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(*b*. Bassano, Vicenza, Italy, 22 November 1803; *d*. Tezze, near Bassano, 6 November 1880)

*mathematics*.

Bellavitis was the son of Ernesto Bellavitis, an accountant with the municipal government of Bassano, and Giovanna Navarini; the family belonged to the nobility but was in modest circumstances. He did not pursue regular studies but was tutored under the guidance of his father, who directed his interest toward mathematics. Soon he surpassed his tutor and diligently pursued his studies on his own, occupying himself with the latest mathematical problems.

From 1822 to 1843 Bellavitis worked for the municipal government of Bassano—without pay for the first ten years—and conscientiously discharged his duties, occupying his free time with mathematical studies and research. During this period he published his first major works, including papers (1835, 1837) on the method of equipollencies, which were hailed as one of his major contributions. On 26 September 1840 Bellavitis became a fellow of the Istituto Veneto, and in 1843 he was appointed professor of mathematics and mechanics at the *liceo* of Vicenza. He then married Maria Tavelli, the woman who for fourteen years had comforted and encouraged him in his difficult career.

On 4 January 1845, through a competitive examination, Bellavitis was appointed full professor of descriptive geometry at the University of Padua. On 4 July 1846, the university awarded him an honorary doctorate in philosophy and mathematics. He transferred in 1867 to the professorship of complementary algebra and analytic geometry. On 15 March 1850, Bellavitis became a fellow of the Società Italiana dei Quaranta, and in 1879 a member of the Accademia dei Lincei In 1866 he was named a senator of the Kingdom of Italy.

Bellavitis' method of equipollencies belongs to a special point of view in mathematical thought: geometric calculus. According to Peano, geometric calculus consists of a system of operations to be carried out on geometric entities; these operations are analogous to those executed on numbers in classical algebra. Such a calculus "enables us to express by means of formulae the results, of geometric constructions, to represent geometric propositions by means of equations, and to replace a logical argument with the transformation of equations." This approach had been developed by Leibniz, who intended to go beyond the Cartesian analytic geometry, by performing calculations directly on the geometric elements, rather than on the coordinates (numbers), Moebius' barycentric calculus finds its expression within this context, but Rellavitis made special reference to Carnot's suggestion of 1803, when he wrote in 1854:

This method complies with one of Carnot's wishes, i.e., he wanted to find an algorithm that could simultaneously represent both the magnitude and the and the position of the various components of a figure ; with the immediate result of obtaining elegant and simple graphic solutions to geometrical problems ["Sposizione del metodo delle equipollenze," p. 226.]

In order to indicate that two segments, *AB* and *DC*, are equipollent—i.e., equal, parallel, and pointing in the same direction—Bellavitis used the formula

$AB \simeq DC$.

Thus we are given a kind of algebra analogous to that of complex numbers with two units; it found its application in various problems of plane geometry and mechanics, and paved the way for W.R. Hamilton's ton's theory of quaternions (1853), through which geometric calculus can be applied to space; it also led to Grassmann's "Ausdehnungslehre" (1844), and finally to the vector theory. With his barycentric calculus, Bellavitis created a calculus more general than Moebius' "baricentrische Calcul."

In 1834, in his formula expressing the area of polygons and the volume of polyhedra as a function of the distances between their vertexes, Bellavitis anticipated results that were later newly discovered by Staudt and published in 1842.

In algebraic geometry, Bellavitis introduced new criteria for the classification of curves, and then completed Newton's findings on plane cubic curves, adding six curves to the seventy-two already known; these six had not been mentioned by Euler and Cramer. He also began the classification of curves of class three. He offered a graphical solution of spherical triangles, based on the transformation—through reciproal vetor radia—of a spherical surface into a plane. This method finds application in the solution of crystallographic problems.

Bellavitis furthered the progress of descriptive geometry with his textbook on the subject. Considering mathematics to be based essentially upon physical facts and proved by sensible experience, Bellavitis looked down on geometry of more than three dimensions and on non-Euclidean geometry. He did, however, like Beltrami's research on the interpretation of Lobachevski's geometry of the pseudosphere, for he felt that this research would help to diminish the prestige of the new geometry, reducing it to geometry of the pseudosphere. He continued to pursue his research on geodetic triangles on such surfaces as the pseudosphere.

In algebra, Bellavitis thoroughly investigated and continued Paolo Ruffini's research on the numerical solution of an algebraic equation of any degree; he also studied the theory of numbers and of congruences. He furnished a geometric base for the theory of complex numbers. Several of Bellavitis' contributions deal with infinitesimal analysis. In this connection we should mention his papers on the Eulerian integrals and on elliptic integrals.

Bellavitis solved various mechanical problems by original methods, among them Hamilton's quaternions. He developed very personal critical observations about the calculus of probabilities and the theory of errors. He also explored physics, especially optics and electrology, and chemistry. As a young man, Bellavitis weighed the problem of a universal scientific language and published a paper on this subject in 1863. He also devoted time to the history of mathematics and, among other things, he vindicated Cataldi attributing the invention of continuous fractions to him.

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