This suggestion was not carried out for some time, and then not by Thomson himself, but, at his instigation, by Clerk Maxwell. In the meantime, however, Thomson added another step to the one already taken, by bringing recent discoveries of Faraday, as well as his

point out how the elementary experimental data referring to electrical charges, as well as to magnetic bodies, can be mathematically expressed equally well by the conceptions of Coulomb and Poisson and by those of conduction and flow, which are more in conformity with Faraday's physical ideas: neither of the mathematical analogies, of attraction at a distance or of conduction through an intervening medium, being sufficient for a physical theory. These papers contain further the record of the gradual growth in the author's mind of the kinetic out of the statical view of natural phenomena. Thomson was the first (1851) to introduce the terms "field" and "lines of force" into mathematical literature, adopting them from Faraday. They have since become indispensable not only to the electrician but likewise to the mathematician; forming, as it were, a unifying term for apparently distant regions of physical phenomena, and being introduced as fundamental notions at the beginning of dynamical treatises. See, for instance, the article by M. Abraham entitled "Geometrische Grundbegriffe," in the second part of the fourth volume of the 'Encyclopädie der mathematischen Wissenschaften,' Leipzig, Teubner, 1901. Independently and quite unknown to Faraday, or to each other, two eminent mathematicians, Sir W. R. Hamilton at Dublin and Herrmann Grassmann at Stettin, were elaborating, between 1835 and 1845, the geometrical conceptions and vocabulary which are required in the representation of "directed" quantities. Their expositions have since become much simplified, and now form, under the title of "vector analysis," an indispensable geometrical instrument. The gradual evolution of the kinetic view of physical phenomena (which here concerns us most) in the memoirs of Thomson is most remarkable. *Inter alia*, he made a communication in 1847 to the British Association at Oxford, in which he dealt with the phenomena of terrestrial magnetism, stating that "it becomes an interesting question whether mere electric currents could produce the actual phenomena observed. Ampère's electro-magnetic theory leads us to an affirmative answer which must be regarded as merely theoretical; for it is absolutely impossible to conceive of the currents which he describes round the molecules of matter as having a physical existence" (Reprint, 2nd ed., p. 469). On this passage he himself remarks in 1872: "From twenty to twenty-five years ago, I had no belief in the reality of this [Ampère's] theory; but I did not then know that motion is the very essence of what has hitherto been called matter. At the 1847 meeting of the British Association in Oxford I learned from Joule the dynamical theory of heat, and was forced to abandon at once many, and gradually from year to year all other, statical preconceptions regarding the ultimate causes of apparently statical phenomena" (ibid., p. 423 note).