colour in a narrative way to support the geometric constructions along with plenty of scope for artistic soul-rendering. And careful support with all the technical elements such as compass work, measurements, and calculations, which can include partially constructed templates, along with supplying quality equipment, enhances the outcomes for the participants.

The following is a sample exploration: Harmonic Quadrilaterals vs Euclidean definitions of Special Quadrilaterals. Learning about Harmonic Quadrilaterals reveals how the dry definitions based on the number of sides and the types of angles of geometric shapes mask the fact that this special shape really belongs to an infinite field of forms. It is a worthwhile challenge to ask students to construct their own diagram relating all the properties of the special quadrilaterals (square, rhombus, kite, parallelogram, trapezium, and rectangle) to the harmonic quadrilaterals. This exercise allows students to

consider how projective geometry incorporates “lines of force”, which create each unique shape from the outside. This is different to the Euclidean method, which only looks at the immediate properties of the shape isolated from its environment. Students will need to reflect on the different relationship between the point, the line and infinity involved for each special quadrilateral. In their journals they can explain how this is different to the Euclidean way of defining the special quadrilaterals.

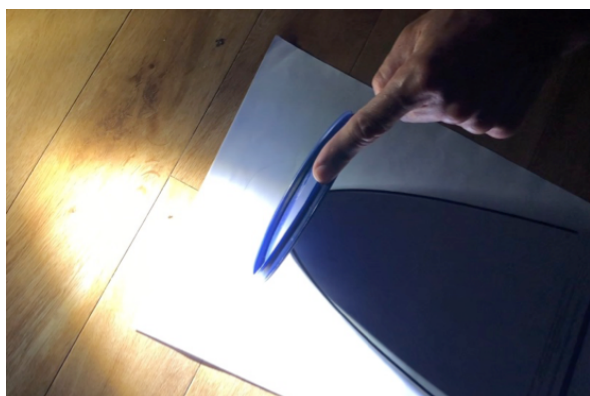
Let us consider the case of a student who is studying organic architecture at this free



***Special properties of harmonic quadrilaterals go beyond Euclidean definitions by incorporating concepts of infinity.***

university. Here the need to create meaningful models through understanding the unique impacts on humans of significant forms and spaces would be crucial. Rudolf Steiner places great emphasis on the need for moral forms in architecture and said of the first Goetheanum:





*Creating a parabola from the shadow of a circle*

Our building must speak through the forms in its interior, but the speech must be that of the gods ... those who really understand our building fully will put away lying and unrighteousness; the building may indeed become a 'Lawgiver.'<sup>2</sup>

Following from Rudolf Steiner's discussions on architecture, projective geometry sessions would explore the dynamic between the centre and periphery. His lectures detail specific approaches to the conic sections, the lemniscate and of course, the dodecahedron (in terms of their metamorphic qualities and the lawfulness of their forms in ideal and natural realms).

When now, at this moment, we unite these three forces, the forces of the heights, the forces of the circumference, the forces of the depths, in a substance that gives form, then in the understanding of our soul we can bring face to face the universal dodecahedron with the human dodecahedron.<sup>3</sup>

Exercises creating shadows projected by a circle can form ellipses, parabolas or hyperbolas

<sup>2</sup> R. Steiner, *Ways to a New Style in Architecture* GA 286 Lecture II. "The House of Speech", 17 June 1914, Dornach.

<sup>3</sup> R. Steiner, *The Christmas Conference: The Laying the Foundation Stone for the Anthroposophical Society* 25 Dec 1923, Dornach.

depending on where the light source is placed, bringing the questions of perspective, viewpoints, and inner and outer spaces into play. Architecture and projective geometry are closely aligned, manifesting images of the invisible interplay between the microcosmic and macrocosmic realms.

If we carry this spatial system of lines and forces constantly active in us out into the world, and if we organise matter according to this system, then architecture arises.<sup>4</sup> ≈

SOPHIA MONTEFIORE is a passionate Steiner high school teacher, adult educator, artist, and author. Her artistic approach to sharing projective geometry has given fresh meaning and accessibility to this inspiring learning experience for many people. All images courtesy Sophia Montefiore. To see more of her work, visit: <https://sophiaartperspectives.com.au/> Her books include *The Art of Projective Geometry for Waldorf Teachers* and *The Art of Projective Geometry for Waldorf Schools*.



## MATHEMATICS AND THE MATHESIS OF LIVING FORM

Rudolf Steiner

It is well known that the inscription over the door of Plato's school was intended to exclude anybody who was unacquainted with the science of mathematics from participating in the teachings of the Master. Whatever we may think of the historical truth of this tradition, it is based upon the correct understanding of the place that Plato assigned to mathematics within the domain of human knowledge.

<sup>4</sup> R. Steiner, *Art as Seen in the Light of Mystery Wisdom: Impulses of Transformation for Man's Artistic Evolution*, 29 Dec 1914, Dornach.

Plato intended to awaken the perceptions of his disciples by training them to move in the realm of purely spiritual being according to his “doctrine of Ideas.” His point of view was that the human being can know nothing of the “true world” so long as his thought is permeated by what his senses transmit. He demanded that thought should be emancipated from sensation. A person moves in the World of Ideas when he thinks, only after he has purged his thought of all that sensuous perception can present. The paramount question for Plato was: “How does a person emancipate himself from all sense-perception?” He considered this to be an all-important question for the education of the spiritual life.

Of course, it is only with difficulty that the human being can emancipate himself from material perceptions, as a simple experiment on one's own self will prove. Even when someone who lives in this every-day world does withdraw into himself and does not allow any material impressions of the senses to work upon him, the residues of sensuous perception still linger, in his mind. As to the man who is as yet undeveloped, when he rejects the impressions which he has received from the physical world of the senses, he simply faces nothingness — the absolute annihilation of consciousness. Hence certain philosophers affirm that there exists no thought free from sense-perception. They say: “Let a man withdraw himself ever so much within the realm of pure thought, he would only be dealing with the shadowy reflections of his sense-perceptions.”

This statement holds good, however, only for the undeveloped man. When he acquires for himself the faculty of developing organs which can perceive spiritual truths (just as nature has

built for him organs of sense), then his thought ceases to remain empty when it rids itself of the contents of sense-perception. It was precisely such a mind emancipated from sense-perception and yet spiritually full, which Plato demanded from those who would understand his Doctrine of Ideas. In demanding this, however, he demanded no more than was always required of their disciples, by those who aspired to make them true initiates of the higher knowledge. Until a person experiences within himself to its full extent what Plato here implies, he cannot have any conception of what true wisdom is.

Now Plato looked upon mathematical science as a means of training for life in the World of Ideas emancipated from sense-perception. The mathematical images hover over the border-line between the material and the purely spiritual world. Let us think about the “circle”; we do not think of any special material circle which perhaps has been drawn on paper, but we think of any and every circle which may be

represented or met with in nature. So it is in the case of all mathematical pictures. They relate to the sense-perceptible, but they are not exhaustively contained in it. They hover over innumerable, manifold sense-perceptible forms.

When I think mathematically, I do indeed think about something my senses can perceive; but at the same time I do not think in terms of sense-

perception. It is not the material circle which teaches me the laws of the circle; it is the ideal circle existing only in my mind and of which the concrete form is a mere representation. I could learn the identical truths from any other sensible image. The essential property of mathematical perception is this: that a single sense-perceptible form leads me beyond itself; it can only be for me a representation of a

“To my mind there is a great field of science which is as yet quite closed to us. I refer to the science which proceeds in terms of life and is established on data of living experience and of sure intuition ... Our science is a science of the dead world. Even biology never considers life, but only mechanistic functioning and apparatus of life ...”

D.H Lawrence, *Fantasia of the Unconscious*, Heinmann, London, 1961, p.6.



comprehensive spiritual fact. Here again, however, there is the possibility that in this sphere I may bring through to sense-perception what is spiritual. From the mathematical figure I can learn to know super-sensible facts by way of the sense-world. This was the all-important point for Plato.

We must visualise the idea in a purely spiritual manner if we would really know it in its true aspect. We can train ourselves to this if we only avail ourselves of the first steps in mathematical knowledge for this purpose, and understand clearly what it is that we really gain from a mathematical figure. *“Learn to emancipate thyself from the senses by mathematics, then mayest thou hope to rise to the comprehension of ideas independently of the senses”*: this was what Plato strove to impress upon his disciples.

The Gnostics desired something similar. They said, *“Gnosis is mathesis.”* They did not mean by this that the essence of the world can be based on mathematical ideas, but only that the first stages in the spiritual education of humanity are constituted by what is super-sensible in mathematical thought. When a man reaches the stage of being able to think of other properties of the world independently of sense-perception in the same way as he is able to think mathematically of geometrical forms and arithmetical relations of numbers, then he is fairly on the path to spiritual knowledge. They did not strive for mathesis as such, but rather for super-sensible knowledge *after the pattern* of mathesis. They regarded mathesis as a model or a prototype, because the geometrical proportions of the world are the most elementary and simple, and such as a person can most easily understand. He must learn through the elementary mathematical truths to become emancipated from sense in order that he may reach, later, the point where the higher problems are appropriately to be considered.



We should also be able to research (in the exact sense of the word) in the domain of the qualitative itself. In this sense Goethe set himself with particular emphasis against an overrating of

mathematics. He did not want to have the qualitative bound and fettered by a purely mathematical method of treatment. Nevertheless, in all things he wanted to think in the *spirit* of the mathematician, according to the model and pattern of the mathematician. This is what he says: “Even where we do not require any calculation, we should go to work in such a manner as if we had to present our accounts to the strictest geometrician. For it is the mathematical method which on account of its thoroughness and clearness reveals each and every defect in our assertions, and its proofs are really only circumstantial explanations to the effect that what is brought into connection has already been there in its simple, single parts and in its entire sequence; that it has been perceived in its entirety and established as incontestably correct under all conditions.”

Goethe wishes to understand the qualitative in the forms of plants with the accuracy and clearness of mathematical thought. Just as one draws up mathematical equations in which one only has to insert special values in order to include under one general formula a multiplicity of single cases, so does Goethe seek for the primordial plant which is qualitatively all-embracing in spiritual reality. Of this he writes to Herder in 1787:

I must further assure you that I am now very near to the secret of the generation and organisation of the plant, and that it is the very simplest thing that can be imagined ... The prototype of the plant (*Urpflanze*) will be the most wonderful creation of the world, for which nature herself shall envy me. With this model and the key thereto one can then discover plants without end, which will necessarily be consistent, that is to say, which — even if they do not exist — could yet exist.

That is to say, Goethe seeks the as yet formless protoplant, and he endeavours to derive therefrom the actual plant-forms just as the mathematician gets from an equation the special forms of lines and surfaces.≈

Excerpted from a lecture by Rudolf Steiner June 21, 1904, GA 35.

## LIVING THINKING

Rudolf Steiner

Science today seeks exactness and feels particularly satisfied if it can achieve it by the application of mathematics to natural processes. Why is this? It is because the perceptions with which external nature provides us, through the senses, for observation and experiment are wholly outside us. We permeate them with something we develop solely in our innermost human entity—with mathematical knowledge. And Kant's saying is often quoted and even more often practised by scientific thinkers: "In all true knowledge there is only so much science as there is mathematics". This is onesided if we are thinking of ordinary mathematics.

And yet, as this is applied to inorganic nature, and nowadays even regard it as an ideal, for instance, to be able to count the chromosomes in the blastoderm, we reveal how satisfied we are if we can permeate with mathematics what otherwise stands outside us. Why? Because mathematics is experienced inside us with immediate certainty: we often have to represent this experience to ourselves by means of diagrams, but the diagrams are not essential to the certainty, the truth. Things mathematical are seen and discovered within us, and what we find within us we connect with what we see outside. In this way we feel satisfied.

Anyone who perceives this process of cognition in its totality must conclude: things can satisfy man as knowledge and lead to a science only if they rest on something he can really experience and observe through his inner powers. With the aid of mathematics, we can penetrate into the

facts and structures of the inorganic world; but we cannot move more than a little way at most, and that somewhat primitively, into the organic world. We need a way of looking as exact as that of mathematics with which to penetrate into the higher processes of the outside world. Even one of the outstanding representatives of the school of Haeckel has expressly admitted that we must advance to an entirely different type of research and observation if we wish to move up from the inorganic into the organic realm of nature.

"An overemphasis on intellectual knowledge. . . has made the university sterile and two-dimensional, depriving it, and human society through it, of the depth dimension that comes from other ways of knowing, especially ways of knowing that would be regarded as instinctive or intuitive or poetic".

J. Pelikan, *The Idea of the University: A Reexamination*, Yale University Press, New Haven, 1992, p.37.

For the inorganic, we have mathematics, geometry; for the organic, the living, we have nothing as yet that corresponds to a triangle, a circle, or an ellipse. We attain to this by means of living thought: not with the ordinary mathematics of numbers and figures, but with a higher mathesis, a mathesis which is qualitative, that works creatively, one which—and here I must say something which many people will find abominable—reaches upward into the artistic.≈

Excerpted from a lecture by Rudolf Steiner, June 1, 1922, GA 83.



## MATHEMATICS IN RELATION TO GOETHEAN PHENOMENOLOGY

Henri Bortoft

Goethe's method was to extend and deepen his experience of the phenomenon until he reached that element of the phenomenon that is not given externally to sense experience. This is the



connection, or relationship in the phenomenon which he called the “law” (*Gesetz*), and which he found by going more deeply into the phenomenon instead of standing back from it or trying to go beyond it intellectually to something that could be experienced.<sup>5</sup> In other words, Goethe believed that the organisation or unity of the phenomenon is real and can be *experienced*, but that it is not evident to sensory experience. It is perceived by an intuitive experience – what Goethe called “*Anschauung*”, which “may be held to signify the intuitive knowledge gained through contemplation of the visible aspect”.<sup>6</sup>

In following Goethe’s approach to scientific knowledge, one finds that the wholeness of the phenomenon is intensive. The experience is one of entering into a dimension that is in the phenomenon, not behind or beyond it, but which is not visible at first. It is perceived through the mind, when the mind functions as an organ of perception instead of the medium of logical thought. Whereas mathematical science begins by transforming the contents of sensory perception into quantitative values and establishing a relationship between them, Goethe looked for a relationship between the perceptible elements that left the contents of perception unchanged. He tried to see these elements themselves holistically instead of replacing them by a relationship analytically. As Ernst Cassirer said, “the mathematical formula strives to make the phenomena calculable, that of Goethe to make them visible”.<sup>7</sup>

It seems clear from his way of working that Goethe could be described correctly as a

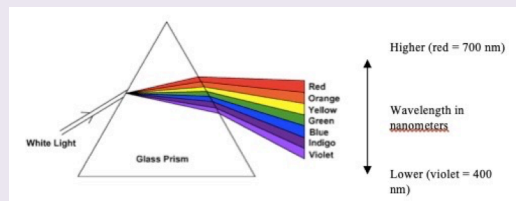
<sup>5</sup> H.B. Nisbet, *Goethe and the Scientific Tradition*, University of London, 1972, p.36.

<sup>6</sup> Agnes Arber, *The Natural Philosophy of Plant Form*, Cambridge Uni Press, 1950, p.209.

<sup>7</sup> Quoted in A.G.F. Gode von Aesch, *Natural Science in German Romanticism*, Columbia University, NY, 1941, p.74.

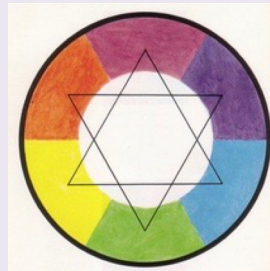
*phenomenologist* of nature, since his approach to knowledge was to let the phenomenon become fully visible without imposing subjective mental constructs.≈

Excerpt from Henri Bortoft, “Counterfeit and Authentic Wholes: Finding a Means for Dwelling in Nature”, in *Goethe’s Way of Science: A Phenomenology of Nature*, eds. D. Seamon & A. Zajonc, SUNY, 1998, pp.290-291.



### THE SPECTRUM OF LIGHT, WITH WAVELENGTHS INDICATED

Newton explained the spectrum as the separation in the prism by diffraction of the colours contained in the light beam (“white light”). The colours are distinguished by the different wavelengths (in other words, the colours are explained by mathematical analysis).



### GOETHE’S COLOUR CIRCLE WITH MAGENTA (UNLIKE THE SPECTRUM OF LIGHT)

Goethe identified the primal or archetypal phenomenon as the union of light and dark, creating the colours (the lightening of the dark to give violet and blue and the darkening of light to give yellow and red). “The colours of the spectrum are simply not intelligible in Newton’s account because there is no inherent reason why there should be red or blue, or green, as there is not reason why they should appear in the order that they do in the spectrum. But with Goethe’s account, one can understand both the quality of the colours and the relationship between them. So that we can perceive the wholeness of the phenomenon without going beyond what can be experienced”.

Henri Bortoft, op. cit. p.290.

## LINKS AND INITIATIVES

This space in future editions will be reserved for news, relevant links and outlines of initiatives.

Please send any information to be included here.

## MISSION STATEMENT OF THE NEWLETTER

To help develop an international community of people together striving to shape a new kind of university. **Please share this newsletter widely.**

To share insights and information which will help to develop the content, methods and organisational principles of this kind of university

## BACKGROUND – ON THE EVOLUTION OF THE UNIVERSITY

The university, since its inception in the medieval people, has become a central organ of the cultural and spiritual life of society. It has been called a “little city”, a melting pot for new ways of thinking and for shaping the world creatively.

All knowledge in the medieval university was unified by faith in a transcendent God. During the time of Renaissance humanism, and later in the early-modern Kantian and Humboldtian universities, the human rational faculty became seen as the unifying power. The university came to be thought of as a centre for universal knowledge. The modern university can better be called a “multi-versity”; faith in God or the rational striving toward the universality of knowledge is not its central concern. It is essentially materialistic in outlook, serving mainly practical ends through its teaching and research.

## SHAPING A NEW FORM OF UNIVERSITY

This means stepping toward a future in which the university is completely free of the state – financially, in terms of course content, and in relation to the awarding of degrees. This freedom is the responsibility and duty of this central organ of the cultural-spiritual sphere of the threefold social organism; it is already recognised in academic freedom. Ways this freedom can be further achieved can be discussed and advanced through this newsletter.

Following the indications of Rudolf Steiner, the aim of lower and higher schooling is not to educate but to awaken – to help awaken the modern human being to the spirit, the spirit working in the human being itself. What can be achieved at the tertiary level will fructify the whole field of education into the future.

Thus we can state boldly: the aim of the new university is to help open the “eye of the spirit” to the working of creative spirit in all forms of nature and the human world. In every faculty, in every aspect of teaching and researching, the task will be to advance human life towards an understanding of the world as a manifestation of spirit.



For this reason the orientation of the new university is fundamentally phenomenological. This is the method which is taught, guided and inspired by what others have perceived in this way. Modern individuals need to learn to see for themselves.

Seeing is grounded in physical perception, in what appears to us in the world (phenomenon literally means – “what appears”). But physical appearance hides what is invisible and essential. When teaching and researching focuses one-sidedly on the physical we have everything technical, the approach which considers what is “real” as only observable, empirical phenomena. Academic thinking then becomes highly materialistic and objective. However, when teaching and learning reaches through what appears to us physically, it rises to the artistic through a “knowing of the heart”. In the works of the later Heidegger and the later Merleau-Ponty we have the vision of the invisible within the visible. We find that “more appears than appears to appear”.\* The appearance hides the innate idea (*eidos*) which may nevertheless come to presence through the pathway of phenomenology; this innate idea Plato equated with *to ekphanestaton* (“what properly shows itself as the most radiant of all is the beautiful”).

The new university is focused on a highly practical, applied phenomenology, on all the phenomena which come within the scope of the different faculties. Different minerals and soil forms; plants and animals; the forms and structures of the human body and human consciousness; the different stages in the growth of children, their different soul gestures and temperaments; all the disease and health appearances; social forms and social processes – and so on. For this advanced practical phenomenology, we look mainly to the indications of German philosopher and artist Rudolf Steiner, who in turn drew greatly on the artistic phenomenological natural science of the poet Johann von Goethe.

Editor

\*R. Bernasconi, “The Good and the Beautiful” in *Phenomenology in Practice and Theory*, Martinus Nijhoff Publishers, Dordrecht, 1985, pp.179-184.

