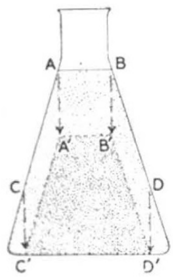
than the specified size will be above the surface $C'A'B'D'$, and the suspension within this region will have a higher specific gravity than the remainder. It was clear, therefore, that some flow of the suspension must occur and that the use of a conical flask would introduce an additional complication into the already difficult problem of particle size analysis.



Recently, one of us (R. J.) was shown a phenomenon which occurred after an aqueous suspension of potters' bone was shaken in a conical flask, and recognized it as connected with the above problem. When the flask was allowed to stand, normal settling commenced; but after a few moments, alternating layers of clear and cloudy liquid appeared to be moving up the sides of the flask. This upward movement is evidently one phase of the readjustment which theoretical consideration requires, but it occurs rhythmically and not as a steady flow.

A similar effect has been observed with straight-sided vessels slightly tilted, suggesting that, when using such vessels, care in the vertical setting of the apparatus is of importance.

R. JOHNSON
F. SMITHSON
British Pottery Research Association,
Penkhull, Stoke-on-Trent.
April 9.

Technique of the Analysis of Variance

THE analysis of variance technique originally devised by Prof. R. A. Fisher for the interpretation of agricultural experiments concerned the case of equal frequencies in the sub-classes. Prof. Fisher himself extended his technique to the case of unequal frequencies[1], when only the effect of one single variable was under examination.

The more general case of unequal frequencies in the sub-classes and more than one variable was dealt with by Brandt[2] and Yates[3], the latter introducing constants fitted by the method of least squares. The analyses already mentioned are special cases of the results produced by this method.

The methods appropriate to the two simple cases can be developed by using orthogonal polynomials, but this is not possible in the general case. However, if the frequencies n_{ij}, say, are such that they can be separated into two factors $u_i v_j$, say, then orthogonal polynomials can again be constructed.

So far as I am aware, it has never been pointed out that this method is not equivalent to that of fitting constants, except in the two special cases mentioned earlier. For example, if two variables with two values each are considered, then the method of fitting constants leads to

$$(x_{11}+x_{12}-x_{21}-x_{22})^2 \Big/ \left(\frac{1}{n_{11}}+\frac{1}{n_{12}}+\frac{1}{n_{21}}+\frac{1}{n_{22}}\right),$$

and that of proportionate frequencies to

$$\left(\frac{n_{11}x_{11}+n_{12}x_{12}}{n_{11}+n_{12}}-\frac{n_{21}x_{21}+n_{22}x_{22}}{n_{21}+n_{22}}\right)^2 \Big/ \left(\frac{1}{n_{11}+n_{12}}+\frac{1}{n_{21}+n_{22}}\right),$$

for the measure of the effect of the first variable.

It appears that different definitions of effects and interactions are implied by the two methods. This is logically unsatisfactory, since the definition of an effect or of an interaction should not depend on whether the frequencies are noticed to be such that a change in the definition leads to easier computations. The method of fitting constants should therefore always be accepted as the only legitimate one.

A detailed analysis, showing also that the case of proportionate frequencies is unique in making the introduction of orthogonal polynomials possible, will appear elsewhere.

S. VAJDA
Statistical Branch,
Admiralty.

[1] Fisher, R. A., "Statistical Methods for Research Workers", 4th ed. § 44 (1932).
[2] Brandt, A. E., *J. Amer. Stat. Assoc.* (1934).
[3] Yates, F., *J. Amer. Stat. Assoc.* (1934).

Significance of Multiple Innervation of Cutaneous Pain 'Spots' in Relation to the Quality of Pain Sensibility

IF a sphygmomanometer cuff is inflated at a pressure above systolic blood pressure on a human limb, a progressive loss of cutaneous sensibility occurs peripheral to the cuff. The work of Lewis, Pickerir and Rothschild[1] in this connexion has been repeated and amplified. These authors describe a regularly ascending 'centripetal paralysis', and attribute this mode of spread to an increasing susceptibility of individual nerve fibres to the effects of pressure as they are traced proximally from the periphery. We have been unable to confirm any such regular centripetal spread of sensory loss. It has been found that, in the territory of any given nerve, loss of sensibility commences in different sites, not only in different subjects, but also in repeated experiments in the same subject, and spreads irregularly rather than centripetally. Indeed, in several instances an almost regular centrifugal spread has been observed.

If the hypothesis of Lewis *et al.* is correct, and individual nerve fibres do indeed become more susceptible to pressure the more proximally they are traced, then sensory paralysis should appear more quickly the more proximally the compressing cuff is situated on the limb. It is certainly the case that sensory loss occurs more quickly when the cuff is on the upper arm than when it is on the forearm. The evidence available, however, indicates that, owing to anatomical factors, pressure is transmitted more effectively to the underlying nerves when the cuff is is any position on the upper arm than when it encircles the forearm. Thus the observed difference between upper arm compressions and forearm compressions can be explained on purely mechanical grounds[2]. Direct evidence that there is no such sensitivity 'gradient', as suggested by Lewis *et al.*, may be obtained by altering the position of the compressing cuff on the *upper arm*. It is then found