Baseball and the Laws of Chance

OR many centuries, as an Oxford don once remarked, teams of playful humanoids have wasted a great deal of time and energy attempting to strike little balls into small holes with instruments singularly ill-adapted to the purpose. The origins of games involving a ball appeared in Egyptian archaeology 5,000 years ago according to researches by R. W. Henderson[1] of the New York Public Library. They were developed, not for amusement, but as a phase of spring-time religious rituals in which the ball was the central symbol of growth and fertility. The ball-playing ceremony was adopted by the Arabs and transported by the Moors into Spain and southern France. Here in the 12th Century it was incorporated into the Easter services of the Christian Church. The Archbishop is said to have *"passed a ball back and forth with the clergy assembled for the processional."* The ball was subsequently thrown out among the congregation, which divided into contending teams. It was then knocked about with sticks or kicked by the participants, as not infrequently occurs in the contemporary version. The good Bishop may thus be charged with the first passed ball in the history of the game.

When the medieval Easter festival was introduced in England, "the British developed a variation of the ball-playing phase, nearer the modern game, called 'stool-ball.' It was first played in a church yard, with a pitcher attempting to throw the ball against an up-turned milking stool. An opponent endeavored to bat the ball away before it reached the home stool. The game spread over the country-side where second, third and fourth bases were added to be circled after striking the ball. When players added the rule that a runner could be put out by being hit with a thrown ball, stool-

[1] *Ball, Bat and Bishop: Origins of Ball Games*, R. W. Henderson (McLeod: Toronto, 1947).

1

ball developed into the old familiar British children's game of 'rounders' ."[1]

Early colonists brought the game to America where a modified version known as "town ball" was formalized by the Olympic Club of Philadelphia in 1833.[2] The game was played on a field laid out as a square with corner "goals" sixty feet apart. The batsman's position was halfway between the first and fourth goals. The catcher stood behind the batsman and outside the square, sometimes with an assistant. There were no foul lines and it was considered expert on the batter's part to deflect the ball behind him, as in cricket. In 1845, the Knickerbocker Baseball Club of New York drew up the first code of rules, and the first match of record was played in Hoboken during the following year.

"In the early days of modern baseball, no one who wrote of it seemed to doubt that it was an evolution from the English children's game of rounders. A simple change in the rules, according to these authorities, transformed it into a man's game. In rounders, the fielder put out a runner making for a base by attempting to strike him with the thrown ball. This precluded the use of a *hard* ball and, since a soft ball cannot be batted very far, limited both the size of the field and the activity of the players. Presumably about 1840 some ingenious American had the idea of putting out the runner by touching him with the ball or the hand holding it. It became possible to use a hard ball—at first a kind of miniature cricket ball. The rules of the pioneer Knickerbocker Baseball Club, drawn up in 1845, constitute the earliest documentary record of this change. The one vital difference between rounders (as described in London in *The Boy's Own Book*, 1828) and modern baseball occurred in this method of the put out."[3]

The new variation of the game, now known as *baseball*, continued in growth and popularity through the Civil War period. An admission fee of fifty cents was first charged the record crowd of 1,500 which watched local all-star teams perform at the Fashion Race Course on Long Island. The fee was applied to the expenses

[1] *Official Encyclopedia of Baseball*, 3rd rev. ed., Hy Turkin and S. C. Thompson (A. S. Barnes: New York, 1963).

[2] *Encyclopaedia Britannica*, 1958 ed., Vol. 3, page 159.

[3] *Ibid.*

for preparing the field. The game was won by the New York team which defeated Brooklyn by a score of 22 to 18, on July 20, 1858.

Professionalism first appeared in 1866 among personnel of barnstorming teams which played the provinces west of the Hudson River. In 1869, the Cincinnati team was hired as an outright professional organization and made a successful tour of the country from New York to San Francisco. In 1871, the National Association of Professional Baseball *Players* was organized in New York including the

Athletics of Philadelphia	Forest Citys of Cleveland
Bostons	Haymakers of Troy
White Stockings of Chicago	Forest Citys of Rockford
Eckfords of Brooklyn	Kekiongas of Fort Wayne

Mutuals of New York

The Association dissolved in 1876 as the result of poor management and of certain improprieties reflecting upon the honesty and integrity of the players. It was superseded by the National League of Baseball *Clubs*. By 1882, public confidence was reestablished and baseball had sufficiently developed to be regarded as an institution. The American Association was now formed in cities not members of the National League. After some years of hopeless rivalry, the several groups were merged in a 12-club organization which enjoyed a monopoly of major league baseball. Attenuation of patronage in Baltimore and Cleveland, mainly due to the weakening of the teams by trades, resulted in return to an 8-club membership beginning in 1900.

In this year Charles Comiskey, owner of the St. Paul Club of the Western League, moved his team to Chicago and renamed it the Chicago White Sox. The Grand Rapids Club of the same league shifted into Cleveland and two years of baseball war followed. The militant circuit changed its name to the American League and, headed by its president, Bancroft Johnson, placed teams in Baltimore, Washington, Philadelphia and Boston for the 1901 season. The American League made such raids upon star players of the rival circuit that it became firmly established as a major league. When peace was made between the two leagues in 1903, an agreement was signed prohibiting consolidation of clubs, shifting of teams without mutual consent and controlling the transfer and recruiting of players.

The New York Giants under John McGraw and the Philadelphia Athletics managed by Connie Mack rose to prominence in the next quarter century of peaceful prosperity. As champions of their respective leagues, they met in the World Series of 1905, 1911 and 1913. Half the gate receipts for the first four of the seven possible games of the Annual Championships go to the player's pool to be divided among the first division teams. While the teams of the National League have been more evenly matched since the McGraw era ending in 1924, the powerful New York Yankees have dominated American League and World Series play since 1920 when the lively ball was first introduced.

For nearly a century, baseball has occupied a prominent position in the affairs and the folklore of the nation. Perhaps the most representative cross section of the American people may be found among the spectators of any well-attended game. The spectrum extends from figures conspicuous in the religious, political, financial, industrial or intellectual life of the country to those of less exalted achievements and positions. By turn, the crowds are good humored or angry, sentimental or cruel, quiet or vociferous, sportsmanlike or ill-mannered, elated or depressed—displaying a complete variegation of emotions and behavior. The appeal of the game is universal. The average fan's encyclopedic knowledge of the rules, personalities, vital statistics and the strategy of play is nothing less than astonishing.

It is recognized that baseball is a complex process with possible variations of play running into the millions. While feasible changes of tactics are few and elementary, an analysis of the strategy of the game can be no less complicated than the play itself. Nevertheless, baseball is a repetitive process rigidly controlled by strict observance of its rules. In its simplest form, it is defined and limited by three fundamental circumstances:

> The batsman may be put out,   O
> He may score a run, or   R
> He may be left on base.   LOB

Formally stated: the Total Batters Facing the Pitcher = BFP = Outs + Runs + LOB. Nothing else can happen, although these basic possibilities can and do occur with infinite variety.

Any system with a sufficient number of cases and a uniform en-

vironment is susceptible to a mathematical approach. Indeed, completely random systems are rare among natural phenomena and can be devised only by the operations of mathematics assisted by digital computers. No cypher has ever been conceived which cannot be broken, and even the most complicated codes resort to electronic scrambling devices to insure their security. Baseball cannot be as enigmatic as this.

In the application of the laws of chance to the strategy of baseball, one must become accustomed to the subtle nuances between *reality* and *probability*. The sum of the total frequencies of any particular series of related events is certainty, and must equal 1.000. The component decimal probabilities developed from the statistical data of the system will *usually* occur with calculated frequency where a sufficiently large test population is contained. For example, eliminating tragedy, a healthy pregnant mother will be delivered of *either* a girl *or* a boy. The statistical probabilities for either closely approach the fraction, $\frac{1}{2}$. A prominent surgeon in Baltimore is the proud father of four boys. As will be explained shortly, his chances for successively siring *four* fine sons were: $(\frac{1}{2}) \times (\frac{1}{2}) \times (\frac{1}{2}) \times (\frac{1}{2})$, or *one* in 16. With some justification and great pride, he considers himself an expert in applied genetics. On the other hand, a local breeder and trainer of race horses, equally renowned in his profession, has experimented with bloodlines all his life. He has been the happy but shell-shocked sire of *six* charming fillies before finally hanging up his spurs. The chances for having ultimately to finance six expensive weddings in succession are: $(\frac{1}{2}) \times (\frac{1}{2}) \times (\frac{1}{2}) \times (\frac{1}{2}) \times (\frac{1}{2}) \times (\frac{1}{2})$, or but *one* in 64! Despite these ad-

TABLE 1

World Series Play from 1903 Through 1961

Actual vs. Chance Distribution of Games Won

Number of Games Won Lost	4-0 0-4	4-1 1-4	4-2 2-4	4-3 3-4	Total
Distribution	10	14	15	19	58
Probability					
Actual	.172	.241	.259	.328	1.000
Chance	.125	.251	.312	.312	1.000
Deviations	.047	.010	.053	.016	(.029)

mirable if erratic performances, the total numbers of male and female infants delivered in the Maryland Free State conform to normal, national frequencies of about .4865 vs. 5135, respectively.

The application of probabilities is inevitably accompanied by *deviations* from standard frequencies. The less the number of cases, the greater the deviation which may often occur. Thus in a World Series of as few as seven games between quite *evenly matched* teams, the championship is largely a matter of chance. As shown in Table 1, the actual distributions of 4-3, 4-2, 4-1 and 4-0 games closely follow those calculated for pure chance, with deviations ranging from .010 to .053. The best team will usually win the pennant in 154 games, but the better team does not necessarily win a 7-game World Series.

It should be emphasized that these researches into the probabilities of baseball are not concerned with prediction. The chance deviations of 154 games in which an average of 5,931 batsmen appear for each team are such as to preclude more than very general prognostications. From 30,000 to 50,000 cases are required to insure minimum deviations. The equations of play, however, have been supported by more than 750,000 cases which are just slightly less than the total number of printed letters and figures in this book. They are competent to follow faithfully the patterns of the game within most acceptable tolerances. It is this ability, not to predict, but to determine and confidently to evaluate the performance and strategy of the game to which the succeeding chapters are devoted. Some of the conclusions disagree with what has been empirically determined to be good baseball for years. For this reason more than usual precautions have been exercised to validate the equations. Some of the hypotheses may be surprising. There is nothing in the area of cervical extension which cannot be verified (or denied) by an intelligent revision of the official score sheets and their statistical presentation. The mathematics involved is elementary; it is the game itself which is so unusually complex. As many as possible of the derivations and calculations have been segregated in separate tables which may be passed over lightly without missing the main floor show. The laws of chance will reveal with astonishing accuracy what may be expected to occur for a particular body of statistics . . . but they can never predict what the statistics themselves may be.