

19.  
Focalising  
effect of  
mathemati-  
cal formulæ.

The mathematical formula is the point through which all the light gained by science passes in order to be of use to practice; it is also the point in which all knowledge gained by practice, experiment, and observation must be concentrated before it can be scientifically grasped. The more distinct and marked the point, the more concentrated will be the light coming from it, the more unmistakable the insight conveyed. All scientific thought, from the simple gravitation formula of Newton, through the more complicated formulæ of physics and of chemistry, the vaguer so-called laws of organic and animated nature, down to the uncertain statements of psychology and the data of our social and historical knowledge, alike partakes of this characteristic, that it is an attempt to gather up the scattered rays of light, the diffused knowledge, in a focus, from whence it can be again spread out and analysed, according to the abstract processes of the thinking mind. But only where this can be done with mathematical precision and accuracy is the image sharp and well defined, and the deductions clear and unmistakable. As we descend from the mechanical, through the physical, chemical, and biological, to the mental, moral, and social sciences, the process of focalisation becomes less and less perfect,—the sharp point, the

most all the present difference between the best steam-engine and the worst is some 5 or 6 per cent" (Lodge). Prof. Unwin sums up by saying: "Since 1845 purely scientific men, scientific experimenters, and practical engineers have all been engaged in the study of the steam-engine. I do not believe that any one of the three can claim all the credit for the im-

provement of the steam-engine to the exclusion of either of the others. . . . Representing perhaps rather the scientific than the practical interest, I do not think that the mathematical and physical researches of which I have tried to give an account have had no influence on the practical business of the engineer."