

Trees in the Mystery of Space and Time – an Essay¹

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Summary

The process of metamorphosis is based on the reciprocal penetration of space and time, of structure and movement – the same could be said for the acquisition of knowledge (*Witzenmann* 1987). This essay seeks to cast light on a little-studied phenomenon: the interaction of rhythm and shape in the plant world, in the solar system and in architecture according to the Golden Number Phi and to Pi. Observations on plants (particularly trees) indicate that mathematically and geometrically-based relations underlie the shape of certain organs, the rhythms of their forming, their progressive fulfilment in space and time. This study will bring us to astronomical dimensions and to the knowledge of ancient civilisations brought to us through certain constructions, and to the question of the relationship between space and time. The notion of temporality and space are considered today as central questions of the modern language of architecture (*Zevi* 1991). In this context, the “archetypal” nature of trees acquires a new dimension and lends them an even deeper significance in our quest for synthesis between space and time.

Zusammenfassung

Der Metamorphoseprozess basiert auf einem Ineinanderwirken von Raum und Zeit, Gestalt und Bewegung – dies betrifft auch den Erkenntnisvorgang (*Witzenmann*, 1987). In der folgenden Schilderung wird versucht zu zeigen, von Beobachtungen an Pflanzen ausgehend, wie sich in der Pflanzenwelt, im Sonnensystem und in der Architektur Räumliches und Zeitliches, Form und Rhythmus nach dem Goldenen Schnitt Phi und nach der Kreiszahl Pi durchdringen. Die Strukturen von Pflanzenorganen (besonders bei Bäumen) und die Rhythmen ihrer Bildung und Entfaltung unterliegen nämlich mathematisch-geometrischen Verhältnissen. Diese Betrachtung führt uns zu astronomischen Dimensionen, zum Wissen alter Kulturen und zur Frage einer möglichen Synthese-Erfahrung von Raum und Zeit, die in der modernen Architektur als relevant betrachtet wird (*Zevi* 1991). In diesem Kontext erhält die «archetypische» Natur der Bäume eine neue Dimension und verleiht ihnen eine noch tiefere Bedeutung in unserer Suche nach einer Synthese von Raum und Zeit.

1 Extended version of an article appearing under the title “Zur Interaktion von Rhythmus und Form”, in the *Jahrbuch für Goetheanismus* 2009 (Tycho Brahe-Verlag, D-75223 Niefern-Öschelbronn), and of the booklet „Les Arbres dans le Mystère de l’Espace et du Temps“, edited by Dom and Jean Paul Ruiz, F-19130 Saint Aulaire.

Polarity: an essential concept to understand the shape of plants

In each initial cell giving rise to an organism – whether it be in the plant or the animal kingdom – a first developmental determination consists of a polarisation (a concept long established in biology), meaning the establishment of a “top” and a “bottom”, of a “front” and a “back”. As in multicellular animals, the ovosphere of higher plants (the homologue of the ovule) thus already has a functional polarisation before fertilisation. A fertilised seed then develops containing an embryo differentiated into an apical pole and a root pole. After germination, the stem in general grows upwards, against gravitational forces, whilst the root grows towards the earth. The aerial shoot can however be considered as not simply “negatively geotropic”, but also “phototropic”, growing towards the sun (*Bloch 1972*). Inside the young stem, the fascicles conducting raw xylem sap and elaborated phloem sap (Fig. 1) ensure the circulation of liquids. A rising flow of water containing mineral salts is separated by a fine layer of meristematic cells ready to divide (cambium) from a downward flow of sugar-rich sap. In trees, the anatomical development leads to the constitution of a thin and continuous cambial layer, situated between the bole periphery whose sapwood relays the upward xylem flow, and the bark whose phloem is the conducting tissue for the downward flow. This polar developmental direction or tendency is designated helio-, resp. geotropism. In lectures considered as forming the basis of the biodynamic agricultural method, Rudolf Steiner (1924) presents the plant as an entity developing between terrestrial and cosmic conditions; for the latter, the sun and other celestial bodies (moon, planets, fixed constellations) and their relative movements are involved.

Rhythms as a living expression of time flow

Together with the polarity in its shape, the plant is governed by the rhythmic nature of physiological processes such as germination, growth or ripening of fruits and seeds. Besides the endogenous rhythms with short periodicity (seconds or minutes), rhythms of medium and long periodicity have been the object of intensive research (see *Bünning 1977* and *Strasburger 1983*). These are synchronous with the variations of living conditions surrounding the organisms studied: daily, tidal, lunar and annual rhythms. In the particular realm of rhythms linked to lunar cycles, research managed to bestow some validity upon “traditional knowledge about cosmic influences” which has always existed in most ancient cultures. The importance of this heritage of intuitive and empirical knowledge had been highlighted by R Steiner and placed into a modern context, in particular when building the foundations of a new form of fundamentally organic farming (*Steiner 1924, Endres &*