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available. In some cases, a 3-dimensional contour or “mountain” picture is used. Several response surface approaches to optimisation are available, but perhaps the most useful method for displaying the two-factor situation is a contour plot (Fig. 1). The contours join points of equal system response: in the figure the optimum is shown by the central point. These graphical displays cannot very easily be extended to cover three or more factors, but the optimisation methods in common use can handle such situations mathematically.

At the start of the optimisation process the form of the contours is evidently unknown, while the aim is to approach their centre as expeditiously as possible. To achieve this we have two general options. We could use a carefully designed set of experiments to explore the response within a region of interest, then fit some mathematical model of the response, which we can use to identify a prospective optimum. This approach is called *response surface methodology* (RSM) and will be discussed in

maxima? These issues will be discussed further in a subsequent Technical Brief.

We have so far assumed that there is a single optimum response that we can locate unequivocally, or at least approach closely. But in some experimental systems this simplification is not justified; there may be ca a a as well as the ba a (Fig. 3). Such situations may be more common than is generally supposed. A search method should ideally be capable of distinguishing the global response from the lesser local maxima, preferably with a modest number of trial experiments: this significant problem will be discussed in subsequent Technical Briefs.

Some experiments require the optimisation of more than one response simultaneously. In an HPLC separation of compounds 1, 2 and 3 we may wish to go a little further and optimise simultaneously two responses, say retention time and peak area. This is a more complex problem than the one discussed above, but it is not fundamentally different. It can be handled by the same methods, though the search space is larger and the number of trial experiments may be larger. The same principles apply, and the same search methods can be used.