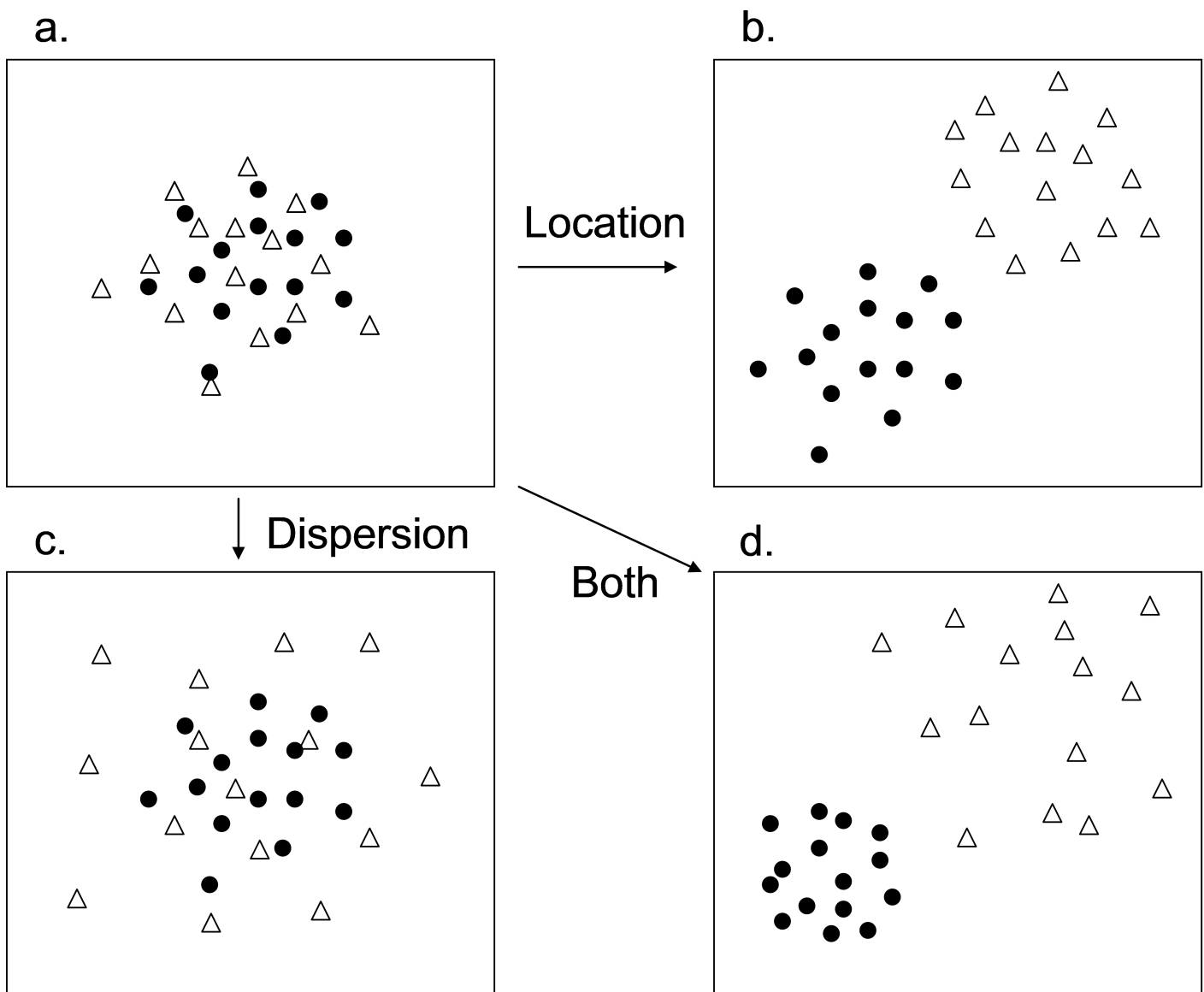


## 2.2 Rationale

There are various reasons why one might wish to perform an explicit test of the null hypothesis of no differences in the within-group multivariate dispersion among groups. First, such a test provides a useful logical complement to the test for location differences that are provided by PERMANOVA.

As pointed out in [chapter 1](#), PERMANOVA, like ANOSIM, is sensitive to differences in multivariate dispersion among groups (e.g., see Fig. 1.6). In fact, the logic of the partitions of variability for all of the ANOVA designs in [chapter 1](#) dictates that the multivariate dispersions of the residuals should be homogeneous, as should also be the dispersions of levels for random factors in nested designs and mixed models. A significant result for a given factor from PERMANOVA could signify that the groups differ in their *location* (Fig. 2.1b), in their *dispersion* (Fig. 2.1c) or some combination of the two (Fig. 2.1d). An analysis using PERMDISP focuses only on dispersion effects, so teases out this part of the null hypothesis (equal dispersions) on its own, perhaps as a prelude to a PERMANOVA analysis, analogous to a univariate test for homogeneity prior to fitting ANOVA models.



**Fig. 2.1.** Schematic diagram showing two groups of samples in a bivariate system (two dimensions) that (a) do not differ in either location or dispersion, (b) differ only in their location in multivariate space, (c) differ only in their relative dispersions and (d) differ in both their location and in their relative dispersion.

Of course, the other reason for applying a test of dispersion is because specific hypotheses of interest may demand such an analysis in its own right. There are many situations in ecology for which changes in the *variability* of assemblages are of direct importance. For example, increases or decreases in the multivariate dispersion of ecological data has been identified as a potentially important indicator of stress in marine communities ( [Warwick & Clarke \(1993\)](#) , [Chapman, Underwood & Skilleter \(1995\)](#) ).

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