creases with increasing deck size. It is amusing that, misguided by the American experience, most midland clubs played with four-pack decks, thereby diminishing their advantage. Of course few players have the skill to achieve these odds, and the bank typically wins around 2–15% of the stake per hand. Downton has verified these figures in an extended series of undergraduate laboratory experiments.

This work has intrinsic interest. It can also be tortured into yielding two morals for ecologists. Downton notes that an interesting characteristic of any game of chance is the "gain ratio", defined as the bank's average gain per unit stake divided by the standard deviation: the gain ratio is the reciprocal of the coefficient of variation. Although all players are doomed to long-term losses, the smaller the gain ratio the higher the probability that a player will win (or, equivalently, will survive through) any one session. In roulette, gain ratios vary from 0.46% playing single members to 3.77% playing groups of 24; in dice or craps they range from 0.99 to 4.42%; in chemin-de-fer with best play the gain ratio is 1.34%. The significance of the gain ratio is illustrated by considering a casino which spins its roulette wheel 90 times per hour. Suppose 20 people each bet £1 on each spin over an 8-hour session. The bank's expected winnings are £390, but the standard deviation is £189 if all players bet on groups of 12 numbers, £706 if all bet on single numbers. This is a consequential difference. The processes whereby, in Reddingius's memorable phrase (*Oecologia*, **5**, 240; 1970), plants and animals "gamble for existence" in an unpredictable world has many similarities with these games. The notion of "gain ratio" is likely to have fruitful applications in ecology.

Casinos and gamblers are usually ignorant of the mathematical structure of their games and strategies, which have, rather, evolved by an intense and highly motivated process of trial and error. In some respects they therefore invite analogies with biological processes of evolution by natural selection. This is particularly so for the way primitive societies may, or may not, have unconsciously "evolved" optimum strategies of resource management. The advantage of gambling games is that the empirically evolved strategies can be compared with the exact optimum ones. Chemin-de-fer provides a beautiful example: the optimum strategy is for the banker to vary his choice of drawing or standing only when he holds 6 and has given no card; most clubs have mandatory instructions to the dealer, and these used to be Crockford's drawing card which allowed options in three cases, namely, holding 6 and giving no card, holding 5 and giving 4, and holding 3 and giving 9; since 1972 the instructions provided by the Casino Association of Great Britain allow the banker a choice in the latter two cases only. Although the differences are inconsequential, it is notable that the strategies chosen by the casinos were never the best, and have changed for the worse. Casino owners should read Downton's work. □

Surprises in the Magellanic Clouds

from M. G. Edmunds

THE research potential of the Magellanic Clouds—the two nearby galaxies easily visible to the naked eye in the Southern Hemisphere—is underlined by the surprising result of a recent investigation of a star cluster in the larger of the two Clouds. An Australian group (Gascoigne *et al.*, *Astrophys. J.*, **209**, L25; 1976) have used the Anglo-Australian 3.9-m telescope to study NGC2209, one of the so-called "intermediate age" globular star clusters in the Clouds.

For stars it is notoriously difficult to assign a reliable age by appearance. But for a cluster of stars, the morphology of a plot of colours of the stars against intrinsic brightness can yield a fair guess. The method essentially works by looking for the highest mass (that is, brightest and bluest) dwarf stars which are only just beginning to evolve into giants. This "turn-off point" from the Main Sequence of dwarf stars can then be compared with computed models of stellar evolution to estimate an age.

In physical appearance a globular cluster has a characteristic spherical shape, held together by the mutual gravitational interaction of the stars. All globular clusters in our own Galaxy seem to have formed at the same time as, or not very much later than, the formation of the Galaxy itself—they are "old" objects. In the Magellanic Clouds there exist gobular clusters which have almost certainly formed recently, as evidenced by the existence of bright young blue dwarfs which will live only a short time as dwarfs on the Main Sequence. The "intermediate age" clusters formed sometime between the young and old. Since there are only old clusters in our own Galaxy, these young and intermediate age Magellanic Cloud objects are of great interest. What is surprising is that the Australian group find good evidence that the stars in the NGC2209 cluster have relatively few heavy elements ("metals") in them, only about one-sixteenth of the solar abundances, and yet they estimate the age of the cluster as a mere 8×10^{8} yr compared with a probable age in excess of 10^{10} yr for the Large Cloud itself. The problem is that the interstellar medium in the main body of the Large Cloud, as determined by several independent investigations of the gaseous nebulae, is certainly not less than one-half solar. If the cluster were very much older, then its composition could be explained by saying it formed out of metal-poor gas, and that metal synthesis in the supernovae explosion of massive stars had enriched the interstellar medium since then. But here is a cluster which is apparently fairly recently formed, and should therefore reflect the present chemical composition of its precursor interstellar medium. It is true that the cluster is one of the most outlying—some 6° or 6 kpc away from the centre of the main body of the Large Cloud, but it is unlikely that the chemical composition of the interstellar medium varies so drastically across the Cloud. Perhaps an outlying cloud of gas somehow survived with very little star formation and consequent metal enrichment, until efficient star formation was suddenly induced.

The metal abundance of the cluster seems well demonstrated since the group used two independent methods. One method relies on the displacement of the locus of stars (relative to Galactic solar composition star clusters) on the colour/brightness plot, due to the weakness of absorption by metal lines in the blue spectral region. A second estimate comes from taking advantage of the light-gathering capacity of a large telescope and isolating just a few spectral lines in two of the stars by interference filters. A comparison of the line strength with that observed for stars in clusters of known composition yields a metal abundance estimate. Both methods agree that the cluster is considerably metal deficient.

The accurate aging of the cluster is more uncertain. The authors unfortunately do not quote error limits on their estimate. An inspection of their published data suggests that using their aging method, errors would not push the age back further than 2×10^{9} yr—still young compared with old clusters and the probable age of the Clouds.

If the age of the cluster is confirmed in subsequent work, then considerable revision of our ideas about the chemical homogeneity of the interstellar medium in galaxies may be required. Investigation of other similar clusters in the Clouds will be awaited with interest. □