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Symmetry in plants: from Bravais' lattices to an explanation of Fibonacci phyllotaxis.

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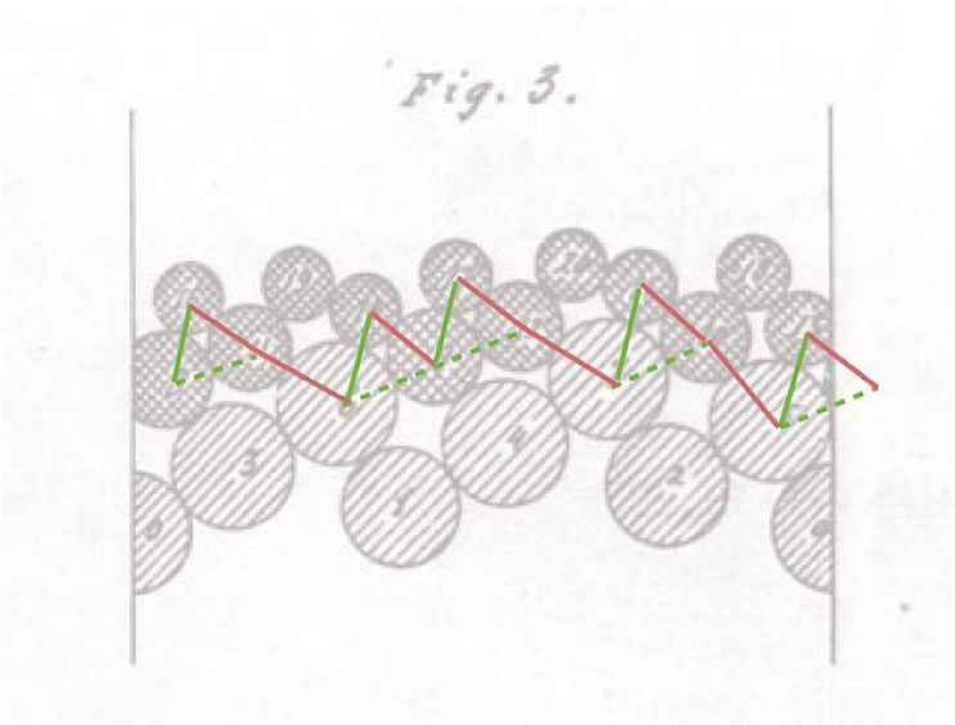
In 1837, fourteen years before publishing his seminal Etude sur la cristallographie Auguste Bravais and his brother Louis wrote an equally seminal work on the arrangement of leaves around the stem of a plant. In this paper, one of the very first truly bio-mathematical work, they introduce and analyze cylindrical lattices and conjecture that only those with the golden angle between successive leaves can exhibit the Fibonacci numbers of spirals predominant in plants. With the advent of the microscope, and following observations of the plants growing tips by Hofmeister, botanists Schwendener and van Iterson developed an accretion model of the plant structures. Their work use ideas of what we now would call renormalization of morphogenetic fronts to understand transitions between successive Fibonacci pairs. This gives rise to a simple explanation of the omni-presence of Fibonacci numbers in plants, which can be verified on digitized plant samples and with systematic computer simulations. This could inform crystallographers in their study of dislocations.

[1] *Bravais L. and Bravais A., (1837) Essai sur la disposition des feuilles curviseriees, Ann. Sci. Nat. 7,* ***[2]*** *van Iterson G., (1907) Mathematische und mikroskopisch-anatomische Studien über Blattstellungen nebst Betrachtungen über den Schalenbau der Miliolinen,* ***[3]*** *http://www.math.smith.edu/phyllo/Research*



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