

Grassmann, in his 'Ausdehnungslehre,' published in 1844, is now generally admitted to have originated quite a novel way of considering geometrical relations.<sup>1</sup> It took twenty years, however, before he succeeded in attracting any attention, and his great work, of which the first edition had been sold as waste-paper, was later on reprinted in its original form—mathematicians having now begun to study and recognise its intrinsic value. Such cases of neglect have undoubtedly been much more frequent in England, where even at the present day no central organisation exists which annually collects and arranges the scattered labours of individual workmen, and where that historical and encyclopædic spirit is wanting which does its utmost to guarantee completeness and thoroughness of search and of research. Men of the greatest eminence, pioneers

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Grassmann.

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<sup>1</sup> Hermann Grassmann (1809-77) was born, lived, and died at Stettin. He did not succeed till late in life, and fully thirty years after he had published his original investigations in geometry, in gaining for these the recognition and appreciation which they deserved. Neither he nor even Jacob Steiner at Berlin attained to positions worthy of their ability; the latter, in spite of his connection with other great mathematicians, never filled the chair of an ordinary professorship, whilst the former never entered the sphere of university teaching at all. The 'Ausdehnungslehre,' as a new branch of mathematics, appeared in 1844. It is a science of pure extension, the application of which to empirical space is geometry. Similar investigations, in which space of three dimensions is considered to be merely a particular case of pure extension of any number of dimensions, which are not necessarily determined by the same pro-

perties as our empirical space, have become familiar since the publication of Riemann's celebrated dissertation of 1854 (published in 1867), and since Helmholtz was led to similar investigations by considering the different dimensions or manifoldnesses of our sense perceptions (see his 'Vorträge und Reden,' in many passages). Grassmann, who at the end of his life witnessed the growing appreciation of his ideas, had filled up the interval with entirely different studies, the translation of the 'Rig-Veda' (Leipzig, 1876-77), and the composition of a dictionary to the same (1872-75). He seems to have been the only mathematician, besides Thomas Young, who combined the ability for exact mathematico-physical and for philological studies. Both can complain of having been very insufficiently appreciated by their contemporaries. See Victor Schlegel, 'Hermann Grassmann,' Leipzig, 1878.