

F. Commandino, de centro gravitatis solidorum, 1565

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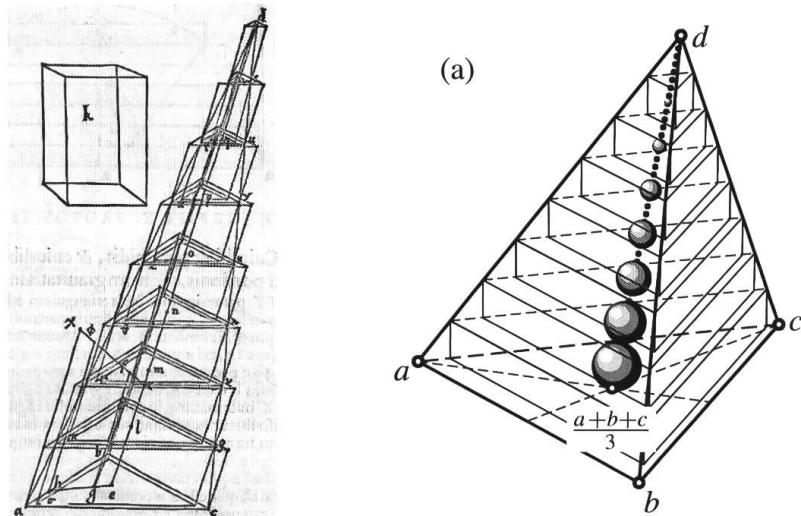
Short note

F. Commandino, de centro gravitatis solidorum, 1565

Gerhard Wanner

The importance of Federico Commandino (1506–1575) cannot be better described than by quoting E. Rosen¹: “In the sixteenth century, Western mathematics emerged swiftly from a millennial decline. This rapid ascent was assisted by Apollonius, Archimedes, Aristarchus, Euclid, Eutocius, Heron, Pappus, Ptolemy and Serenus – as published by Commandino”.

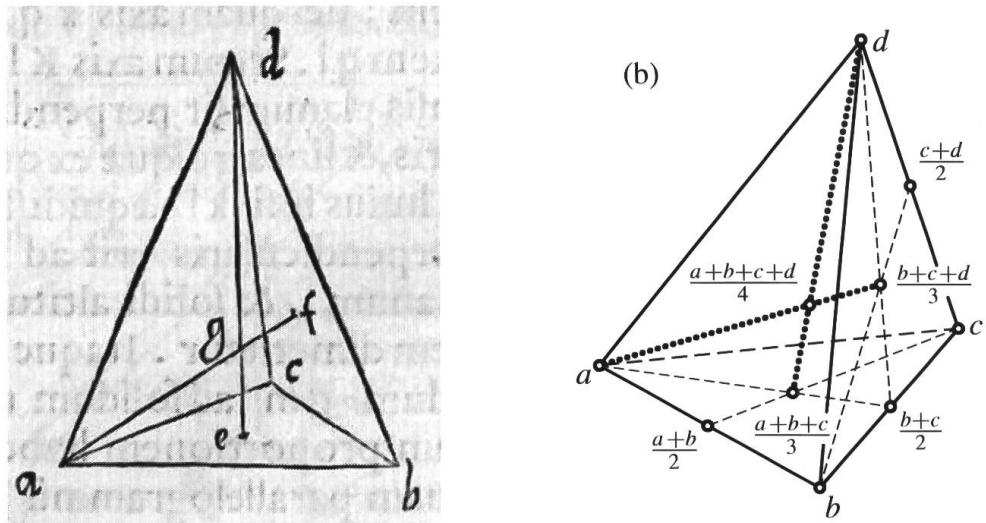
In addition to all this extraordinary editorial work, Commandino also developed his own research in [1] ($4\frac{1}{2}$ centuries ago), among which the determination of the center of gravity of the Tetrahedron led to one of the first new theorems above the Greek heritage.



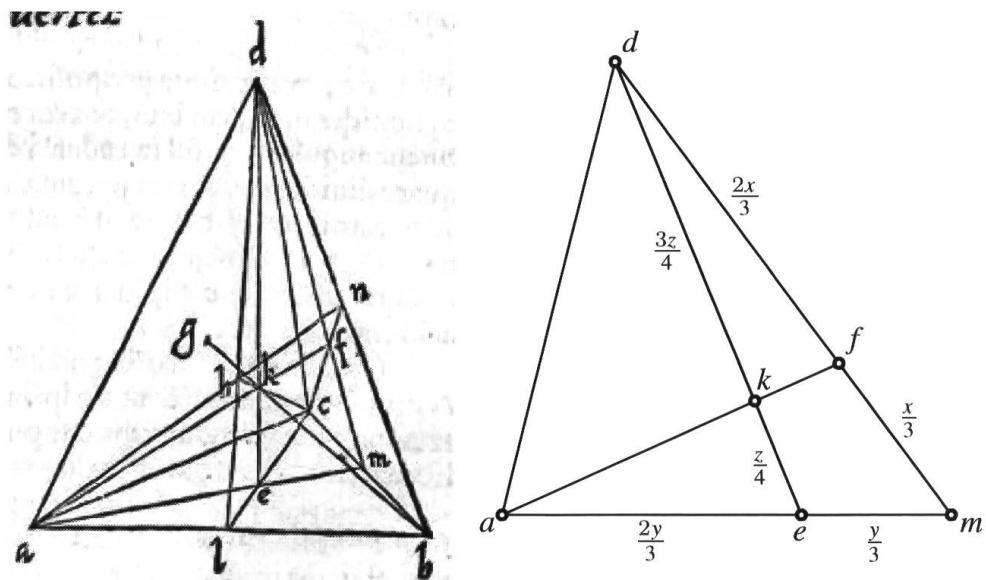
Theorema X. “pyramidis ... centrum gravitatis in axe consistit” [The barycentre of a tetrahedron lies on the median (i.e., the line connecting a vertex to the barycenter of the opposite triangle)].

¹Biography in Dictionary of Scientific Biography, New York 1970–1990, also reproduced in www-groups.dcs.st-and.ac.uk/history/Biographies/Commandino.html

Proof (inspired by Archimedes' *Equilibrium of planes*). Concentrate the masses of slim triangular prisms² in their centre of gravity, all lying on the median, and then concentrate these masses in one point, which lies on the median, too.



Theorema XIII. “grauitatis centrum est in puncto, in quo ipsius axes conueniunt” [The barycentre of a tetrahedron lies on the point where medians meet].



Sit pyramis, cuius basis triangulum ab c; axis d e; & grauitatis centrum K. Dico lineam dk ipsius ke triplam esse.

Theorema XVIII. “Dico lineam dk ipsius ke triplam esse” [The centroid divides the medians in ratio 3 : 1].

²If you look closer, you see that Commandino, like Archimedes, distinguished carefully between “upper and lower Riemann sums”. Also the method of indirect proofs, by drawing the points g, f and χ , was adopted from Archimedes.

Proof. We consider Commandino's triangle amd , where m is the mid-point of bc (see Figures). We know from Archimedes that f and e , which are the barycenters of two triangular faces, cut *their* medians, of lengths x and y respectively, in ratio $2 : 1$.

We reduce Commandino's proof, which extends over 2 pages, to one line by applying Menelaus' Theorem for the triangle dem (see, e.g., [3, pp. 87–88])

$$\frac{ek}{kd} \cdot \frac{df}{fm} \cdot \frac{am}{ae} = 1 \quad \text{or} \quad \frac{ek}{kd} = \frac{1}{2} \cdot \frac{\frac{2}{3}}{1} = \frac{1}{3},$$

which is the stated result. \square

Remark. Exactly the same idea, after applying a second time Menelaus' Theorem to the triangle dea and dividing the results, allowed al-Mu'taman ibn Hūd (11th century) to give the first proof of what many centuries later became known as “Ceva's Theorem” (see [2]³).

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Acknowledgement. Thanks to Christian Aebi for suggestions.

References

- [1] Federici Commandini Urbinatis, *Liber de centro gravitatis solidorum*, Bononiæ, Ex Officina Alexandri Benacii. MDLXV (Bologna 1565).
- [2] J.P. Hogendijk, *The lost geometrical parts of the Istikmāl of Yusuf al-Mu'taman ibn Hūd (11th century) in the redaction of Ibn Sartāq (14th century): an analytical table of contents*, Arch. Internat. Hist. Sci. 53 (2003) 19–34.
- [3] A. Ostermann, G. Wanner, *Geometry by its history*, Springer, 2012.

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³The author is grateful to D. Paunić for this reference; see also the Proceedings of ICM 1994, Zürich, p. 1570.