11.3.6: Errors, Mistakes and Blunders

I was once told that the distinction between errors, mistakes and blunders was roughly as follows. *Errors* are the inevitable small variations caused by imprecision of measurement, or, in the case of computation, the small random errors produced by rounding off (which, incidentally, should not be done before the final "answer" is arrived at). *Mistakes* are things such as writing a 3 instead of 4, or 56 instead of 65, or writing 944 instead of 994 (this is a common one), or reading a poorly-handwritten 6 as a 0 or a 4, or writing a plus sign instead of a minus (this sort of mistake can be quite large!), or thinking that six times eight is 42. A *blunder* is a complete misconception of the entire problem!

Even with the greatest care, errors and mistakes can occur during measurement and reduction of an astrometric plate. The important thing is to find them and either correct or reject them. A stellar image can be contaminated by blending with another star or with a blemish on the plate. A star can be misidentified. There may be a mistake in the catalogued position, or the proper motion may be poor. A measurement can be poor simply because of fatigue or carelessness.

If only the minimum number of comparison stars are used (i.e. three for a linear plate solution, six for a quadratic plate solution), there is no way of detecting errors and mistakes other than carefully repeating the entire measurement and calculation. Error and mistake detection requires an overdetermination of the solution, by using more than the minimum number of comparison stars.

What has to be done is as follows. Once the plate constants have been determined, the right ascension and declination of each of the comparison stars must be calculated, and compared with the right ascension and declination given in the catalogue. The difference $(O - C)$ is determined for each star, and the standard deviation of the residuals is calculated. Any star with a residual of more that two or three standard deviations should be rejected. The exact criterion for rejection will depend on how many stars we used. Statistical tests will determine the probability that a given residual is a random or gaussian deviation from zero. A full and proper statistical test is slightly laborious (although a computer can make short work of it), and many measurers may decide to reject any star whose residual is more than 2.5 standard deviations from zero, even if this is not strictly the correct statistical way of doing it.