

independent witnesses, all testifying to the same fact, may be 'vitiated' by one of them being very much mistaken. It is to be regretted that the writer of the note does not tell us just how far the one erroneous star must have been wrong in order to vitiate the result. The corresponding testimony of the ten Pulkowa observations upon another group of ten stars may be left out of consideration, because this conclusion might be vitiated in the same way.

S. NEWCOMB.

THE PERTURBATIONS OF 70 OPHIUCHI.

PROF. JACOBY'S review in a recent number of this journal (p. 197) is eminently fair in spirit; it is incomplete, and therefore I fear it will be misleading. It is a mistake to say that my work on the perturbations of 70 Ophiuchi is supported by the American observations, but contradicted by those made at the same time in Europe. On the contrary, the deviation from Schur's orbit and the work of the American observers is confirmed by the measures of all the best observers abroad. Thus the deviation appears unmistakably in the observations of Bigourdan, Callandreau, Schiaparelli, Glasnapp and Knorre. Since publishing the paper in *American Journal* 363, measures have been received from several of the above observers, and there is absolutely no doubt of the substantial accuracy of the American observations. Among the European observers Schur and Ebell (a student at Berlin) alone find no deviation, but Schur's measures are very discordant, and he admits (A. N. 3324) that they are of little value; while Ebell's measures show discrepancies on the several nights amounting to over ten degrees in angle.

Hence it is evident that all the best observations, both American and European, confirm the deviation from Schur's orbit and point to the existence of the dark body as the cause of this unexpected phenomenon. My researches on the orbits of 40 binary stars, which are now practically complete, will probably remove all doubt as to the propriety of using the distances in such investigations. Indeed the discovery of the perturbations in 70 Ophiuchi by using both angles and distances, after Schur had con-

sciously rejected the distances which would have given him the discovery, is a striking illustration of the evil of orthodoxy in scientific procedure.

T. J. J. SEE.

THE UNIVERSITY OF CHICAGO, February 11, 1896.

PSYCHOLOGY OF NUMBER.

TO THE EDITOR OF SCIENCE—*Sir*: As Prof. Fine in his review of McLellan's and Dewey's *Psychology of Number* (January 24, 1896) raised a question of considerable importance to educators and to psychologists, permit me to add a few words to the discussion, first thanking the reviewer for the generally appreciative tone of his article.

1. The question of principle raised is whether or no counting is measuring, whether or no integral number has a metric origin or purpose, and involves the idea of ratio. Now measurement is a word both of a more general and a more technical sense. That, in the most technical mathematical sense, counting is not measurement, is clearly recognized in the book referred to. But as it is held that in the larger sense of the term it is a process of measuring, and that the technical mode of measurement is an outgrowth, psychologically, of the broader and looser sense, this disclaimer amounts, perhaps, to little.

Starting from the larger sense, it is held that number has its psychological genesis in the felt need for valuation, and that its function (psychologically once more) is to serve the purposes of valuation. Now counting seems to me indubitably one mode of defining the value of a previously unvalued mental whole, and in that sense to be a mode of measurement. Any process of defining value is, I should say, a form of measurement in the broad sense of that term. Counting implies first a mental whole; secondly, the breaking up of that whole into distinct parts; third, the use of one (any one, not some one) of these parts as a unit; fourth, the measurement of the amount or value of the original whole, through equalizing it to a certain definite number of the selected unit.

But Prof. Fine says: "In however loose a sense the word may be used, 'measuring' at least involves the conscious use of a unit of ref-