

On the Abbe Theory (1873)

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In the 1870's E. Abbe¹ and H. von Helmholtz² independently presented theories of the microscope. There has been no examination of the aims of their papers, though it has been believed that they both succeeded in determining the resolution limit based on their theories.³ However, the lack of a comparative historical study makes it difficult to account for the fact that Abbe's theory survives and Helmholtz's is scarcely known today.

During the first ten years of the 20th century, Abbe's theory replaced Helmholtz's. Before this, both were viewed as being very similar and Helmholtz's was more popular than Abbe's. Several reasons may be given for this. The first is that their theories were presented successively. Secondly, Helmholtz was much more famous than Abbe in the academic world. Thirdly, the study of the microscope had followed that of the telescope, and the study by Helmholtz, as Rayleigh pointed out,⁴ is analogous to that dealing with the telescope.

It is not difficult to show that many scientists felt that both studies were much the same, so they read Helmholtz's paper only and did not feel it necessary to give their attention to Abbe's. In the case of Rayleigh, for example, he knew of the existence of both papers,⁵ but he did not read Abbe's paper until 1894 when G. J. Stoney and L. Wright discussed Abbe's theory in *English Mechanics*.⁶ Following their discussions, Rayleigh began to formulate and compare the two theories. This fact shows that many academicians did not recognize the importance and originality of Abbe's theory before Stoney's suggestion, considering them to be much the same, and were satisfied to read only Helmholtz's paper.

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¹ E. Abbe, "Beiträge zur Theorie des Mikroskops und der mikroskopischen Wahrnehmung", *Arch. f. mikrosk. Anatomie*, 9 (1873); *Ges. Abh.*, Bd. 1, pp. 45-100, (1904).

² H. von Helmholtz, "Die theoretische Grenze für die Leistungsfähigkeit der Mikroskope", *Poggendorff's Annalen*, 50 (1874); *Wiss. Abh.*, Bd. 2, pp. 185-212.

³ Lord Rayleigh, "On the Theory of Optical Images, with special reference to the microscope", *Phil. Mag.*, 42 (1896); *Scientific Papers*, vol. 4, pp. 235-260.

A. E. Conrady, *Applied optics and optical design*, Dover ed., pp. 132-3, (1913).

⁴ Rayleigh, *ibid.*, p. 253.

⁵ Rayleigh, "Optics", *Encyclopedia Britannica*, XVII (1884); *Scientific Papers*, Vol. 2, p. 412.

⁶ *English Mechanics and World of Science*, No. 1603-1608.