

Geometric Intuition and Formalism in Passing from Indivisibles to Infinitesimals: Pascal and Leibniz

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Abstract : The paper focuses on Pascal's indivisibles evolving to Leibniz's infinitesimals. It starts with parallel developments by the two savants in Combinatorics (triangular numbers for Pascal and harmonic triangles for Leibniz) and their implication in determining the sum of mathematical series. It follows with a focus on the geometrical contributions of Pascal. He considered the cycloid and other mechanical curves the epitome of geometric comprehensibility in a series of challenging problems he posed to the mathematical world. Pascal provided the solutions in 1658, in a volume published under the pseudonym of Dettonville, using indivisibles and ratios between curved and straight lines. In the third part, the research follows the impact of this volume on Leibniz as the initial impetus for the elaboration of modern calculus as an algorithmic method disjoint of geometrical intuition. Then paper analyses the further steps and proves that Leibniz's developments relate to his philosophical frame (the search for a characteristic Universalis, the consideration of principle of continuity or the rule of sufficient reason) different from Pascal's and impacting mathematical problems and their solutions. At this stage in Leibniz's evolution, the infinitesimals replaced the indivisibles proper. The last part of the paper starts with speculation around "What if?". Could Pascal, if he lived more, accomplish the same feat? The document uses Pascal's reconstructed philosophical frame to formulate a positive answer. It also proposes to teach calculus with indivisibles and infinitesimals mimicking Pascal and Leibniz's achievements.

Keywords : indivisibles, infinitesimals, characteristic triangle, the principle of continuity

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