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The application of Sabermetrics to the teaching and coaching of collegiate baseball

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Middle Tennessee State University, 1988

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The Application of Sabermetrics to the Teaching and Coaching of Collegiate Baseball

Ron R. Barry

A dissertation presented to the
Graduate Faculty of Middle Tennessee State University
in partial fulfillment of the requirements
for the degree Doctor of Arts

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The Application of Sabermetrics

to the Teaching and Coaching

of Collegiate Baseball

APPROVED:

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Abstract

The Application of Sabermetrics
to the Teaching and Coaching
of Collegiate Baseball

by Ron R. Barry

This study was designed to improve the teaching and coaching techniques presently used by many in leadership positions in the realm of collegiate baseball. By applying the principles of sabermetrics, the in-depth analysis of baseball statistics, coaches and teachers of the sport would benefit in many key situations involving the sport: choosing personnel for the best potential lineup, selecting appropriate game strategies, gaining statistical support for time-honored theories while refuting others, and boosting bench morale. The author collected data contained in individual scoresheets used in collegiate games played by Union University, a National Collegiate Athletic Association (NAIA) member school, in the years from 1983 to 1985. Sabermetric principles were applied to the statistical information gathered from these games to determine which numerical indicators are most useful and reliable when dissecting the college game. Statistics in a multitude of areas were collected, as indicated in a seasonal sample illustrated in Appendix B of this paper.

Ron R. Barry

The writer applied theories and formulas pioneered by founding sabermetricians Bill James and Pete Palmer, among others, including "Runs Created," "Total Average," on-base percentages, run-scoring probabilities, and several other categories of measurement. Among the major discoveries of the study were: (1) more times than not, using a bunt in an inning reduces the chances of scoring, despite the belief of most coaches that it helps the chances; (2) many player personnel selections would be made more easily if a coach used more pertinent information than is currently employed, such as substituting on-base percentages for batting averages; (3) the stolen base attempt usually will hinder an offense as much as it helps it; (4) scoring the first run in a game results in a victory well over 65 percent of the time; and (5) the concentration of pitchers can be greatly enhanced by keeping statistics of their performances after two men are out in an inning. The study also includes run-scoring probabilities in all possible ball/strike combinations and baserunning situations. Team morale and cohesiveness can be improved by assigning the tabulation of game statistics to non-playing reserves, interested spectators, and/or handicapped personnel unable to physically play the sport. Many of the statistics used were compiled from major league baseball games, but the author has found them relevant at the collegiate level.

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Pioneering sabermetricians such as Bill James and Pete Palmer have served as major motivators.

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Finally, to Rocky Colavito--my favorite player in all my years of loving this sport--thanks for making baseball

become more than just a game in the heart of a little boy in Detroit.

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Chapter 1

Introduction

Baseball coaches and physical educators involved in the teaching of coaching methods should be constantly striving to discover new techniques for success. Many, however, are content to continue to develop their philosophies and strategies around theories created during the "dead ball" era of the sport, ignoring many of the advancements of modern technology and their effect on the game. A review of the numerous textbooks used in the teaching of baseball in Tennessee colleges and universities found that none of them includes sabermetric principles designed to aid a coach in the evaluation of personnel and performance.

Pioneering sabermetricians such as Bill James, Craig Wright, Thomas Boswell, Seymour Siwoff, Steve Hirdt, and Peter Hirdt have spent years developing formulas and statistical measures of success that, in the opinion of this writer, yield a much more realistic indication of solid performance than do those traditional methods employed almost universally by coaches and managers. Creative application of sabermetrical techniques should enable coaches and teachers of baseball to realize many new methods

for rating their personnel, solidifying their decisions, and improving team morale and performance.

Statement of the Problem

This project explored the various uses of sabermetrics as a means for improving the quality of the teaching and coaching of collegiate baseball. Included are techniques for the use of sabermetrics, strategy alterations and suggestions that may result from their use, student workship options and creative use of team personnel, and the applications to the teaching and coaching of other sports on the collegiate level.

The desire for the study arose partially from the interest of the author to attempt to answer a question that commonly is discussed within the sport of baseball: does the use of the designated hitter (DH) remove much of the strategy from managing in the American League? This topic, and many others, is addressed in Chapter 3.

Review of Related Literature

Virtually all, if not all, of the sabermetrical studies that have been published have been limited to the use of statistics from major league baseball and have been applied solely to major league baseball. Most of the current information has been published in magazines and newspapers, with the exception of one major book on the subject and two annual series of books.

Foremost is Thorn and Palmer's The Hidden Game of Baseball (1985), which rates as one of the most definitive volumes ever published on the subject of sabermetrics. The annual publications are The Bill James Baseball Abstract series and The Elias Baseball Analyst series. Each book is released in the spring of the year and is designated specifically by the number of the year in which it is published. The James series has been issued since 1977, and the Elias series, compiled annually by Siwoff, Hirdt, and Hirdt, has been released only in the past 4 years, taking advantage of the national attention ignited by the works of Bill James.

The review illustrates the differing angles of inspection used by sabermetricians and includes their own attempts to justify their professions and hobbies. Also included are some of the major new approaches favored by these authors to more truly evaluate the sport of baseball and its players and coaches.

Measuring the Game

The act of hitting a baseball has been called the hardest accomplishment in sport, perhaps illustrated by the fact that major league batters earn multi-million-dollar contracts despite failure rates of 70 percent, the frank definition of a .300 hitter. The game lends itself to intensive statistical measurement by its very nature, from the box scores seen in daily newspapers across the United

States to the scientific analyses by persons such as Kindel (1983), who explained the physical reasoning behind the difficulty in hitting a baseball:

> As a ball leaves the pitcher's hand, it begins to spin. A fastball thrown at 98 miles per hour will turn about its circumference approximately 40 times in the .42 of a second between the pitcher's release and the batter's attempt to make contact. While the ball spins, it also wobbles a bit because the pitcher's fingers did not leave its surface all at once. . . . Put it all together--the speed, spin, wobble, and downward angle of the ball versus the speed, upward angle, and torque of the bat--and then throw in the variable coefficient of friction to deal with the effect of the ball's cowhide surface as it meets the ash of the bat, and it's a wonder that a batter ever connects accurately at all. (pp. 180-181)

James, quoted in a magazine interview (Okrent, 1981), has said:

> A baseball field is so covered with statistics that nothing can happen there without leaving its tracks in the records. There may be no other facet of American life, the activities of laboratory rats excepted, which is so extensively categorized, counted, and recorded. (p. 45)

The Justification for Sabermetrics

Wolkomir (1983) credited the speedy rise of computers over the past 5 years with the current surge of statistical data (p. 152). Lehman (1984) remarked that sabermetricians "have sparked a minirevolution as startling in its way as the adoption of the designated hitter rule by the American League a decade ago" (p. 75).

The expansion of the James book series is a case in point. The first Abstract sold 75 copies, increased to 325 in 1978, 600 in 1979, and 750 in 1980, when James was self-publishing the book. Now it is a nationwide best-seller each season (Okrent, 1981, p. 48). James began delving into the differences between a .300 hitter and a .310 hitter just to satisfy his own curiosities, until he began to find some intriguing and rational data. He wrote, "It used to be a matter of you've got your theory and I've got mine; now it's a matter of you've got your theory and I've got a stack of evidence this high to show that your theory is bunk" (James, 1983, p. 11). Lyons, in a profile on James (1983), quoted him as saying, "If it doesn't strike people as strange that George Brett spends his life playing baseball, why would they think it strange that I'd spend my life thinking about it" (p. 76)?

Craig Wright, the only sabermetrician who is a full-time employee of a major league team, the Texas Rangers, stated in an interview (Adams, 1984):

> Some writers have criticized sabermetricians as being know-it-all sorts of people. They're afraid we'll make the game too technical. Well, sabermetrics is like meeting a pretty girl. Getting to know her doesn't destroy your image of her, it only heightens the mystery. I believe sabermetricians have proven their worth. (p. 2)

Wright maintained that certain major league managers are virtually walking computers. "I'm constantly amazed that when a manager is presented with a supposedly new fact," Wright said, "he already has it. Every good manager is a sabermetrician at heart" (Leerhsen, 1983, p. 55).

Longtime Baltimore Oriole manager Earl Weaver agreed with Wright in his book Weaver on Strategy (1984):

> From the day I took over the Orioles I wanted all the statistical information I could get. Maybe I wouldn't use everything, but I wanted to see it. I believe that what you don't know can hurt you and that you can never know enough. We had charts that showed how our hitters did against every pitcher in the league. It's the most important information you can have. Its worth is impossible to measure, but you'd better believe the charts helped us win a lot of games. (p. 53)

Ken Dugan, successful coach of David Lipscomb College in Nashville, also stressed the importance of charting in his

book Secrets of Championship Baseball (1980), one of the few collegiate references to sabermetrical analyses:

> A coach, unless he has an exceptional memory, can help himself considerably by keeping charts, records, and notes on his own personnel and on the opposition. Some of the observations will have to be made and recorded during or after the game or practice sessions. (p. 33)

Along with James, the most outspoken of today's sabermetricans are Thorn and Palmer, who have stated that too much of today's baseball strategy is steeped in tradition (1985):

> The same maneuvers that Ned Hanlon, Connie Mack, and John McGraw used with so much success in the era of the dead ball have remained articles of faith for managers throughout the explosive hitting period between the wars and continue to be revered today. Like the Church, baseball is a conservative institution that does not reevaluate and revise its tenets lightly. (p. 151)

Thorn and Palmer believe that player performance can be measured much more effectively than is currently being done, viewing performance "in terms of its runs contributed or saved and within a context formed by the average level of performance prevailing at the time" (p. 7).

Arnold (1983), in a two-part article, lauded the application of game statistics as an important index of sport performance:

> Game stats are often used as the basis for selection of players, development of strategy, and retention of coaches. Awards, grades, and salaries may also be based, in part, on performance-related statistics. However, these statistics are not necessarily indicative of the outcome of the contest or the success of the player or team. (Pt. 1, p. 18)
>
> Even when the majority of individuals agree on the importance of a particular game factor in winning, rarely has that opinion been substantiated by systematic analysis of related game statistics. . . . The advantage of conducting your own analysis is that data can be collected for your own players, for your level of competition, within your framework of interests and concerns. A wealth of data is generated during every sport contest. A systematic analysis is all that is required to extract valuable, practical information and conclusions. (Pt. 1, p. 49)

James (1984) stated "The Known Principles of Sabermetrics" as the basis for all of the statistical information he gathers on major league baseball teams:

> ITEM 1: There are two essential elements of an offense: its ability to get people on base and its

> ability to advance runners. (p. 12) A team has 27 outs a game to make its runs. At-bats are not the context in which offense occurs. Outs are the context in which offense occurs. (p. 19)
>
> ITEM 2: Batting and pitching statistics never represent pure accomplishments, but are heavily colored by all kinds of illusions and extraneous effects. (p. 20)
>
> ITEM 3: There is a predictable relationship between the number of runs a team scores, the number they allow, and the number of games that they will win. The ratio between a team's wins and losses will be the ratio between the square of their runs scored and the square of their runs allowed. (p. 20)

Illustrations of each of the principles stated by James (1984) will be provided in the analysis of Union University baseball data.

Objections to the Traditional

Many sabermetricians have presented arguments regarding the extreme unreliability of most of the traditional measuring sticks of baseball: the batting average, earned run average, pitching wins and losses, home run totals, and fielding averages. None has argued as vehemently (and with more statistical evidence in support of their views) as have Thorn and Palmer (1985), whose entire book was devoted to showing the fallacies of these measures.

The batting average remains the most hallowed statistic of baseball, despite its shortcomings: it makes no distinction between a bunt single and a home run, gives no indication of the effect of each hit, and fails to account for bases reached by walks, errors, and hit batsmen (Thorn and Palmer, 1985, pp. 17-18). A 2-out bunt single in the ninth inning with no one on base and your team trailing by 6 runs counts the same as Bobby Thomson's "shot heard 'round the world"; and no credit for fouling off 7 strikes after gaining a full count to earn a walk is given in the batting average (p. 23).

Perhaps Thorn and Palmer stated their view best with the following passage:

> Time has given the batting average a powerful hold on the American baseball public; everyone knows that a man who hits .300 is a good hitter while a man who hits .250 is not. Everyone knows that, no matter that it is not true. You want to trade Bill Buckner for Mike Schmidt or Darrell Evans? (p. 23)

Using the batting average alone to determine the quality of a player diminishes the accomplishments of the extra-base hitter, the batter whose talent it is to draw excessive bases on balls, and the man whose hits are few but may be well-timed: they score runs. The main problem with the batting average is that it is an unweighted average.

The category of runs batted in, another traditional measure used to evaluate players, also has its weaknesses:

> They tell how many runs a batter pushed across the plate, all right, but they don't tell how many fewer he might have driven in had he batted eighth rather than fourth, or how many more he might have driven in on a team that put more men on base. (Thorn and Palmer, 1985, p. 25)

The category is situation-dependent, tied to factors which vary wildly for individuals on the same team or on others. The same criticism applies to virtually any statistic that is simply a "total" of anything. For instance, a player with a lot of stolen bases is not necessarily the best baserunner; he might have been caught as often as he stole and thus have cost his team many runs on balance. A man with the most triples is not necessarily "a slugger or a speed merchant; he probably plays half his games in a park conducive to triples, like the Astrodome" (Thorn and Palmer, 1985, p. 27).

Other stats also draw the ire of Thorn and Palmer (1985). A bunt single can improve a player's slugging percentage (p. 24); the on-base percentage, times on base divided by the total number of plate appearances, a new statistic beneficial in many ways, still makes no distinction between a walk and a grand-slam homer (p. 25); the earned run average for pitchers fails to penalize a

hurler who retires the first two batters, watches a ground ball get booted by his shortstop, and then yields 6 home runs (p. 29); pitching wins and losses are inaccurate because one may pitch poorly and win, or pitch well and lose (p. 28); the "saves" earned by relief pitchers are situation-dependent and have no negative to counteract the positive--except, all too often, a "win" when they blow the lead and then see their team rally--such as "saves blown" (p. 33); and the fielding average has a well-known weakness, that you can't make an error on a ball you don't touch (p. 33).

Examples of Current Statistical Uses

Computer usage in professional sports is becoming more widely spread throughout the country. Eleven of the 28 teams in the National Football League had already computerized as early as 5 years ago (Wolkomir, 1983, p. 154); the Chicago White Sox, New York Yankees, and Oakland Athletics are using Apple II Pluses to analyze performances (Leerhsen, 1983, p. 55); and New York Met manager Davey Johnson's collegiate degree in computer science was widely discussed during the telecasts of the 1986 playoffs and World Series. Craig Wright was hired by the Texas Rangers after he produced hard evidence that players who grew up in warm climates performed better in steamy Arlington Stadium than those who did not (Leerhsen, 1983, p. 55).

During major league baseball salary negotiations now, both players and management routinely bring in statisticians to help pinpoint the value of a player to the team (Wolkomir, 1983, p. 154). In fact, the administration of the major league uses a statistical system itself, the Grebey system, to determine the compensation degrees when a player signs with another team under free agency, although the general manager of the Milwaukee Brewers, Harry Dalton, summarized the measure in this manner: "It's useful for propping up the fourth leg on an uneven table" (Waggoner, 1983, p. 25).

The Baltimore Orioles, among other teams, have extensive charts on every hitter in the American League that show where he hits the ball against Baltimore pitchers (Weaver, 1984, p. 152).

Sabermetrics have been utilized in the study of whether it is more beneficial to the major league teams to draft college players or high school players, finding the following: (1) the college players are twice as likely to be successful contributors to major league teams; (2) among the top 50 draft choices each year, college players made the majors a far greater percentage of the time than those drafted out of high school; (3) college draftees became major league regulars more of the time than did high schoolers; and (4) college players are still being

undervalued and underdrafted, despite this evidence (James, 1985, p. 168).

Another sabermetrical study, done by a team of Hofstra University psychologists, investigated the performances of players who signed long-term contracts as free agents, compared to the performances of players who had 1-year contracts. Especially in the cases of pitchers, the long-term contract group fared much more poorly (Horn, 1982, p. 14). Sabermetrical findings are also used in the major league awards system for relief pitchers.

Managing Strategy

Dugan (1980) said, "The successful baseball coach will be a successful teacher. Teaching is an art that may be acquired and improved upon with practice. The personal philosophy of the coach will dictate the emphasis placed upon coaching." (p. 271)

Successful teaching and coaching generally relies on having the most recent available information, or discovering and inventing new techniques. Of what help to developing strategies and coaching philosophies can the new sabermetrical measures be?

James (1984) stated:

> Let's be up front about this: game strategy does not decide whether a team finishes first or fourth. Game strategy has as much to do with winning pennants as New Year's resolutions have to do with February . . .

> anybody who is too stupid to manage a baseball team is never going to get to the park to begin with. (p. 51)

Obviously, then, most sabermetricians feel their information is better suited to long-term decisions about the game and about the selection and evaluation of players, although some evidence helps to determine specific game strategies. However, as James continued, "The best game managers, generally speaking, are those who have the courage to keep their hands in their pockets, let their players play, and take the inevitable flak from the fans" (p. 52). Weaver, who compiled a winning percentage of .596 at Baltimore favoring a philosophy of "fundamentals, pitching, and three-run homers" (Weaver, 1984, p. 6), also credited a simpler approach to success in coaching:

> Frank Robinson would come to bat with two guys on base. I'd yell, "Hit it hard, Frank." Frank would hit it hard and far, over the fence. Then he would come around the bases and back into the dugout. I'd say, "Nice hit, Frank." Now <u>that</u> is the ideal way to manage, and that's how people first decided I was smart. (p. 33)

Weaver, however, a stickler for fundamentals in spring training, has used sabermetrical analyses to develop his philosophies, often keeping his information on small note cards in the dugout. He disdained the use of the bunt and hit-and-run plays because of these findings, rarely ordered

his players to attempt stolen bases, and still found his teams in more post-season play than any of his coaching contemporaries. He summarized his own philosophy neatly in his book (1984) by stating "Weaver's Ten Laws":

> (1) No one's going to give a damn in July if you lost a game in March. (p. 22)
>
> (2) If you don't make any promises to your players, you won't have to break them. (p. 26)
>
> (3) The easiest way around the bases is with one swing of the bat. (p. 34)
>
> (4) Your most precious possessions on offense are your 27 outs. (p. 39)
>
> (5) If you play for one run, that's all you'll get. (p. 39)
>
> (6) Don't play for one run unless you know that run will win a ballgame. (p. 45)
>
> (7) It's easier to find four good starting pitchers than five. (p. 67)
>
> (8) The best place for a rookie pitcher is long relief. (p. 74)
>
> (9) The key step for an infielder is the first one--to the left or right, but before the ball is hit. (p. 86)
>
> (10) The job of arguing with an umpire belongs to the manager, because it won't hurt the team if he gets thrown out of the game. (p. 131)

Ironically, most of Weaver's laws find direct substantiation through the work of the leading sabermetricians, which is a major reason Weaver has been well-respected among them. They do not feel that the fact that his winning percentage is better than those of other managers is a coincidence.

Losses in March, Weaver reasoned, do not matter because they are spring exhibition games in which many rookie players are scrutinized. Avoiding promises to players was simply a philosophical point of his. Weaver's love for the 3-run homer is well-supported throughout sabermetrical research and in this paper. Giving up an out and using strategies designed to score one run and one run only rarely seemed to have an influence unless used late in a tie game, he felt.

Weaver's pitching theories (his sixth and seventh "laws"), while seemingly full of common sense, have been largely abandoned by modern-day managers, who favor five-man pitching rotations and short relief roles for many rookies. This is especially strange in light of the fact that it was often Baltimore's strong pitching staff that earned Weaver a string of post-season opportunities.

Weaver concluded his book with a point very basic to what all coaches and teachers of baseball should realize:

> All a manager can do is get his best team on the field for any particular game and see that the players know what their jobs are and how to do them. That's the whole point of all your work, from the drills in the spring to your last pregame meeting at the end of the year. After that, it's all up to your players. (p. 187)

Dugan (1980) included one more facet regarding sabermetrical application that will be addressed later in this project:

> Many coaches overlook the bench as a factor in building a championship team. So much concentration is devoted to fielding nine men that the bench is often neglected. If good discipline and team morale are to be achieved, these players must feel they are members of the squad . . . an alert bench reflects championship coaching, the kind that insists on attention to detail and instills in every squad member the belief that he is an integral part of a successful organization. He may uncover valuable information about the opponents that will help his team. (p. 32)

The simplest way to ensure that these reserve players give their effort and attention to the game in progress would be to assign to them a category of sabermetrical investigation for that particular game.

Debunking Myths

One of the most popular utilizations of sabermetrical measures has been the refuting of "knowledge" that has been traditional in baseball for decades. The attention that some of the findings have produced is exactly the reason that sabermetricians are finally being taken seriously for the first time.

A prime example was the report by Leo (1983) on a Pete Palmer study:

> Trying to go from second to third on a ground ball to short has always been considered a bonehead play. Palmer has shown mathematically that it is actually a high-percentage strategy. His finding: the potential gain (two runners on base plus one less out) is so much greater than the penalty (loss of a single base) that the play has to succeed only 23 percent of the time with nobody out and 16 percent of the time with one out to produce a net gain for the team. In 1982, Billy Martin's Oakland A's were 16-for-16 in attempts to go from second to third on ground balls to the left side. (pp. 71-72)

Another common misconception was addressed by Okrent (1981), referring to a Bill James comment:

> A fan knows that a .300 hitter is a good hitter and a .275 hitter a mediocre one, but James defies anybody to tell the difference by watching both men hit. He

> points out that the actual, measurable difference between the two over the course of a season is about one hit every two weeks. (p. 48)

Sabermetrical findings have also toppled explanations for the great achievements of past players. How many times have the accomplishments of New York Yankee left-handed sluggers been rationalized by the "experts" as direct results of the short fence in right field of Yankee Stadium? Consider, then, this "evidence": Babe Ruth hit 20 more home runs on the road than at home during his career, including 32 road homers in his 1927 total of 60 (James, 1983, p. 99); and current Yankee phenomenon Don Mattingly hit 18 of his 35 homers in 1985 off lefthanded pitchers trying to keep him away from that short fence (Siwoff, Hirdt, and Hirdt, 1986, p. 198).

Atlanta Brave announcers were often trumpeting the "fact" that slugger Dale Murphy hit so much better when Bob Horner, who was frequently hurt, was in the lineup. However, James (1985) begged to differ:

> It makes absolutely no difference to Dale Murphy's bat whether Bob Horner is or is not in the lineup. His career totals (the first number is with Horner/the second number is without Horner): batting average, .269/.283; slugging percentage, .480/.494; RBIs per game, .0.59/0.63; and home runs per game, 0.20/0.19. (p. 258)

James (1983) has also found that more games are decided in the first 4 innings than they are in the last 5 (p. 77), contrary to popular opinion, and casting a questioning eye on the recent explosion among teams to develop that "stopper" relief pitcher out of the bullpen.

Thorn and Palmer (1985) shattered another myth by exploring the need to build your team around the areas that can be exploited in your home ballpark:

> The ability to take advantage of one's home park--that is, to an above-average degree--was never terribly important and is less so now than ever before. The ability to win away from home, however--again, to an above-average degree--<u>is</u> important, with less than 5 percent of all teams since 1901 being able to take a pennant despite a road record of 10 percent or less above average. . . . To win a pennant with an extreme park factor, a team must construct its talent to take maximum advantage of what its home park <u>hinders</u>, not what it helps. (p. 209)

The authors used the 1982 world champion St. Louis Cardinals as a prime example of their viewpoint, pointing out the team, built for speed to take advantage of the Busch Stadium artificial turf, actually fielded a better record on natural grass that season, winning the title because of it (p. 207).

Other sabermetrical studies of pitching location supported a theory by Weaver that more hitters can be pitched high than low, which goes against the grain of most baseball instruction (Weaver, 1984):

> I've always felt that most hitters are low-ball hitters. Scott McGregor struck out Reggie Jackson four times in a game on high fastballs. Off low pitches, the batter usually hits a ground ball or a line drive. On a high pitch the batter often pops up. (p. 71)

The "Bad Plays"

Most sabermetricians think that the primary failing of current baseball coaches is their overabundant use of "one-run" tactics, such as the stolen base, the sacrifice bunt, and their offspring. Palmer (Leo, 1983) said, "Playing for one run reduces the chances of winning the game. The only time it makes sense is in the bottom of the ninth with the score tied" (p. 72).

James (1983) concurred:

> An unfortunate side-effect (of the sacrifice bunt and the stolen base) is that they decrease the chance of scoring three or four or five runs in the inning, since the runner risks or forfeits one of the outs in the inning without doing anything to increase anybody else's chances of scoring. (p. 81)

A study done by James (1982) brought this conclusion: "Contrary to popular belief, stolen bases don't create very

many runs, nor do they have very much to do with determining who wins and who loses" (p. 30).

> Thorn and Palmer (1985) supported James statistically: The stolen base is an overrated play, with even the best base stealers contributing few extra runs or wins to their teams. The reason for this is that the break-even point is so high, roughly two steals in three attempts. A runner on first with one out is worth .478 runs; a steal of second increases this to .699; a failure leaves no one on base and two out, worth .095. (p. 158)

The mathematics there indicate that a successful steal creates 0.2 of a run for a team, but that each player caught stealing costs that team about 0.35 of a run. James (1982) further added that Maury Wills, one of the all-time base stealers, never led his league in scoring runs, and Lou Brock, the all-time leader in steals, did so only one time, earning a tie for the lead in another season (p. 34). His study also found that in the past 20 years, eight teams have led their respective leagues in stolen bases and still finished last, twice the number of last-place finishers who led their leagues in all the other major offensive categories combined (p. 34).

Thorn and Palmer (1985) also provided the numbers to show that the sacrifice bunt is a bad play:

> The potential run value is always lower after a successful sacrifice. . . . On average, a runner on first with nobody out creates for his team a run-scoring potential of .783; a runner on second base with one out--the situation that results after a successful sacrifice--is worth only .699 runs. The "successful" bunt reduces the potential offense for your team in that half-inning by some 10 percent. (p. 157)

Weaver (1984) reinforced the thought:

> Its name, the sacrifice bunt, tells you something. Sacrifice means you are giving up something. In this instance, you're giving up an out to the opposition. There are only three an inning, and they should be treasured. It's such a basic fact that fans sometimes forget it, but an inning doesn't last 15 minutes or six batters or 20 pitches; it lasts three outs. Give one away and you're making everything harder for yourself. (p. 38)

Another "bad play" for the sabermetricians is the use of the intentional base on balls. James (1984) noted, "The Rangers' won-lost record in games in which an intentional walk was given was 3-18. In view of the fact that they were tied up or ahead at the time of the walk 10 of the 23 times, that doesn't seem too good" (p. 161).

Thorn and Palmer (1985) again supplied more mathematical evidence:

> The intentional base on balls never reduces the expected number of runs scored. The classic use of the intentional walk--not to set up a force play but to work to a batter of lesser ability--reduces slightly the probability of a run scoring in that half-inning, but the reduction is more than offset by the enhanced probability of the team scoring in its next turn at bat. This is because the next inning, instead of beginning with the pitcher batting and, eight times in ten, being retired, opens with the number-one hitter, who is likely to be retired not even seven times in ten. (pp. 159-160)

Thorn and Palmer also wrote that pitching strikeouts are vastly overrated (p. 30) and that pulling the infield in to cut off a runner at the plate is usually counter-productive (Leo, 1983, p. 72).

> One other "bad play" has been noted by Weaver (1984): I don't have a hit-and-run sign, and I believe it's the worst play in baseball. First, the runner is going to second base at half-speed, looking to see if the hitter makes contact. If the hitter fails to connect, 90 percent of the time that runner is thrown out stealing second. Also, the hitter is at a disadvantage because he knows he has to swing at any pitch in order

> to protect the runner. Odds are that he'll be going after a pitch that isn't a particularly good one to hit. It puts everyone at a disadvantage, and I don't think much of it. (p. 46)

Hitting or Pitching?

One of the longest running controversies in the sport of baseball has been the argument regarding the importance of pitching and hitting. Many baseball traditionalists have placed the value of pitching as high as 90 percent, while some lean toward another often-quoted statement: Good pitching always beats good hitting, and vice versa.

Most sabermetricians prefer to give more weight to the offense in baseball, not the pitching. They begin with the simple premise that, at any given time in a game, half of the action is offensive and half of the action is defensive. Then they begin playing with their numbers.

Thorn and Palmer (1985) have researched a profile of all major league pennant winners from 1901 to 1982, studying which areas of the sport these teams tended to dominate. Among their findings: 106 teams ranked first in batting, 89 in pitching, 47 in neither, and 39 in both. Eight teams won the pennant while below the league average in ERA, and nine teams won the pennant while below the league average in batting (p. 204). Therefore, the most common trait among the pennant winners was a league-leading offensive attack.

Those authors (p. 203) also quoted a 1970 study by Arnold Soolman, who used a multivariant linear-regression analysis to develop the percentages of importance in this century, illustrated in Table 1.

Thorn and Palmer added that in recent years, with only 12 percent of all runs now being unearned, fielding thus accounts for 6 percent of the game and pitching 44 percent; if unearned runs continue to decline as a percentage of total runs, pitching will one day become as large a part of the game as batting, but "it is not as large now" (p. 178).

James (1985) provided more interesting numbers for the 1984 finish in the National League East: the team with the best ERA, Pittsburgh, finished last; the team with the second-best ERA, Montreal, finished next-to-last; and the team with the worst ERA, the Chicago Cubs, won the division (p. 183).

The last time a major league team won the pennant with its league's lowest batting was in 1906, when the Chicago White Sox won the American League flag despite hitting .230 for the season. Even then, it took a team ERA of 1.76 to do it (Siwoff, Hirdt, & Hirdt, 1986, p. 23).

James (1983) addressed one more running argument between hitting and pitching: Who has the advantage, once each is familiar with the other, the hitter or the pitcher? James felt the advantage of a pitcher over a hitter shrinks in this situation, using the Kansas City Royal designated

Table 1

Relative Percentages of Baseball Skill Importance by Era

Period	Hitting	Pitching	Fielding
1901-20	45.1%	36.1%	18.8%
1921-45	46.2%	43.3%	10.5%
1946-60	48.0%	44.8%	7.2%
1961-70	46.2%	45.9%	7.9%

hitter Hal McRae as an example. In 1982, facing pitchers who would throw against the Royals more than once during the season, McRae hit .245 against them the first time around and .396 against them the second time (p. 191).

The major treatise by James on the controversy between the weight given to pitching over hitting in baseball was delivered in his 1986 Abstract, in which he specifically questioned the statement that "pitching is 75 percent of baseball." If that were true, James reasoned, the teams which have the best pitching staffs would win the pennants 75 percent of the time; in any given game, the team which has the better starting pitcher would win 75 percent of the time; in a free market economy, pitchers would make the most money; teams would never trade a regular pitcher for a regular player; pitchers would monopolize the award voting; and almost all first-round draft choices would be pitchers. None of these things is true, he said; therefore, pitching can not be 75 percent of the game (pp. 3-4). Generally, the sabermetricians give the edge in importance to the offense.

Pitching Rotations

The trend in the major leagues over recent seasons has been the move from four-man starting rotations to five-man rotations. Most sabermetricians have no explanation for this; in fact, they generally feel that the move is fairly foolish.

In 1985, for instance, Cincinnati pitchers started 86 games with 3 days of rest, compiling a 35-29 record and a 3.45 earned run average. They started 37 games with 4 days of rest and were 11-15 with a 4.60 ERA (Siwoff, Hirdt, & Hirdt, 1986, p. 109).

James (1983) was rather blunt with his assessment of the five-man rotation:

> (1) If I have a four-man rotation and you are trying to persuade me to switch to a five-man rotation, what you are saying is that I should take 8 starts away from my best pitcher, 8 away from my second-best pitcher, 8 away from my third-best pitcher, 8 away from my fourth-best pitcher, and then give all 32 starts to my fifth-best pitcher. (2) Before I am going to do that, I want to see some real (sic) good evidence that I am going to get something back in exchange for it. (3) I have not seen any such evidence. Ergo (4) I wouldn't do it. (p. 51)

James favored tailoring the pitching staff to the ballpark, much more than tailoring the offense to the park, which is what is done by most organizations. In 1983, for instance, he advised the New York Mets to concentrate on pitchers who can produce strikeouts, "because Shea Stadium has poor visibility, which favors power pitchers" (Ziegel, 1983, p. 77).

James used the fact that the Mets have finished above .500 only seven times in their history, and on six of those occasions, their pitching staff led the league in strikeouts. The Mets promptly went out and added Dwight Gooden and Sid Fernandez to their lineup, and won the World Series in 1986.

Palmer, probably the most radical of all the sabermetricians, put less stock in the importance of a good starting rotation:

> Pete Palmer thinks some National League manager should assemble a pitching staff made up entirely of relievers, and then pinch-hit for the pitcher every time. His calculations show that this would be worth at least 50 extra runs a year, or five net wins, good enough to propel the fourth-place team in the eastern division in 1982 into first place. (Leo, 1983, p. 72)

Pitching Strategies

No subject divides the opinions of sabermetricians more than does the subject of pitching strategies. Some favor power pitchers, while others view the strikeout as an overblown statistic that is pure spectacle. Some say the ballpark makes all the difference, while others say the park has no effect on the quality pitchers.

Their findings can have a significant impact on the teaching of baseball, however, especially in the area of ball/strike counts, which will be addressed in its own

sub-heading; but Palmer has found that the first pitch is crucially important--if it is a ball, the batter is 90 percent more effective than when the first pitch is a strike (Leo, 1983, p. 72).

Siwoff, Hirdt, and Hirdt (1986), the men who compile the official statistics for the major leagues through the Elias Sports Bureau, favored the power pitchers:

> In this century, the team finishing last in the league in pitching strikeouts has allowed the fewest runs in the league only six times, but has allowed the most runs 40 times. The team leading in strikeouts finished first or second in the league in fewest runs allowed 44 percent of the time in the American League and 53 percent of the time in the National League. (p. 30)

Weaver (1984), who also tended to favor power pitchers, added insight as to when to think about removing a starting pitcher during a game:

> One way to tell if a pitcher is losing his edge is to pay attention to foul balls. When a pitcher gets in a good groove, the hitters will usually foul his deliveries straight back. There'll be plenty of foul tips. (p. 76)

Other pitching strategies are accented in the material contained in several of the other portions of this chapter.

Relief Pitching

The relief pitcher has become one of the superstar productions of major league baseball. Every manager is looking for the guy who can nail down the victory in the final 2 innings, even though James has found that the team that is leading in the eighth inning wins 97 percent of the time regardless of who is pitching (Okrent, 1981, p. 42).

Newman (1984) said that a top reliever needs three things: a single, dominant pitch, extraordinary determination, and a certain equanimity of temperament (p. 86).

The major leagues annually award a "Fireman of the Year" honor to the relief pitcher who is supposedly the most outstanding performer in his role each season. Most sabermetricians feel, however, that the best relievers are often ignored by the point system used to determine the winner.

The current system awards points for saves and wins and subtracts points for losses. Many of the wins received by relief pitchers, however, come after they have "blown" a lead, and saves can go only to pitchers who finish games. In fact, some of the best relief pitchers of recent times (through 1982) had career records hovering near or below the .500 mark: Rollie Fingers was 101-90, Bruce Sutter was 35-35, and Mike Marshall was 92-98 (Kaplan, 1982, p. 79).

The Kaplan article (1982) was an effort by Sports Illustrated to develop a fairer system for rating relief pitchers, using the sabermetrical efforts of the Elias Bureau, and pointed out many of the flaws used in rating relief pitchers: earned run average (ERA) was not useful, because it told nothing about ability to keep inherited baserunners from scoring; wins and saves were too dependent on the situation; and pitchers who worked the middle innings rarely received any credit for their efforts (p. 79).

The magazine suggested several improvements in the system, such as the addition of these categories: holds (keeping your team ahead, or keeping your team close when behind, but not qualifying for a save), first-batter effectiveness, run prevention (awarding points for men left in scoring position and subtracting points for runners who are allowed to score), percentage of appearances in which a win, save, or hold is earned, runners allowed on base per 9 innings, and innings pitched in relief (Kaplan, 1982, p. 80, 83). As is the case with most sabermetrical breakthroughs, the system is not presently being used by the major leagues for its awards.

Ball/Strike Counts

One of the biggest sabermetrical achievements for instruction purposes is the research done in the area of ball/strike counts and their effects on offensive performance in baseball. The studies range from the

first-strike hitting habits of certain teams to a 9-year charting of every World Series pitch thrown between 1974 and 1982.

James (1985) noted that the 1984 Toronto Blue Jays took the first pitch 64.9 percent of the time, and their opponents took it 68.3 percent of the time. When those swinging at the first pitch put the ball into play (not counting foul balls), Toronto hit .324 and its opponents hit .335, significantly higher than the team batting averages for the season (p. 42). Several conclusions may be drawn, but it would appear profitable to the pitchers to make the first pitch a strike.

The study further stated that for each 100 plate appearances, the first pitch resulted in: 42 called balls, 24 called strikes, 18 swinging strikes, and 16 put in play (p. 43). Again, it would seem profitable for the pitcher to get the ball over the plate for the first pitch.

Palmer (Thorn and Palmer, 1985) was the man who charted the nine World Series, finding the mathematical value of each ball-and-strike combination, identifying the implications for players, managers, and fans alike. His chart (p. 164) is illustrated in Table 2.

If the first pitch was a ball, the batter produced runs at a rate 35 percent above average, nearly double that of batters who started with an 0-1 count (p. 163). Of all

Table 2

Major League Performance by Ball/Strike Count

		Balls			
Strikes		0	1	2	3
	Samples	2,525	3,091	1,070	336
0	Batting average	.259	.267	.260	.250
	On-base average	.317	.371	.477	.750
	Samples	3,196	2,689	1,450	583
1	Batting average	.240	.243	.265	.285
	On-base average	.273	.306	.389	.600
	Samples	1,208	1,733	1,322	750
2	Batting average	.198	.195	.208	.199
	On-base average	.221	.239	.309	.479

bases on balls allowed, 78 percent occurred when the first pitch was a ball (p. 164).

Clearly, the 3-1 and 2-0 counts are the great hitting situations, which support traditional expectations (p. 164). This is a case in which sabermetrics can defend a coach.

Bases on Balls

The big contracts go to the home run hitters. Sabermetricians, however, continue to crusade for the guy with the ability to get on base, regardless of the means.

Weaver (1984) remarked:

> I wish there was a way to convince some players of the importance of walks. Take a guy like Glenn Gulliver. I played him down the stretch in 1982 because of his ability to walk. For a long time he had a batting average in the low .200s, but his on-base percentage was .430. He was helping the club, and there is a place in the majors for a guy like that. (p. 43)

The on-base percentage is a relatively new tool, one of the advances by sabermetricians that is being used by knowledgeable baseball people. The statistic has helped shed new appreciation on players who never received their deserved respect. Waggoner (1983) provided the best example in recent history:

> Once upon a time, Washington Senator third baseman Eddie Yost was renowned for his ability to draw bases on balls. One season the "Walking Man" drew 151 free

> passes in 152 games, yet sportswriters of the day treated Yost's expertise as little more than an amusing oddity, on a par with the ability to yodel and tap dance at the same time. Nowadays, Yost would be recognized as a valuable offensive player, despite his .254 career batting average and little power. Why? Because of his consistently high on-base percentage. (p. 23)

James (1983) produced startling evidence as to the importance of bases on balls (p. 92):

> Compare the 1982 totals of the teams below. Even though the teams had the same batting average, virtually the same home run and total bases count, equivalent totals of doubles and triples, and despite the fact that the Tigers stole almost twice as many bases as the Orioles, somehow Baltimore managed to score 45 more runs than Detroit. How? The Orioles drew 634 walks to just 470 for the Tigers; divide the difference by 4, and you have the difference between the two offenses.

	AB	R	H	2B	3B	HR	RBI	AVE	SB	TB
Detroit	5590	729	1489	237	40	177	684	.266	93	2337
Baltimore	5557	774	1478	259	27	179	735	.266	49	2328

Fielding Considerations

The ratio of hits to runs has diminished through the years, but the ratio of earned runs to total runs has

increased (Thorn & Palmer, 1985, p. 27). The advent of artificial turf and larger gloves has produced a dramatic drop in errors in the major leagues, but sabermetricians are not satisfied with the present measuring system for defense in baseball.

Thorn and Palmer (1985) are among those who object that the fielding average--putouts and assists, divided by putouts, assists, and errors--is not an accurate gauge. There are too many position factors to make it work. They wrote:

> An error hurts a team more than a routine putout or assist helps it, for it transforms into a hit (in effect) a batted ball which should have produced an out. The value of a hit is approximately 0.50 runs (allowing for the possibility of extra bases on errors), the value of an out approximately -0.25 runs. Because an error takes a -0.25 situation and makes it a +0.50, its cost to the defensive team is on the average 0.75 runs, or the equivalent of <u>three</u> outs. Similarly, a fielder who makes a great play, a hit-saving play, has saved his team 0.75 runs. An outfield error, because it so often produces more than one base for both batter and runners, costs about 1.1 runs. (pp. 195-196)

Attempting to correct the inaccuracies of the fielding average, James (Okrent, 1981) developed the "Range Factor":

> The traditional fielding average . . . is an excellent measure of a player's ability to get out of the way of a potential error. On the other hand, what James calls Range Factor, or the total errorless chances per game that a fielder handles, is a more accurate measure of his true ability. James noted that in 1978 Pete Rose cleanly handled 2.39 chances per game at third base, while Mike Schmidt handled 3.01 per game. Over the course of, say, 150 games, that 0.62 difference translates to 93 balls Schmidt would handle that Rose wouldn't. (p 48)

Thorn and Palmer (1985) also reported that, according to a study done by sabermetrician Dick Cramer, about 85 percent of all plays in the field are routine (p. 196). Coaches and teachers could use that information to calculate the worth of playing a better offensive or defensive player at a certain position, and estimating how much of a difference it would make.

Baserunning

Sabermetrical studies have also focused on various basepath activities, lending insight for coaches who like to "play the percentages." For instance, the chances of stealing a base on artificial turf are about 12 percent better than on grass (Thorn & Palmer, 1985, p. 167), and the American League average in 1985 in going from first to third

on a single while the baserunning team was ahead was 35.4 percent (Siwoff, Hirdt, & Hirdt, 1986, p. 217).

James (1984) carried that approach even further:

> The 1983 Texas Rangers went from first to third 99 times on 327 singles, or 30 percent of the time. They were thrown out at third base 5 times. The baserunners who made it to third scored 56.6 percent of the time. Those who stopped at second only scored 41.3 percent of the time. (p. 156)

Is the 15.3 percent increase in scoring from third worth increasing the 1.5 percent chance of being thrown out at third? That is the decision the sabermetricians leave to the coaches.

Run-scoring Percentages

The area of run-scoring percentages is one in which diversity of statistical formulas runs wild among sabermetricians. Most are extremely complicated. For example, Bennett and Flueck (1983) developed this formula for predicting the run production of a team for a season:

> The expected run production (ERP) model: ERP = (.499 x singles) + (.728 x doubles) + (1.265 x triples) + (1.449 x home runs) + (.353 x bases on balls) + (.362 x hit by pitches) + (.126 x stolen bases) + (.394 x sacrifice flies) - (.395 x times grounded into double plays) - (.085 x outs made) - 67. (p. 78)

James (1983) touted a similar, but simpler, formula geared to estimate the number of runs that a leadoff batter can be expected to score:

> You figure the number of times the guy is likely to be on first (multiplied by .35), the number of times he is likely to be on second (multiplied by .55), and then multiply his number of triples by .80 and add the number of his home runs. The result of these additions gives the number of runs that he is likely to have scored, given a normal offense coming up behind him and normal clutch performance when he is on base, plus perhaps a little variation for the player's speed. (p. 176)

There are also much simpler observations that have been made, but perhaps even more applicable to coaching and teaching baseball: the relationship between runs scored and the number of runners left on base is direct (and strong), not the other way around, a common but erroneous assumption (James, 1985, p. 65); when the Boston Red Sox leadoff man reached base in 1983, the team scored 0.93 runs per inning, with that figure dropping to 0.27 runs when the leadoff man did not reach (James, 1984, p. 129); and in 1985, National League teams scored in 48.9 percent of the innings in which the leadoff man reached base, and in only 14.6 percent of the innings in which he did not, with the American League

percentages reading 51.7 percent and 16.4 percent, respectively (Siwoff, Hirdt, & Hirdt, 1986, pp. 219, 261).

The latter authors also noted the following percentages:

> In 1985, the average American League player drove in 59 percent of runners on third base with less than two outs; drove in 20 percent of all runners from second base; drove in 44 percent of all runners from third base; and drove in 29 percent of all runners in scoring position. (p. 219)
>
> During the 1985 major league season, the bases were loaded with nobody out 433 times. In 49 occasions, nobody scored. The most common number of runs scoring was one (113 times), although the average situation produced 2.52 runs. (p. 36)
>
> The 1985 New York Yankees won 39 of 42 home games in which they scored in the first inning. (p. 218)

For all the various angles taken for run-scoring computations, the crowning sabermetrical achievement was Thorn and Palmer's (1985, p. 153) 17-year study of run-scoring potential for all 24 base/out situations that may arise, as indicated in Table 3.

With this information, coaches can more emphatically teach to pitchers the importance of preventing baserunners. They can also better gauge the strength of their own individual offenses.

Table 3

Potential Runs for 24 Base/Out Situations in Major League Baseball from 1961 to 1977

	Number of Outs		
Runners	0	1	2
None	.454	.249	.095
1st	.783	.478	.209
2nd	1.068	.699	.348
3rd	1.277	.897	.382
1st & 2nd	1.380	.888	.457
1st & 3rd	1.639	1.088	.494
2nd & 3rd	1.946	1.371	.661
Full	2.254	1.546	.798

Winning Percentages

Winning is the name of the game at the major league level, and it would be naive to assume that it was not the dominating factor at the collegiate level as well. Therefore, the study of factors that influence the specific outcomes of games is most beneficial.

Sabermetricians have studied all kinds of information in their attempts to determine the key ingredients to winning ballgames. The one that, surprisingly, seems to top the list is scoring the first run of the game. Evidence was most obvious in the findings by Siwoff, Hirdt, and Hirdt (1986, p. 12), illustrated in Table 4. The worst team in the league scoring the first run has a better record than the best team in the league that allows the first run.

Other factors can also be studied. The average winning percentage of all home teams for major league baseball in this century, for instance, is .543, while on the road the average is .457 (Thorn & Palmer, 1985, p. 207).

Breaking down records against opponents can be helpful. In 1985, the St. Louis Cardinals were 34-8 (an .810 percentage) against the three teams with the worst records in the National League, and played .558 ball against the other teams. The Mets, meanwhile, were "only" 28-14 (.667) against the three worst teams (Siwoff, Hirdt, & Hirdt, 1986, p. 151).

Table 4

Importance of Scoring First in the American League in 1985

Scoring First Run of Game				Allowing First Run of Game			
	W	L	Pct		W	L	Pct
Toronto	61	19	.763	Toronto	38	43	.469
Chicago	59	21	.738	Baltimore	38	49	.437
Kansas City	65	24	.730	New York	23	32	.418
California	54	20	.730	California	36	52	.409
Seattle	56	22	.718	Detroit	25	44	.362
Minnesota	53	21	.716	Kansas City	26	47	.356
Boston	60	24	.714	Oakland	33	64	.340
New York	74	32	.698	Milwaukee	29	57	.337
Oakland	44	21	.677	Chicago	26	56	.317
Detroit	59	33	.641	Minnesota	24	64	.273
Baltimore	45	29	.608	Boston	21	57	.269
Milwaukee	42	33	.560	Texas	21	62	.253
Texas	41	37	.526	Cleveland	20	60	.250
Cleveland	40	42	.488	Seattle	18	66	.214

James (Kindel, 1983) has carried winning percentages to the individual player, compiling a formula to assign to each player what he called an "offensive winning percentage":

> James calculates a player's offensive capabilities by the number of runs he has created per 25.5 outs, converted into runs created per game. That figure is adjusted for variances in a player's home park against a league norm, and is then rendered into a won/lost percentage. From this he calculates a "responsibility" for games, based on the number of outs a player has made and, applying the won/lost percentage, arrives at a won/lost number for each player. This is combined--if you're still with us--with a defensive ranking that takes into account errors, double plays, total chances, and other arcana, and finally arrives at a number that ought to reflect a player's contribution to his particular team over time. (pp. 186-187)

Regardless of the complexities involved in that particular computation, knowledge of the major influences on winning percentages is a vast aid in the teaching and coaching of baseball.

Hit Charts

Almost every modern version of a baseball scorebook includes a method of indicating where each ball was hit. Most coaches, however, do not study the charting at the end

of the game, if at all. Much can be learned from the study of these charts, especially in aligning the defense.

James (1983) charted 47 games of the Kansas City Royals in 1982 to see where most of the hits went. In those games, there were 888 hits. In order of their location, the biggest holes in the defense were: (1) straight up the middle, between the shortstop and the second baseman, at ground level--108 hits; (2) all infield hits, grouped together--91; (3) in front of the left fielder--90; (4) in front of the center fielder--76; (5) in the hole between short and third--66; (6) in front of the right fielder--63; (7) into the gap in right field--55; (8) between the left fielder and the left-field line--50; (9) on the ground between the first and second basemen--47; (10) between the right fielder and the right- field line--41; (11) into the gap in left field--40; and (12) between the third baseman and the third-base line--30. The totals did not include home runs over the fences: 48 to left, 30 to right, and 26 between left-center and right-center (p. 118).

Comparing Lefthanders and Righthanders

One of the true advances in baseball, because of the findings of sabermetricians, has been increased use of the platoon system, batting righthanders against lefthanders and vice versa. Most players enjoy huge statistical advantages in these types of matchups.

For instance, Thorn and Palmer (1985) stated that a study of major league batters between 1974 and 1977 showed that the batting average of a righthander was 7.5 percent higher against lefthanded pitching, while a lefthanded batter hit 11.5 percent higher against righthanded pitching (p. 165). Overall, most of the leading hitters in baseball are lefthanded, with their edge due to: (1) the fact that two-thirds of the pitchers in baseball are righthanded; (2) they are closer to first base when leaving the batter's box, the better to beat out an infield hit; and (3) 70 percent of lefthanded batters come from the "hitting positions"--outfield and first base (pp. 165-166).

James (1983) noted that over the 10-year period between 1972 and 1982, the championship teams in major league baseball had 44 percent more games started by lefthanded pitchers than did the last-place teams (p. 63). Okrent (1981) confirmed that lefthanded pitchers throw more double-play balls than do righthanders (p. 42).

Percentage breakdowns are also useful to determine the power likelihood and potential success of switch-hitters from the various sides of the plate.

Artificial Turf Considerations

Most of the studies done regarding the effects of artificial turf on performance have been surprising, yielding unexpected results to the sabermetricians doing the investigations. For instance, in 1984, the two teams in the

major leagues with the best winning percentages on artificial turf were the Detroit Tigers and the Atlanta Braves, two teams whose home fields are grass (James, 1985, p. 147).

Siwoff, Hirdt, and Hirdt (1986) found that the 1985 National League champion St. Louis Cardinals played better on grass fields, winning 27 of 42 games (a .643 percentage) compared to a record of 65-55 (.542) on artificial turf (p. 151). The authors commented that the finding was not unusual:

> In 1985, National League teams that play their home games on a rug stole 46 percent more bases than their grass-field counterparts and hit 15 percent fewer homers. If it were true that the grass game and the plastic game were becoming two separate sports, we would expect teams to have a large home-field advantage over teams from opposite surfaces, and a much-reduced advantage over those with like fields. A survey of National League games over the past 10 seasons indicates that this is nowhere near the case: road teams actually play a little better in parks with surfaces that differ from their own, winning 46.3 percent of the time as opposed to 45.1 percent on like surfaces. (p. 115)

While the artificial turf differences are not a major

college consideration yet, more and more baseball fields are being designed with the plastic grass in mind.

Ballpark Factors

The differences in the ballparks used in the major leagues is staggering, and researching these differences consumes much of the time that Bill James applies to his books. In addition to many other findings, sabermetricians were the first to statistically support the differences in batting averages between Fenway Park in Boston and Busch Stadium in St. Louis; the high home run totals in the Kingdome in Seattle, compared to the low ones in the Astrodome in Houston; and the inflated earned run averages in Atlanta-Fulton County Stadium, compared to the microscopic ones at Dodger Stadium in Los Angeles.

Where games are played makes a huge difference, the sabermetricians say. James (1983) broke down the numbers for every single major league park, finding that Shea Stadium in New York increases fielding errors more than any other park except Candlestick Park in San Francisco (p. 43), and that Atlanta-Fulton County Stadium increases batting averages 25 to 35 points, increases home runs by 60 percent, and decreases triples by 30 percent (p. 49). The source of most of his speculation, however, was in Chicago:

> Wrigley Field lifts batting averages 20-30 points on the average, increases doubles by 10-15 percent and homers by about 40 percent, and increases infield

> errors 7-8 percent. Lack of night games is a very important factor in the high offensive totals there. You can trace the growth of night baseball directly in the decline of batting averages from the late 1930s to the early 1960s. Besides the better visibility in the daytime, it is also warmer in the day, and players hit better in warm temperatures. And it is possible that there is some difference in how well the ball travels at night. If Wrigley did get lights, it is probable that the number of runs scored there would decline sharply. (p. 39)

Altitude Effects

James (1988) published a study by retired army officer Dick O'Brien regarding the effects of altitude on the flight of a baseball, begun in part because of the discrepancy in the number of home runs hit in Atlanta's Fulton County Stadium and Busch Stadium in St. Louis. The two parks have virtually the same dimensions, but many more homers are hit in Atlanta. O'Brien discovered one baseball league in this country in which virtually all conditions were equal, such as temperature, players, and dimensions: the Texas League. Each park was basically 330 feet down the lines and 395 to dead center. The major difference in the stadia was altitude: the park in Beaumont was only 20 feet above sea level, three other parks were less than 300 feet above sea level, two parks were about 800 feet above sea level, the

Midland park was 2,780 feet above sea level, and the El Paso park had an elevation of 3,700 feet. O'Brien studied the number of home runs hit by the teams that played in each of those parks over a number of years and found an almost perfect relationship: the higher the altitude of the park, the more home runs the team which played there would hit. The study becomes even more convincing when one considers the turnover rate among personnel that is common in the minor leagues from year to year. (p. 215)

Special Situations

Leo (1983) wrote, "A sabermetrician can be counted on to look into any baseball question, no matter how marginal" (p. 71). Some of their strange probings, however, uncover the most interesting information, and more and more journalists are using it. For example, according to data collected by James (1983), Steve Garvey had the worst strikeout-to-walk ratio among regular players in the major leagues (p. 158). Why would pitchers even throw him a strike? James (1983) also found:

> In 1982, Reggie Jackson played 27 games in front of crowds larger than 40,000. He hit 11 homers and drove in 22 runs, batting .368 with 35 hits in 95 tries. When crowds were below 40,000 in that same year, he hit just .255 for the season. (p. 187)

Wulf (1981) discovered a West German scientist who applied the Stokes equation for the drag of a sphere and

developed a formula to explain the magic behind a spitball (p. 96), but Siwoff, Hirdt, and Hirdt (1986) found things to be just as strange in the American ballparks. For instance, Cleveland's Pat Tabler, entering the 1986 season, had a career batting average with the bases loaded of .611, with 22 hits in 36 tries, and two grand slams (p. 35), while in 1979, a player named Nelson Norman was 0-for-17 with the bases loaded in that season alone (p. 185). Dave Collins has a career batting average of .384 against knuckleball experts Phil Niekro, Charlie Hough, and Joe Niekro (p. 182). Steve Henderson has a career batting average of .393 against Joe Niekro, but hits just .140 against Phil Niekro (p. 192). Atlanta's Glenn Hubbard has a career batting average of .094 against pitchers named Smith: 0-for-17 against Bryn, 3-for-19 against Dave, 2-for-16 against Lee, and 0-for-1 against Mike (p. 238). Finally, Wade Boggs, considered one of the finest hitters in baseball, has a career batting average of .373 against righthanders and .300 against lefthanders, but is 0-for-14 in his career against Seattle's Matt Young (p. 178).

An award for the strangest statistic of all, however, would have to go to Weir (1986) for his USA Today newspaper account of Philadelphia's Mike Schmidt:

> There appear to be heavy lunar influences on the hitting of Mike Schmidt, and not just because some of his home runs seem headed for outer space. When

> playing under a full moon, no one in baseball has hit better than the Phillies' third baseman this season. Tuesday (August 19), playing his fifth full-moon game of the year, Schmidt was 2-for-4 with a homer, bringing his season totals for those games to 11-for-19 with 4 homers, 7 runs scored, and 12 runs batted in. Toronto's temperamental George Bell, sometimes accused of being a Jekyll-Hyde type, also has had reason to howl on those nights, with a 7-for-15 mark and 3 homers. But not superstitious Wade Boggs, the man who eats chicken every day because he once had a great game after dining on poultry. He may be hitting .350 for the season, but is just 1-for-11 when playing in the brightest of moonbeams. (p. 3C)

Most of the information discovered in statistics such as these is helpful in plotting the likelihood of success in individual matchups with particular players.

Lineup Percentages

James has pioneered work in the area of lineup percentages, computing the record for every team over the last several years for every different starting lineup combination. The information has sometimes been surprising and sometimes not.

For instance, writing in his 1984 Abstract he noted that over the last three seasons, the Detroit Tigers were 170-168 (for a .503 winning percentage) with all-star

catcher Lance Parrish starting behind the plate, and a stunning 65-30 (.684) without him (p. 193). Yet in the following world championship season for the Tigers, Detroit was 83-41 (.669) with Parrish behind the plate and only 21-17 (.553) without him (James, 1985, p. 230). Siwoff, Hirdt, and Hirdt now annually print the lineup percentages for each team in the major leagues in their Elias series, providing the information on all starting players.

Ground Ball/Fly Ball Ratios

Another new area of sabermetric research is in the ratios, per batter and pitcher, between hitting or throwing ground balls as opposed to fly balls. This information can offer interesting insights as to the worth of certain players in certain ballparks, as well as indicating why certain hitters have higher batting averages than others.

Siwoff, Hirdt, and Hirdt (1986) provided examples of the latter situation: Rod Carew hit 1.9 ground balls for every fly ball throughout his career (p. 181), and Wade Boggs went until the final week of the 1985 season before hitting a fair-ball pop fly to an infielder for an out (p. 178). Ground-ball hitters, then, appear to be more likely to achieve high batting averages.

James (1983) uncovered data to further question the intelligence of a 1982 trade in which the Atlanta Braves gave up three young players in exchange for an aging starting pitcher:

> In 1982, Atlanta's Rick Camp had the best double-play support in baseball, getting 1.57 per start. Cleveland's Len Barker had the worst (.58 per start), indicating that he allows more fly balls than normal, which would be dangerous in Atlanta's park. So why did the Braves trade three good prospects to get him? (p. 203)

Barker, of course, bombed in his brief appearance in a Brave uniform, while the three young prospects became starters for the Indians.

Day/Night Performance

Sabermetrical studies have also focused on the differences between day and night games and how individual players perform in each type of contest. One of the more interesting findings, and a perfect example of how sabermetrical study can help to solve problems, was detailed by Siwoff, Hirdt, and Hirdt (1986):

> Over the past four seasons, Wayne Gross of the Orioles has had the following comparisons in his batting averages between day games and night games: .301/.225, .298/.192, .306/.175, and .297/.209. Despite having more than twice as many at-bats in night games, he has hit 26 of his 54 home runs in daylight. (p. 189)

Gross eventually was sent for an extensive physical examination, and he was found to have a vitamin-A deficiency, causing night blindness. With the addition of

glasses and an altered diet, Gross returned to a better balance in the numbers.

The "Birthday Effect"

James (1983) compiled statistics for the 89 regular players (excluding pitchers) in the major leagues who celebrated birthdays during the 1982 season, and found that they hit .337 with 96 hits, 12 home runs, and 48 runs batted in on those days, with a .565 slugging percentage. Two players had 4 hits each, six had 3 hits, and even Doug Flynn (whom James annually called "the worst player in the major leagues") had a game-winning single. Andre Dawson and Andre Thornton each drove in 4 runs (p. 157), so it appears the ideal move for a manager is to find nine players named Andre who were born on the same day and play for a championship on that day.

The Hit Batsmen Study

James (1985) has even done an extensive investigation of players who were hit by pitches, the pitchers that threw them, and the injuries that resulted, and noted these findings:

> On hit batsmen: (1) A player who was hurt by a pitched ball once is an excellent candidate to be hurt again; (2) A pitcher who has thrown a pitch which was responsible for one injury is a good candidate to throw a pitch which is responsible for another; (3) The most common injuries resulting from hit batsmen are those

> in which the player is hit on the wrist or hand, and the most serious are those in which he is hit on the head; (4) Broken bones and other injuries resulting from hit batsmen occur every year, but not in huge numbers; (5) An injury resulting from a hit batsman seems to have a major impact on a pennant race one year in two. (p. 134)

It would perhaps be interesting for a future study to examine the statistics compiled by players who have been seriously injured by pitched balls, to see if their abilities deteriorated after being hit.

Total Average

One of the more popular new statistics among sabermetricians is "Total Average" (TA), developed by sportswriter Thomas Boswell (1985). The statistic measures the total number of bases that a player produces offensively and then divides that figure by the number of total outs that a player produces. For a graphic representation, Boswell offers this example:

> Take Tim Raines as an example. The Expo outfielder had 137 singles, 38 doubles, 9 triples, 8 home runs, 87 walks, 2 hit-by-pitches, and 75 stolen bases. That's 436 bases. Subtract 10 bases for the 10 times he was caught stealing, leaving 426 bases. Raines also came to bat 622 times and got 192 hits, which meant that the other 430 times he made an out. Add to this

> the 10 times he got thrown out stealing, plus an extra out for each of the 7 times he grounded into a double play. That makes 447 outs. Now divide the bases by the outs and you get Total Average--.953 for Raines, the best in the National League in 1984. (p. 27)

Boswell maintains that his statistic is the best possible measure of a player's offensive ability, and it certainly does its best to differentiate between players who are both considered to be "pretty good" at their positions.

Consider this comparison by Boswell (1985):

> The gap between Eddie Murray and Steve Garvey (the best TA in the American League vs. the worst TA among first basemen in the National League), like the difference between many well-known players, is vastly greater than we normally assume. In 1984 Murray amassed 416 bases for his team to 254 for Garvey, while Garvey actually made 50 more outs than Murray. In fact, Murray had 21 more homers than Garvey, reached base an amazing 89 times more, had 69 more total bases, stole 9 more bases, and grounded into 16 fewer double plays. All this while Garvey actually had 29 more at-bats. Murray's Total Average was .993, and Garvey's was .542, which would be mediocre for a shortstop and is almost unthinkable at a power position such as first base. (p. 28)

Boswell's figures help managers to realize things for which they may not have been searching, such as Garvey's lack of patience at the plate (he almost never accepted a base on balls, swinging instead at many poor pitches). A good manager could use this information both as hitting and pitching instruction.

The Dominance Ratio

Sabermetricians have also developed a method to deal with the age-old arguments of who was the better player, a current superstar or a Hall-of-Famer from the war years. The statistic, called the "Dominance Ratio," is explained by Hirdt (1984):

> The Dominance Ratio is a statistical measure of the superiority of one player over his peers. Assuming that an average performance in any given season represents an equivalent achievement to an average performance in any other season, relative superiority can be measured across eras, independent of concerns such as longer schedules, increased emphasis on relief pitching, etc. It measures how much better than average the superior player is, and thus allows us to compare levels of dominance. (p. 34)

Charting Umpires

Never content with assuming that all action on the field is in the direct control of the players and managers, one sabermetrician has even done an extensive study on the

tendencies of the umpires, the officials of the major leagues. An Associated Press newspaper article (1985) described the study:

> David Driscoll charted every pitch thrown in 1985 Toronto Blue Jay games to produce a unique set of statistics on American League umpires. The stats cover nearly 44,000 pitches. Pitchers are getting early strikes and staying ahead of the hitters, Driscoll concludes. Low batting averages fit with other studies that show major leaguers bat only about .200 when behind in the count and above .300 when ahead. Driscoll's study provides a breakdown of all 32 American League umpires, giving an overall indication of whether they favor the hitters or the pitchers. At least five of them definitely favor the pitchers, and four definitely stand out as favoring the hitters. (p. 11)

A good manager could use this information in adjusting his particular pitching rotation for a certain series, if he knew who would be calling the balls and strikes on any given day.

Opinions

The better-known sabermetricians have become so because they possess a sense of humor that helps them rise above the glut of statistical work that would otherwise label them as a collection of dull eggheads. Probably the best of the lot

is the originator, none other than Bill James. James is often quoted in newspaper and magazine articles because he is extremely opinionated, especially when he knows he has the sabermetrical data to back his comments. Ziegel (1983, p. 76), providing an example of a James gem, wrote, "If you listen to Sparky Anderson talk on the subject, it is obvious that he knows as much about where a hitter is likely to hit the ball as he knows about the ovulation cycle of an orangutan."

James generally saves his best stuff for his own books. From the 1984 Abstract, he said, "Al Cowens of Seattle had a worse year than a biker in a Clint Eastwood movie" (p. 224), and, "If there were no professional baseball, what would Billy Martin probably be doing? Fifteen to life!" (p. 110).

One reason James is quick with his sense of humor is that, even with all his sabermetrical formulas, occasionally his predictions end up well off-base. For instance, in his 1982 Abstract, James rated John Denny 82nd among major league pitchers, stating Denny's manager "must have seen something in him I never saw." That same year, Denny went on to win the National League Cy Young Award (p. 210).

Applications in Other Sports

The principles of sabermetrics have been applied to research done in other sports. Still, the possibilities for their extensive use have barely been explored.

In an analysis of high school wrestling statistics, Maertz (Arnold, 1983, p. 47) found that wrestlers who scored the first takedown in a match won the match 76 percent of the time. When the score was tied at the end of the first period, the wrestler who started the second period in the top position won significantly more matches (60 percent) than the wrestler who started in the bottom position. A study of 18-year records of three-period wrestling matches found that just the opposite trend took place in the third period: the wrestler on the bottom scored more points than the top wrestler in a significant number of matches (p. 47).

Data related to corner kicks were obtained for 31 soccer games in another study quoted in the Arnold article. In 23 of the 31 cases the team which was awarded the greater number of corner kicks won the game, despite the lack of popularity of this measure among coaches (p. 48). Time of ball control was found not to be related to winning. The application of these methods to other sports should yield results that are equally as interesting.

Purpose of the Study

This project describes and explains the more common devices used in sabermetrical assessment, providing practical examples in the direct application of the principles cited. Thorn and Palmer (1985) stated:

> The complex texture of the game, which for many is its real delight--the thing that pleases the mind as well

> as the eye--cannot be fully grasped while the game is in progress. And that's what statistical analysis allows us to do. Statistics are not the instruments of vivisection, taking the life out of a thing in order to examine it; rather, statistics are themselves the vital part of baseball, the only tangible and imperishable remains of games played yesterday or a hundred years ago. Baseball may be loved without statistics, but it cannot be understood without them. (pp. 3,4)

This project will serve to provide fresh ground for a new understanding of strategies that will enhance the chances for success among the coaches, managers, and teachers who choose to implement them. Some material will enhance a portion of the traditional approaches to baseball strategy, while some will serve to disprove and revolutionize much of what has been taught as "fundamental" to the game.

Justification for the Study

Many baseball coaches and teachers have been instructing the sport in virtually the same way for years and years. Very few innovations in methods have been widely adopted. The sport is accepted as being extremely traditional, and some "purists" will argue that the application of sabermetrical principles is just another attempt to computerize a facet of American life that should

not be altered. Therefore, many coaches may never reflect an interest in what can be obtained through this study.

As the game of baseball evolves, and modern technology along with it, it should be evident that certain conditions necessitate a re-evaluation of strategies and player assessment. The athletes are generally bigger, stronger, and faster than before. Television has given youngsters more nationwide exposure to the game. The emergence of artificial turf, larger gloves, aerodynamic designs of bats, and other considerations require that the coach and teacher of today maintain an updated knowledge of these changes. Sadly, however, many in leadership roles have not changed their traditional views on the subject. As Thorn and Palmer (1985) have said:

> Dead ball era strategies continue to be employed 60 years beyond the point at which they outlived their usefulness. Front office decisions are made on the basis of player-performance measures which tell next to nothing of a man's value to his team. (p. 6)

Limitations of the Study

Data collected for this project were obtained from the scoresheets of Union University baseball games played in the three seasons from 1983 to 1985; from major league baseball statistical box scores from 1983 and 1985; and from books and periodicals which center on the study of sabermetrical principles. Therefore, specific findings by the author

apply only to the collegiate level, but the application of the principles have been shown to work at virtually any level on which baseball is played, especially with regard to the teaching of the fundamentals of the game, backed by percentages derived from the use of sabermetrics. Statistics from the major leagues have provided almost all previous sabermetrical studies, but the principles should be equally successful for a high school or Little League instructor and coach.

Expectancies

The writer expected to find the following:

1. Applying sabermetrical techniques to traditional statistical categories would yield several significant discoveries that would enable a coach or teacher to make sounder judgments regarding strategies and personnel.

2. Coaches who use sabermetrical techniques would begin to question many of the "traditional" moves utilized in baseball, perhaps finding they have been using the wrong numbers in "playing the percentages."

3. Using a designated hitter in place of a pitcher in the batting order would not reduce the amount of game strategy facing a coach, as many National League "purists" claim.

4. Offense would be found to be every bit as important as pitching, if not more so, in achieving success in baseball.

Definitions of Terms

Sabermetrics--a term coined by "founder" James to mean "the mathematical and statistical analysis of baseball records" (Thorn and Palmer, 1985, p. 38). Sabermetrics is designed to introduce new evidence, previously unknown data derived from original source material. James, who has a degree in English and economics, with graduate credits in psychology (Okrent, 1981, p.45), took the word from the acronym of The Society for American Baseball Research, "a group of avowed figure filberts which now claims more than 3200 sabermetricians who spend countless hours analyzing the game from odd angles" (Leerhsen, 1983, p.55). Sabermetrics involves the use of a scoresheet for each game to be studied, and also involves considerable time spent tracking and computing the necessary figures. James (1983) uses as his guiding principle, "I make it a point never to believe anything just because it is widely known to be so" (p. 3).

Runs Created--a formula devised by James which accurately projects the number of runs produced by a particular player or team.

Total Average--devised by Thomas Boswell, a measure of a player's ability to get on base or advance other players who are already on base. Boswell contends that this measure provides coaches with a more accurate appraisal of a player's worth than the "sacred" batting averages, the traditional offensive measuring stick of baseball.

Slugging Percentage--the number of total bases accumulated by a player, divided by his official number of times at bat. Players who hit for power generally have the highest slugging percentages on a team.

Earned Run Average (ERA)--the number of earned runs (runs not due to some kind of fielding error) a pitcher allows, multiplied by 9 (for the number of innings in a complete game), and divided by the total number of innings pitched by the player. The final figure represents the number of earned runs a pitcher would allow in an average game for that pitcher.

It is assumed in this project that the reader is familiar with common baseball terminology. Attempts are not made to explain a "home run," a "triple," and a "single," nor to differentiate between a "sacrifice bunt" and a "sacrifice fly."

Chapter 2

Method

The author has done extensive study with both major league statistics and those acquired from the 1983-1985 scoresheets of Union University Bulldog collegiate baseball games. Some of the research was intended to either support or refute traditional baseball ideas and techniques, while some was intended to simply uncover any unusual or recurring aspects of the sport that were not previously deemed as common knowledge. In virtually all cases, data were discovered that should greatly benefit any baseball coach or instructor who was sincerely interested in improving his ability to manage or teach the sport of baseball.

Subjects

For data relating to the collegiate level, the author used the game-by-game scoresheets of Union University (Jackson, Tennessee) baseball contests played in the years of 1983 through 1985. Union, a private school of about 1,500 students, is a member of the National Association of Intercollegiate Athletics (NAIA). The 1983 Bulldog team, featuring All-American and future professional minor leaguer Ronnie Giddens, finished third in the NAIA World Series, the annual national tournament for the year's top eight teams.

Union compiled a 48-11 record that season and won the NAIA District 24 championship.

The 1984 Bulldogs, despite returning several starters from the World Series squad, won 28 of 39 games but finished well down in the standings of the Volunteer State Athletic Conference, now the Tennessee Collegiate Athletic Conference (TCAC). Comparing the sabermetrical measures of the two teams, it was hoped, would yield some of the reasons the 1983 team enjoyed more success. Research should show certain team trends that contribute mightily to increased chances for victory, as well as indicate certain individual players' strengths and weaknesses.

The 1985 Union team compiled a 39-11 overall record and again won the NAIA District 24 championship, advancing to the Area 5 Tournament in Arkansas before being eliminated. Heading that team were two All-Americans, pitcher Tommy Locke and outfielder Rod Hari.

Another investigation was done by the author using major league box scores from The Sporting News and the final published list of 1983 major league batting averages, Total Averages, and Bill James' "Runs Created" rankings. A further study involved the 1985 major league batting averages and on-base percentages. These additional major league studies were done by the author to help validate the importance that the "new statistics" display in the managing of a baseball team.

Procedure

In the vast majority of sabermetrical studies, research centers on finding simple percentages. Researchers are generally trying to discover what happens most of the time in certain situations. Therefore, most of the findings in the studies presented here are expressed simply in terms of percentages.

In the one particular area of study in which percentages were not applicable, the author performed a Spearman rank correlation between the batting averages and the on-base percentages of the 1985 American League teams, in an attempt to show that there are, indeed, vast differences between the two. The study originated as an investigation of the importance of the traditional batting average as "the" major measure of a player's offensive ability.

Data Analyses

For sabermetrical measures relating to collegiate baseball, the author went through the 1983-1985 Union scorebooks, detailing the performance of each individual batter inning by inning. Each time at bat was analyzed with regard to any or all of the following questions: Was he leading off? How many outs were there? How many teammates were on base? What was the count and how did it progress? Where was the ball hit? Was the pitcher righthanded or lefthanded? Was the game played at home or away? What was

the score at the time of the at-bat? How was the batter being defended?

All of these at-bats were also analyzed to benefit the inspection of pitcher performances and defensive efforts. Data collected reflect the traditional totals of certain baseball categories necessary for sabermetrical computations. In addition to analyzing box scores and pitching patterns, all batted balls were charted to improve fielding considerations and positioning. Figures from all computations were plugged into certain previously-developed formulas for measuring playing effectiveness. Most of the computations were done, necessarily, by hand, but the application of the figures to sabermetrical principles were done with the use of a desk computer.

The data will be used to examine certain areas of performance involved in the evaluation of players and team personnel. Studying the data will yield insights to coaches and teachers about the tendencies of certain players and/or teams, enabling the coach or teacher to quickly make necessary decisions that will further enhance the opportunity to succeed.

Chapter 3

Results

Many of the discoveries that take place in using sabermetrics come from the simple process of counting. Before applying sabermetrical principles to the collegiate baseball level, the writer first studied two questions that have often been the topic of much baseball debate.

Preliminary Studies

The author's first study employing sabermetrics was designed to attempt to answer a specific baseball question, and it required counting several categories from major league box scores for the 8 opening weeks of the 1983 season. The question arose from an argument that has raged in the sport from the inception of the designated hitter: Does the use of the designated hitter remove much of the strategy from managing in the American League, assuming that the talent of hitting and pitching in the National League is not significantly different?

The Designated Hitter

Sabermetrical techniques offered at least fuel for the fire on this discussion. The author counted the offensive accomplishments, for 8 weeks, of all American League designated hitters, National League pitchers, pinch-hitters

from both leagues, National League eighth-place hitters, and American League ninth-place hitters in the 1985 season. Merely comparing the accomplishments of the designated hitters with the pitchers would obviously yield an expected result--more offense is produced by the designated hitters. That would not really answer the question.

By studying the other subjects, however, one can compare the American League ninth-place hitters with National League pitchers (they bat in the same place in the order in their respective leagues); one can compare the effect the designated hitter has on the quality of pinch-hitting in baseball (the American League is, theoretically, using its best pinch-hitter per team in the regular lineup, which could weaken reserve strength later in the game); and one can study the offensive achievements of the National League eighth-place hitters, who would be batting ninth if the league used a designated hitter.

The offensive contributions of each group mentioned are delineated in Table 5. The figures were compiled from game box scores as reported in The Sporting News.

By comparing the American League ninth-place hitters to the National League pitchers, one gets the true picture of the impact of the designated hitter in baseball. It is fairly evident, through the total of 66 stolen bases by the American League ninth-place batters, that managers are using the slot as a kind of second "leadoff" position,

Table 5

Offensive Contribution Comparisons for Major League Batters in 1985

Batters	G	AB	R	H	2B	3B	HR	RBI	AVE	SB	SH
AL DHs	610	2192	286	559	115	12	63	301	.255	15	6
NL Pitchers	506	1169	67	165	29	2	0	61	.141	1	110
AL 9th-Place	610	1966	228	499	86	13	24	196	.254	66	40
NL 8th-Place	506	1642	177	399	58	12	21	146	.243	21	18
AL Pinch	305	513	62	137	20	4	12	87	.267	4	2
NL Pinch	253	677	57	142	20	3	7	83	.210	3	5

Percentages:

AL DHs went hitless: 229 of 610 games--37.5%

NL Pitchers went hitless: 365 of 506 games--72.1%

AL 9th went hitless: 244 of 610 games--40.0%

NL 8th went hitless: 208 of 506 games--41.1%

AL DHs drove in runs: 203 of 610 games--33.3%

NL Pitchers drove in runs: 54 of 506 games--10.7%

AL 9th drove in runs: 143 of 610 games--23.4%

NL 8th drove in runs: 109 of 506 games--21.5%

AL used a pinch-hitter: 230 of 305 games--75.4%

NL used a pinch-hitter: 248 of 253 games--98.0%

incorporating speed and bat control as desirable qualities of the players used there. The use of a DH has also significantly reduced the utilization of the sacrifice bunt in the American League, a fact that would please any sabermetrician. National League pitchers were credited with 110 sacrifice bunts, compared to just 40 for the American League ninth-place hitters.

The figures also seem to indicate that there is just as much strategy still involved in the American League game. While it is true that American League managers do not have to make certain pitching changes as much as their National League counterparts, it is just as true, according to these figures, that they are making more decisions regarding stolen bases and advancing runners. American League managers are also still using pinch-hitters in over 75 percent of the games.

It is in the performance of the pinch-hitters where another benefit of the designated hitter seems to surface. American League pinch-hitters out-hit the other league .267 to .210, with more power and runs batted in despite fewer times at bat.

Does the National League simply have better pitching, or could it be that using a designated hitter actually improves the reserve strength of a team, rather than decreasing it? The writer feels that the latter is more likely to be true, especially when the designated hitter

responsibility is shared by a group of players, because all of them, getting occasional starts in the position, stay fresher for pinch-hitting duty than if they merely batted once or twice a week, as they would without a designated hitter.

This was the first in a series of studies that personally convinced the researcher of the benefit of sabermetrics in improving coaching and teaching ability. The next step was to address a specific statistic favored by sabermetricians but refuted somewhat by managers and put it to the test.

The On-base Percentage

Batting average (the number of hits a player makes, divided by his number of official times at bat) has been the most-used measure of offensive achievement since baseball began. Sabermetricians say that the amount of importance attached to it is overrated, however, favoring instead the implementation of the on-base percentage (hits, walks, and times hit by pitches, divided by the total number of times at the plate). A player who has a good "eye" and draws a number of walks receives no credit for it in the batting average and is therefore de-valued somewhat.

"Purists" tend to argue that there would be little difference between a player's batting average and his on-base percentage. The question deserved a study.

The researcher, through the opening quarter of the 1985 American League season, ranked every batter with at least 50 official plate appearances, according to his batting average. All 14 teams had their players ranked, with each team's highest batting average being ranked first and then in like manner down the line. The author then did the same by each player's on-base percentage, again ranking the players from high to low. Each team then was submitted to a Spearman rank correlation, to indicate if there is, indeed, much difference between batting averages and on-base percentages in rating players.

Table 6 contains the specific rankings and correlations of each American League team in the study (BA=batting average; OB=on-base percentage; rho=the correlation). In the entire rankings, only four teams have correlations of .80 or better, and they are the four teams who had the worst won/lost records in the American League at that time!

The on-base percentage is a valuable statistic because it helps to point out those players who do not always hit for a high average but seem to get on base more often than some players who do. The above tables show that two players named Evans, Darrell of Detroit and Dwight of Boston, fit this mold. The latter Evans, despite ranking last among the Red Sox regulars that season in batting average, was getting on base more often than all but Wade Boggs, who was the eventual batting champion.

Table 6

American League Correlations between Batting Average and On-Base Percentage in 1985

BALTIMORE	BA	OB	CHICAGO	BA	OB
Sheets	1	6	Hulett	1	1
Dwyer	2	3	Walker	2	5
Ripken	3	7	Baines	3	3
Lynn	4	5	Fisk	4	4
Connally	5	1	Guillen	5	10
Murray	6	8	Fletcher	6	6
Dempsey	7	4	Law	7	8
Lacy	8	12	Gamble	8	2
Young	9	9	Boston	9	9
Roenicke	10	10	Paciorek	10	11
Gross	11	2	Cruz	11	7
Dauer	12	11	rho=.60		
rho=.41					

(table continues)

KANSAS CITY	BA	OB	DETROIT	BA	OB	TORONTO	BA	OB
Brett	1	1	Whitaker	1	1	Iorg	1	3
Wilson	2	4	Parrish	2	6	Mulliniks	2	2
Orta	3	2	Brookens	3	7	Burroughs	3	1
Balboni	4	6	Gibson	4	3	Garcia	4	7
Sundberg	5	7	Lemon	5	2	Whitt	5	6
Sheridan	6	5	Trammell	6	5	Barfield	6	5
White	7	8	Simmons	7	8	Bell	7	8
Motley	8	9	Evans	8	4	Matuszek	8	9
McRae	9	3	Pittaro	9	9	Moseby	9	4
Concepcion rho=.68	10	10	Herndon rho=.62	10	10	Fernandez rho=.72	10	10
SEATTLE	AB	OB	OAKLAND	BA	OB	NEW YORK	AB	OB
Bradley	1	1	Bochte	1	1	Mattingly	1	5
Henderson	2	5	Davis	2	2	Henderson	2	1
Calderon	3	3	Griffin	3	6	Randolph	3	3
Davis	4	2	Baker	4	3	Berra	4	10
Cowens	5	7	Kingman	5	4	Griffey	5	8
Presley	6	6	Hill	6	9	Meacham	6	2
Thomas	7	4	Lansford	7	7	Baylor	7	4
Scott	8	9	Collins	8	10	Wynegar	8	7
Perconte	9	10	Heath	9	8	Winfield	9	9
Owen rho=.81	10	8	Murphy rho=.70	10	5	Pagliarulo rho=.37	10	6

(table continues)

CLEVELAND	BA	OB	CALIFORNIA	BA	OB	MINNESOTA	BA	OB
Hall	1	1	Jones	1	1	Salas	1	5
Franco	2	2	Beniquez	2	8	Brunansky	2	1
Tabler	3	3	Jackson	3	5	Gagne	3	3
Bernazard	4	3	Carew	4	2	Hatcher	4	10
Jacoby	5	4	Grich	5	4	Puckett	5	6
Butler	6	6	Pettis	6	6	Smalley	6	2
Vukovich	7	7	Downing	7	3	Gaetti	7	4
Carter	8	8	Boone	8	9	Bush	8	8
Benton	9	9	Brown	9	10	Teufel	9	7
Thornton rho=.96	10	10	DeCinces rho=.56	10	7	Hrbek rho=.49	10	9
MILWAUKEE	**BA**	**OB**	**BOSTON**	**BA**	**OB**	**TEXAS**	**BA**	**OB**
Cooper	1	3	Buckner	1	3	Harrah	1	1
Molitor	2	1	Boggs	2	1	Bell	2	2
Simmons	3	2	Gedman	3	4	Ward	3	4
Moore	4	5	Rice	4	5	Johnson	4	3
Yount	5	4	Barrett	5	6	Wilkerson	5	5
Schroeder	6	7	Armas	6	9	Parrish	6	6
Oglivie	7	8	Gutierrez	7	7	Slaught	7	7
Romero	8	6	Easler	8	8	O'Brien rho=.98	8	8
Gantner rho=.88	9	9	Evans rho=.45	9	2			

The statistic is also beneficial for managers in determining which players possess adequate batting averages but rarely get on base without a hit. Larry Sheets and Cal Ripken of Baltimore, Dale Berra, then of New York, and Juan Beniquez, then of California, are examples in the tables of players who apparently refuse to let a pitcher walk them. This statistical proof of the value of the on-base percentage, a new statistic developed by the work of sabermetricians, has a direct application in the findings produced by the study of Union University baseball games.

Comparison of Data

The 1984 Bulldog team had a third baseman named Lynn Yarbrough who opened the season hitting in the leadoff position. After 20 games, Union owned a 16-4 record, but Yarbrough was batting .196 and there was talk of sending him to the bench.

This was the first season, however, that sabermetrical categories were being tallied along with the more traditional statistics. Among the things that stood out with Yarbrough, despite his .196 batting average, which would have been enough for many coaches to justify sitting him down, was the fact that he batted 40 times before he struck out (which indicated that he was making significant contact) and he was getting on base over 49 percent of the time.

Yarbrough, noticeably depressed with his batting average, was called in for a conference and was assured that the coaches were satisfied with his leadoff effort. They told him that, since it was obvious he was making consistent contact, his batting average would soon begin to climb if he avoided pressuring himself. With his confidence renewed, Yarbrough batted .456 over the remainder of the season, boosting his on-base percentage to an amazing .540, and earned Union's Most Valuable Player Award for the season at the athletic banquet.

A player like Yarbrough, who "batted" .351 for the season, was actually on base over half the times he was at the plate, including 44 walks in 40 games. That was almost as good a mark as recorded by the team's leading hitter, shortstop Rusty Shuler. Shuler had a batting average of .431, an impressive mark, but his on-base percentage was .574, meaning he reached base safely only 3 percent of the time more than Yarbrough.

Sabermetrical techniques can assist a coach or teacher in a number of ways in dealing with the psychology of their athletes. In 1984, Union had an All-District catcher named Barry Bishop, who went on to become the school's all-time home run leader.

In Union's 40-game season, Bishop caught 30 games and was the designated hitter in the other 10. When he was not the catcher, he used to constantly gripe that his hitting

suffered. He often complained that, on the days when he was the designated hitter, he simply didn't hit as well.

Union's coaches, using the sabermetrical process of breaking down batting averages according to defensive positions, went to the statistics after a series of these complaints and demonstrated to Bishop that he actually was batting .469 in his designated hitter games compared to just .393 in his catching games. With his psychological barrier then removed, Bishop went on to bat .409 and hit safely over the last 16 games of the season, leading the squad in runs batted in.

Figuring out batting averages according to a player's fielding position is a relatively easy sabermetrical step, but it made the difference in curing Bishop's dissatisfaction. Another Union player, Jeff Wyatt, hit .350 as a third baseman, .333 as a designated hitter, and .192 as an outfielder. This could be due to the fact that playing third base takes a bit more concentration than playing the outfield or being the DH, and in Wyatt's case, concentration was always an area the coaches needed to watch.

Pitchers can especially benefit from sabermetrical analysis. A case in point was Union's outstanding lefthander Ted Siler, who possessed tremendous talent but did not always match his physical skills with an ability to concentrate. The 1983 World Series team featured a solid pitching staff, and Siler was a key member of the starting

rotation. He also pitched for Union in the 1984 and 1985 seasons, and his progression indicated the help that sabermetrical techniques can produce.

Siler's 3-year breakdowns are illustrated in Table 7. The numbers properly indicate that Siler experienced so much control trouble (54 walks) in his first season that he started taking speed off his pitches to concentrate on throwing strikes. Consequently, he yielded quite a few more hits (over 1 an inning), and his earned run average was less than impressive.

What these basic numbers do not indicate without deeper study is that Siler had particular problems finishing an inning, giving up half of the runs scored against him with 2 outs. This disturbing trend followed him into the 1984 season, in which he gave up 5 of the 8 home runs he allowed with 2 outs, and when opposing batters hit 40 percentage points higher against him when there were 2 outs.

With 2 seasons of statistics under their belts as ample ammunition, Union coaches convinced Siler by his senior year (1985) that the only thing holding him back from being one of the premier pitchers in the nation was a lack of consistent concentration. As a result of this information, Siler taught himself to concentrate, and the basic 1985 numbers display the results: a return to power pitching (100 strikeouts), a sizeable reduction in walks, and a microscopic earned run average of 1.98, helping him to a 9-3

Table 7

Collegiate Pitching Statistics of Ted Siler at Union University

YEAR	G	IP	H	R	ER	K	BB	W	L	ERA
1983	15	83	87	47	39	66	54	7	0	4.23
1984	10	67	49	32	16	65	23	4	4	2.15
1985	14	86	58	44	19	100	32	9	3	1.98

record. Deeper study indicates that Siler allowed only 16 2-out hits in 14 games (none of them home runs) and actually had a lower ERA in 2-out situations (1.96) than overall. Studying this trend with Siler also enabled the coaches to convince the other Union pitchers that concentration is a key. Freshman hurler David Hughes learned so well that he limited opposing batters to a .128 batting average with 2 outs, a major reason why only 4 of 28 batters he walked managed to cross home plate.

In tracing the differences between the 1983 World Series Union team and the less successful 1984 unit, one of the more illustrative statistics surfaced in an unlikely place. Union outfielder Rod Hari, who would become a first-team NAIA All-American in the 1985 season, constructed the Bulldogs' longest hitting streak of the 1984 campaign. Hari hit safely in 17 games, going 26-for-53 (.491) during the stretch, yet drove in only 7 runs during the hot streak. That seemed to be typical of the team's play: when one player was hot, the rest of the squad was not.

Union's basic problem in the 1984 season was a noticeable drop in performance in pressure situations. The 1983 squad, keyed by Giddens and superb hitter Jeff Dobbins, consistently delivered the clutch hit when needed. The 1984 team did not, as evidenced by the fact that 10 of the 14 "regular" players had significant drops in their batting averages in the second half of the season, with four players

showing declines of over 200 points. Union batters struck out only 58 times in their first 20 games and accumulated 113 walks; in the final 20 games, they struck out 93 times and walked just 98 times.

Further comparison with the 1983 team gives the 1984 squad an edge in batting average (.342 to .336) and power (52 homers in 40 games to 51 in 59), but a deficit in both speed and on-base percentage. The 1984 pitchers had a collective earned run average of 2.98, while the 1983 staff allowed 4.19 earned runs a game, yet had the clutch hitting to overcome it.

The "magic" of the 1983 Bulldogs centered around Giddens and Dobbins. Giddens batted 71 times and Dobbins 110 times before either struck out, an incredible feat. Both batted over .400, drove in over a run a game, and possessed outstanding on-base percentages (.506 for Giddens, .480 for Dobbins). In fact, all nine regulars for that unit had on-base percentages over .400, which certainly serve as a catalyst for the scoring of many runs.

The amazing response to pressure situations was even more evident in post-season play. Giddens hit .437 and drove in 25 runs in 17 games, including a grand slam to defeat Trevecca Nazarene College with 2 outs in the bottom of the final inning to stave off elimination in the NAIA District 24 Tournament.

Dobbins batted .382; Bishop hit .349 and slammed 7 homers during a 6-game stretch; Tony Kirk added 6 homers and batted .403, cutting his strikeouts from nearly 1 a game to less than 1 for each 3 games; and senior Terry Gossett batted .410 and was on base nearly 60 percent of the time.

Union played the 1983 World Series at Lubbock, Texas, where the wind was blowing out toward the fences throughout the week at near-gale force. The Bulldogs won their opener 13-12 when Rusty Shuler, who had not hit a homer all season, blasted one to break a tie after being removed for a pinch-hitter in his previous at-bat and then re-entering the game. In the bottom of the ninth, Union's foe loaded the bases, but pitcher Doug Kendall, in his first relief appearance of the season, induced a game-ending double play. It was that kind of season.

The Bulldogs also won a 21-17 slugfest with Liberty Baptist of Virginia, again surviving a bases-loaded jam in the ninth inning when second baseman Giddens leaped high into the air to snare a line drive headed for the right-field gap, ending the game. Giddens collected 5 hits and 6 runs batted in before his game-saving catch.

One of the more interesting and revealing studies for any team to undertake is to compare its statistics in the games won by that team to the statistics compiled in the games lost by that team, as illustrated in Table 8. In 1984, Union hit .392 when it won and .238 when it lost,

Table 8

Comparison between Statistics of Games Won and Lost by Union University in 1984

In Games Union Won:

	G	AB	R	H	2B	3B	HR	RBI	AVE	K	BB	SB
Union	28	789	307	309	57	8	45	265	.392	91	154	44-55
Opponents	28	645	73	113	10	4	17	61	.175	192	114	13-21

In Games Union Lost or Tied:

	G	AB	R	H	2B	3B	HR	RBI	AVE	K	BB	SB
Union	12	378	58	90	17	2	7	47	.238	60	57	4-13
Opponents	12	383	82	101	13	1	14	66	.264	83	62	11-12

while its opponents hit .175 when Union won and .264 when Union lost.

Upon studying these figures, a somewhat strong case could be made that Union may have loaded its schedule with "powderpuff" opponents in the games won by the Bulldogs, because the performance of those opponents borders on, and actually surpasses, statistical incompetence. Union scored 42 runs in those games which had no RBI credit, meaning its foes literally handed the Bulldogs 1.5 runs each game. Those same foes also batted only .175, struck out over twice as much as Union did, and were outscored about 11-3 on the average. A quick review of the schedule shows Union victories of 10-0, 14-2, 16-2, 12-2, 11-1, 21-2 twice, and 15-0, all against teams that could be honestly considered less-than-quality. When the conference season began, the Bulldogs lost 9 of 14 games and defeated only one legitimate championship contender.

The same story seemed to apply for the 1985 season as well. The per-game averages for Union wins and losses are contained in Table 9, illustrating quite a difference in the level of performance.

Despite the fact that Union sent virtually the same number of batters to the plate, the Bulldogs more than doubled their run production in the games they won and struck out much less. On the defensive side, Union made

Table 9

Comparison of Per-Game Averages between Wins and Losses by Union University in 1985

	AB	R	H	HR	K	BB	ERRORS	BA
Losses	30.54	5.00	8.27	0.45	5.91	4.91	4.45	.271
Wins	30.88	10.88	11.20	1.25	3.30	5.35	2.08	.363

more than twice as many errors in the games it lost, one of the more obvious reasons for the team's troubles.

The defensive lapses were worsened by the fact that Union pitchers walked an average of 8.18 batters in the defeats, as opposed to only 3.30 opponents in each Union victory. Bulldog hurlers yielded 10 hits a game in the losses and only 5.4 hits a game in the victories. Again, the poor quality of pre-conference scheduling appeared to be a factor, with Union winning games by scores of 11-0, 12-3, 14-4 (three times), 13-3, 16-0, 18-5, 12-0, and 11-1 (twice).

Still, Union recovered from a league loss of 26-12 against Trevecca Nazarene to bounce back and defeat the Trojans 8-1 in the District 24 Tournament, propelling the Bulldogs to the Area 5 event before being eliminated for the season.

In both seasons cited, the importance of scoring the first run in a game was also extremely evident. In 1984, when Union scored first, the Bulldogs won 25 and lost three, an .893 percentage. When the opponent scored first, Union won just 3 of 11 contests, a .273 success rate. The team scoring first in the 1984 season was 33-6 overall, an .846 winning percentage.

In 1985, Union was 25-4 (.862) when scoring first and only 14-7 (.667) when the opponent tallied first, giving the team with the initial run a 32-18 edge (.640).

Other sabermetrical observations are apparent in Appendix B containing the final statistics from the 1985 season, which provide an example of how a coach can learn from studying certain new categories that are not kept currently by most team statisticians.

Chapter 4

Discussion

This study was designed to discover the effects that would result by applying sabermetrical principles to the collection of collegiate baseball statistics. The researcher collected data from baseball games played by Union University from 1983 to 1985 and utilized sabermetrical techniques to find certain trends, discrepancies with "traditional" expectations, patterns, and other information that could improve the teaching and coaching of the sport. The project began in March of 1983 and was completed in May of 1986. It incorporated a study by the author regarding the impact of the designated hitter on strategy alteration in major league baseball, using data from 1985, and another study utilizing a Spearman rank correlation to illustrate the importance of the on-base percentage, again using major league statistics from 1985.

Findings

With the advent of aluminum bats on the collegiate level, and with the percentages illustrating the futility of the bunt play demonstrated earlier in this project, it would appear that much use of the bunt in today's game is virtually foolish. With the aluminum bats, baseballs hit by

the batters shoot through the infield much quicker than before, increasing the possibilities of base hits. For this same reason, it is less reasonable to bring a defensive infield alignment closer to home plate with a baserunner on third base in today's game, and yet, on any given day, one can still watch coaches bunting and bringing in their infield players as if nothing has changed.

Sabermetrical data have shown that many of the long-standing, traditional moves made by coaches simply are not the best strategies to use in today's brand of baseball. The advent of the designated hitter has revamped the offensive attack: the bunt, stolen base, and "playing for one run" approach have all become outdated. Statistics used to rate players before, such as batting average, are not as useful as on-base percentage, total average, and the like.

The use of sabermetrical data can have a tremendous positive effect on the psychological aspects of the game, including player confidence and morale. Having reserve players keep the statistics can even improve the bench strength of a ballclub and maintain high morale in the dugout, solving one of the biggest problems that most coaches face.

Sabermetrical data have shown the importance of scoring first in a game; of throwing strikes and getting ahead of the batters as quickly as possible; of tailoring lineups to

certain ballparks; of learning the "true" percentages, not just "perceived" ones.

The data can help a coach learn about individual tendencies with each player. Is he a good clutch hitter? Would he be a good leadoff hitter? Does he hit well with 2 strikes on him, or with 2 outs in the inning? Can he hit lefthanded pitching as well as he hits righthanded pitching? Does his fielding position affect his offensive performance?

For pitchers, sabermetrical data also can aid in coaching and teaching. Does a pitcher concentrate as well with no one on base as he does with men on base? Does he fare well with 2 outs in an inning, or does he tend to ease his aggressiveness? Does he get ahead of the batters? Does he give up more fly balls than ground balls (helping a coach decide in which size of a ballpark he would be most effective)? Sabermetrical findings provide these answers, and more.

Conclusions

Each singular game of baseball contains the opportunities to make literally hundreds of decisions as a coach. Many of those decisions are subject to strategies developed long before the game started: who will be playing where, the pitching rotation, what kind of batting order, should speed or power be favored in a particular ballpark, and the like.

The use of sabermetrical data in making decisions regarding both strategy and personnel can be extremely beneficial to the coach smart enough to employ it. The game of baseball is constantly changing, and the coach who refuses to change with it may find himself on the losing end of the score far too many times.

A coach who fails to utilize sabermetrical measures to better his ballclub may never achieve his full potential as an educator and motivator. Continuing to "play by the percentages," even when those "percentages" have been proven to be wrong, will eventually cost even the most sincere coach somewhere down the road.

These measures have been demonstrated to work at the level of major league baseball. The use of sabermetrical data has been shown to improve coaching and teaching at Union University as well. When the figures are there, it is so much easier to get a message across to a player who may otherwise have reasons not to listen to his coaching staff. Obstacles such as personal bias, work habits, and other problems come crashing downward when a coach can specifically point to the numbers and say, "It's all here in black and white, friend!"

Even then, the good coach will still trust certain instincts and go with his hunches on occasion, but he will be doing so knowing he is better prepared to trust his hunch than he would have been without the sabermetrical data.

Technology and the statisticians will never, and should never, take the outcome of ballgames away from the players on the field. However, the coach who refuses to learn from his findings and continues to ignore the progress made in sabermetrical techniques is a coach who is probably a self-made man who should not have hired such cheap labor.

Recommendations

Coaches interested in applying sabermetrical techniques to their programs can do so in a variety of ways. Some computer companies have already begun to issue software that automatically computes some of the more recent sabermetrical discoveries and theories, such as Total Average and Runs Created.

A coach without the budget to manage that kind of software could still apply the techniques simply by devising a few creative charts for use by his players and/or statisticians. Some of the areas to be charted should include:

Each Pitch Thrown (Location, Ball/Strike, Type)

Location of Each Batted Ball Put into Play

Ball/Strike Counts and Their Results

Baserunners/Out Situations (Scoring Percentages)

Leadoff Batting Efficiency Per Inning

Two-Out Batting Efficiency Per Inning

Switch-Hitting Efficiency from Each Side

Righthander/Lefthander Comparisons

All these areas could be charted during each ballgame. In addition, teams should compute seasonal totals in all these areas as well as continuing to figure cumulative totals in the generic baseball categories: times at bat, runs, hits, extra-base hits, runs batted in, strikeouts, bases on balls, times hit by pitches, stolen bases, fielding percentages, and the like. These could then be broken down later into home/road performances, day/night efficiency, late-inning pressure situations, and the like.

Coaches should put more weight in the on-base percentage than in the batting average. With pitchers, coaches can probably learn more from computing the average number of batters faced in an inning than they can from earned run averages or other cumulative totals.

Certain sabermetrical measures lend themselves to instructional purposes better than others. Coaches can use some to teach their players various things, while other data should be strictly for the personal use of the coach. If a player questions a coaching move in a private conference, then a coach has the option of revealing his information. If he chooses the private setting, players have less chance of being publicly humiliated if the pertinent information is in the form of a negative statistic than if all the statistics were published for all the players to see. There

is some statistical information that is probably best kept confidential by the coach.

Much sabermetrical information is ideal for classroom use in the collegiate coaching course. Percentages on scoring situations, the statistical edge of a batter ahead in the count as opposed to a batter behind in the count, and so on, provide the coach and teacher with a myriad of improved educational numbers. He should take advantage of these; it should bring more respect from the players and others in the classroom.

All pitchers know that it is important to throw strikes. With sabermetrical information, a coach can demonstrate how important it is to throw strikes. All batters know it is easier to hit with a 3-1 count than with an 0-2 count. With this data, a coach can demonstrate the meaning of the differences.

Utilizing Reserves or Handicapped Persons

Compiling sabermetrical data for a baseball team, if done by one person, takes a great deal of time. Many coaches, even if interested in the revelations this data might produce, do not have the time to compute it.

One of the main problems coaches also have, however, is the task of keeping their reserve players interested in each game, especially when their prospects of playing in that game are limited. The obvious solution is to assign these

reserve players certain areas of sabermetrical duties for each contest.

One reserve could be assigned to track pitches (type of pitch, ball or strike, location, etc.); another could chart where each batted ball is hit; another could keep up with ball/strike counts and their results; another could figure the relationship between baserunners and scoring situations for the day, and so on.

If this were done, a coach not only has up-to-date data to aid in his decision-making, he has all his players "into the game" emotionally, which will make them more ready if he decides to use them as substitutes. A player whose mind has been sharply attuned to the game should fare better as a pinch-hitter than would another player who has not been paying much attention to the proceedings.

Once each game is completed, all the sabermetrical data could be gathered from each player and turned over to the team statistician for immediate entry into the seasonal findings. This would be the most efficient way for the data to be kept current without taxing the time and effort of any one person too much.

A coach could also utilize handicapped persons to keep data. Almost every school has a wheelchair-bound person who is very interested in sports and wants to be part of a team, but never had a chance because of his infirmity. This

person could be an ideal candidate for keeping sabermetrical data for the team.

Using reserves and/or handicapped persons for this task should aid team morale considerably, because it gives each person involved a sense of contribution to the total team effort. A person computing sabermetrical data may discover a pattern or trend that leads directly to a victory, either immediately or down the road, and this will greatly enhance morale. Every member of the team will feel useful each and every game, and every member of the team will also know that his coach is doing all he can to gather the most useful information available all the time. The players will respect him for being more prepared and for making them a part of the preparation.

Applications to Other Sports

While baseball is the sport most known for its devotion to statistics, coaches in other sports could benefit just as greatly by utilizing sabermetrical techniques. Basketball coaches could use sabermetrics to evaluate their offensive and defensive efficiencies. Against which type of defense do we score most easily? Which lineup produces the most points per minute as a unit? Which defensive alignment is most effective against each opponent? How many points are we scoring on each possession, compared to our opponents? How has the 3-point shot affected rebounding tendencies? All of these questions could be answered, while giving the

coach new insight, simply by figuring the sabermetrical data.

In football, a coach can figure which plays have been most successful in certain situations; what the opponent is most likely to try in each situation; which combination of players in the backfield is the most successful, relative to yards gained per play; and so on.

Tennis coaches can show the importance of working on serves by charting the percentage of points won on first serves compared to points won on second serves. A player's efficiency at the net could be illustrated by tracking the percentage of points won on volleys. There is room in all sports for some type of sabermetrical data to improve the insight and techniques of coaches, if these persons just take the time to be creative in their quests.

By using reserve players and/or statisticians, all information could be gathered game-by-game in a relatively short amount of time. Coaches should take strides to learn the inside workings of the game that may be passing right under their noses. Then and only then will they be fully prepared.

It is the purpose of this project to demonstrate the necessity and relative ease with which baseball can be better coached and taught on the collegiate level. The argument for the use of sabermetrics seems to have considerable merit. It is recommended that coaches attempt

to upgrade their approaches to the modern game of baseball by employing these measures before their opponents do.

The game of baseball is changing. It is time for the coaches of the sport to change with it.

Appendixes

Appendix A

Examples of Sabermetrical Player Sketches from the 1984 Season

LYNN YARBROUGH

G	AB	R	H	2B	3B	HR	RBI	AVE	K	BB	SH	SF	HP	PO	A	E	PCT
40	114	42	40	4	0	11	37	.351	10	44	6	1	3	50	64	13	.898

Total bases: 77 Slugging percentage: .675 On-Base pct: .540
Leading off games (1st inning): batted .379 (11 for 29), with 6 BB, 2 HP, 3 HR, and on-base pct. of .514; last half of season: hit .529 (9 for 17), with 1 BB, 3 HR, and on-base pct. of .556.
With men in scoring position: hit .350 (14 for 40), with 13 BB, 1 HP, 2 SH, 1 SF, 3 2B, 5 HR (2 grand slams), 31 RBI; had 12 hits in his last 23 AB for a .522 average.
Had 40 plate appearances before striking out (in 11th game).
Between games 20-26: was 10 for 19 with 5 HR, 14 RBI.
Closed season with 12-game hitting streak (.488, 20 for 41).
1st half of season: hit .196 2nd half: hit .456
On-base pct. was .493 in 1st half despite low batting average.
Hit into 2 double plays; stole 4 bases in 5 tries.

RUSTY SHULER

G	AB	R	H	2B	3B	HR	RBI	AVE	K	BB	SH	SF	HP	PO	A	E	PCT
38	102	31	44	9	2	3	24	.431	12	34	5	0	0	39	77	10	.921

Total bases: 66 Slugging percentage: .647 On-base pct: .574
Leading off innings: hit .250 (5 for 20), 7 BB, 3 2B.
With men in scoring position: hit .586 (17 for 29), 9 BB, 2 SH, 3 2B, 1 3B, 1 HR, 19 RBI.
Fielding percentage was .943 until making 3 errors in final game; handled first 35 chances without an error at short.
Finished season with 5-game hitting streak (11 for 19, .579); longest streak was 7 games (12 for 16, .750, with an on-base pct. of .852 in games 4-11); walked 11 times in those 7 games.
1st half of season: hit .462 2nd half: hit .413
Hit into 2 double plays; stole 1 base in 3 tries.

BARRY BISHOP

G	AB	R	H	2B	3B	HR	RBI	AVE	K	BB	SH	SF	HP	PO	A	E	PCT
40	149	18	61	14	1	10	58	.409	7	10	0	0	0	202	15	14	.939

Total bases: 107 Slugging percentage: .718 On-base pct: .447
Leading off innings: hit .333 (11 for 33), 1 HR, 3 2B, 2 BB.
With men in scoring position: hit .482 (27 for 56), 3 BB, 8 2B, 1 3B, 2 HR, 44 RBI.
Finished season with 16-game hitting streak (26 for 63, .413).
As a DH: hit .469 (10 games, 15 for 32, 2 HR, 15 RBI).
As a catcher: hit .393 (30 games, 46 for 117, 8 HR, 43 RBI).
Drove in runs in his first 8 games; hit safely in his first 9 games.
1st half of season: hit .370 2nd half: hit .447
Hit into 5 double plays; stole a base on his only attempt.

TED SILER

G	IP	BF	H	R	ER	K	BB	GS	CG	SV	BK	WP	HP	2B	3B	HR	W	L	ERA
10	67	286	49	32	16	65	23	9	7	1	0	1	1	6	0	8	4	4	2.15

ERA as starter: 2.18 (9 G) ERA as reliever: 0.00 (1 G)
ERA in 1st half of season: 0.62 2nd half: 3.32
Leadoff men vs. Siler: hit .231 (15 for 65), 1 2B, 2 HR, 2 BB, 11 R, 7 reached on E, 17 K.
Opponents with 2 outs: hit .226 (19 for 84), 2 2B, 5 HR, 6 BB, 9 R.
Faced average of 4.27 batters per inning (.48 R and .73 H per inning).
Walked 3.09 batters per 9 innings (23 BB--only 5 scored).
Opened season with no-hitter, fanning every man in lineup at least once (13 K); allowed only 1 fly ball, and caught all grounders himself.
Opponent batting average: .187 (49 for 262).

TIM NICHOLS

G	IP	BF	H	R	ER	K	BB	GS	CG	SV	BK	WP	HP	2B	3B	HR	W	L	ERA
9	48.2	225	37	32	18	61	34	9	5	0	0	4	3	5	1	7	5	2	3.33

ERA as starter: 3.33 (9 G) Never pitched in relief
ERA in 1st half of season: 2.00 2nd half: 4.98
Leadoff men vs. Nichols: hit .286 (12 for 42), 2 2B, 3 HR, 7 BB, 1 HP, 11 R, 14 K.
Opponents with 2 outs: hit .190 (11 for 58), 3 2B, 1 3B, 2 HR, 11 BB, 15 R, 7 reached on E.
Faced average of 4.62 batters per inning (.66 R and .76 H per inning).
Walked 6.29 batters per 9 innings (34 BB--9 scored); forced in 5 runs with bases-loaded walks.
Yielded 15 of his 32 runs with 2 outs in the inning.
Gave up almost as many walks as hits for the season.
Last 5 starts: 27.2 IP, 24 H, 27 R (16 ER), 29 K, 27 BB, 7 HR, 5.21 ERA.
Opponent batting average: .198 (37 for 188).

STEVE WILDER

G	IP	BF	H	R	ER	K	BB	GS	CG	SV	BK	WP	HP	2B	3B	HR	W	L	ERA
11	44.1	204	32	23	11	37	32	4	2	1	0	3	2	2	0	4	5	1	2.23

ERA as starter: 1.74 (4 G) ERA as reliever: 2.66 (7 G)
ERA in 1st half of season: 3.57 2nd half: 0.83
Leadoff men vs. Wilder: hit .270 (10 for 37), 6 BB, 1 reached on E, 6 R, 6 K.
Opponents with 2 outs: hit .203 (13 for 64), 2 2B, 1 HR, 11 BB, 1 HP, 7 reached on E, 12 R.
Faced average of 4.60 betters per inning (.52 R and .72 H per inning).
Walked 6.50 batters per 9 innings (32 BB--8 scored).
Struck out 10 in pitching his only shutout.
In 7 relief appearances: K'd the first batter 4 times, walked 1, and retired the first batter 6 of the 7 times.
Opponent batting average: .188 (32 for 170).

Appendix B

Example of a Sabermetrical Season Summary

1985 UNION UNIVERSITY BASEBALL STATISTICS (final--all games)
Record: 39-11 VSAC: 10-3 NAIA District 24: 22-4

BATTING	G	AB	R	H	2B	3B	HR	RBI	AVE	K	BB
Rod Hari	51	195	68	84	6	2	9	60	.431	12	22
Barry Bishop	51	180	26	75	18	6	12	82	.417	25	24
Tony Fry	47	155	44	61	19	5	11	68	.394	17	11
Fred Williams	37	93	33	33	9	3	1	20	.355	16	8
Mark Tutor	41	104	40	35	7	0	3	28	.337	19	24
Neil Thagard	47	131	26	44	8	0	4	29	.336	15	24
Pete Williams	49	164	64	52	9	1	4	34	.317	14	35
Kris Weir	50	137	64	42	11	1	0	31	.307	22	54
Jeff Wyatt	38	127	22	38	7	4	0	22	.299	9	7
Grant Ward	36	45	25	12	2	1	3	10	.267	13	6
Brady Webb	46	113	38	28	5	0	3	19	.248	18	29
Scott Treadway	28	69	15	17	7	0	1	10	.246	9	12
Bart Teague	30	53	18	13	1	0	1	11	.245	5	7
(less than 10 official at-bats)											
Tom Weiler	16	9	2	5	2	0	2	8	.556	1	2
Steve Carnal	2	0	1	0	0	0	0	0	---	0	0
Randy Hunt	1	0	0	0	0	0	0	0	---	0	0
Ted Siler	1	0	0	0	0	0	0	0	---	0	0
Frank Glover	3	1	1	0	0	0	0	0	.000	0	0
Steve Wilder	2	2	1	0	0	0	0	0	.000	1	0
David Hughes	2	2	0	0	0	0	0	0	.000	0	0
Tommy Locke	0	0	0	0	0	0	0	0	---	0	0
Tim Nichols	0	0	0	0	0	0	0	0	---	0	0
John McCullough	0	0	0	0	0	0	0	0	---	0	0
UNION TOTALS	51	1571	490	539	111	24	55	432	.343	196	268
Opponents	51	1448	261	326	49	3	21	203	.225	433	222

			SLG				-----FIELDING-----			
PLAYER	AB	TB	PCT	HP	SH	SF	PO	A	E	PCT
Rod Hari	195	121	.621	0	1	1	65	1	2	.971
Barry Bishop	180	141	.783	1	0	5	312	28	7	.980
Tony Fry	156	123	.789	1	0	3	36	0	12	.750
Fred Williams	93	51	.548	4	1	1	5	1	0	1.000
Mark Tutor	104	51	.490	1	4	2	48	60	26	.806
Neil Thagard	131	64	.489	0	1	2	119	42	12	.931
Pete Williams	164	75	.457	0	4	2	70	9	5	.941
Kris Weir	137	56	.409	4	10	0	264	14	10	.965
Jeff Wyatt	127	53	.417	0	2	4	25	55	15	.842
Grant Ward	45	25	.556	1	0	0	7	0	2	.778
Brady Webb	113	44	.389	5	3	1	42	56	16	.860
Scott Treadway	69	27	.391	0	2	1	51	2	1	.982
Bart Teague	53	17	.321	0	3	0	25	29	11	.831
(less than 10 official at-bats)										
Tom Weiler	9	13	1.444	0	0	0	36	2	2	.950
Steve Carnal	0	0	---	0	0	0	0	0	0	---
Randy Hunt	0	0	---	0	0	0	2	7	0	1.000
Ted Siler	0	0	---	0	0	0	4	18	0	1.000
Frank Glover	1	0	.000	0	0	0	1	3	2	.667
Steve Wilder	2	0	.000	0	0	0	2	16	1	.947
David Hughes	2	0	.000	0	0	0	1	15	3	.842
Tommy Locke	0	0	---	0	0	0	4	18	1	.957
Tim Nichols	0	0	---	0	0	0	1	10	1	.917
John McCullough	0	0	---	0	0	0	1	0	2	.333
UNION TOTALS	1571	856	.545	18	32	23	1119	392	132	.920
Opponents	1448	456	.315	8	16	12	1074	481	119	.929

1985 UNION UNIVERSITY PITCHING STATISTICS

PLAYER	G	IP	H	R	ER	K	BB	HP	W	L	ERA
Ted Siler	14	86.1	58	44	19	100	32	1	9	3	1.98
Steve Wilder	16	45.2	43	27	11	37	31	1	4	0	2.17
Tommy Locke	15	80.2	76	45	28	89	32	3	8	3	3.12
David Hughes	13	64.2	46	48	24	64	42	2	6	4	3.34
Randy Hunt	12	29.1	30	22	15	43	16	0	3	0	4.60
Tim Nichols	17	50.2	53	49	31	86	41	1	7	1	5.51
(less than 10 innings pitched)											
Kris Weir	1	0.2	0	0	0	0	0	0	0	0	0.00
Frank Glover	7	8.2	12	13	3	8	11	0	1	0	3.12
Steve Carnal	6	4.1	3	8	7	3	10	0	1	0	14.54
John McCullough	4	2.0	7	10	8	3	7	0	0	0	36.00
UNION TOTALS	51	374.0	326	261	146	433	222	8	39	11	3.51
Opponents	51	357.2	539	490	399	196	268	18	11	39	10.04

SAVES--Wilder 4, Hughes 1, Locke 1, TOTAL--6. Opponents--3.
GAMES STARTED--Locke 12, Hughes 12, Siler 11, Wilder 2, Nichols 10, Hunt 3, Glover 1, TOTAL--51. Opponents--51.
COMPLETE GAMES--Hughes 4, Nichols 2, Locke 6, Siler 8, Hunt 2, TOTAL--22. Opponents--18.
WILD PITCHES--Nichols 5, Wilder 3, Carnal 1, Locke 4, Hughes 5, Hunt 5, Glover 4, TOTAL--27. Opponents--33.
HOME RUNS ALLOWED--Wilder 1, Hughes 3, Siler 5, Nichols 4, Hunt 1, Locke 4, Carnal 2, Glover 1, TOTAL--21. Opponents--55.
TOTAL BATTERS FACED--Siler 356, Hunt 138, Carnal 26, Wilder 206, Nichols 257, Hughes 297, Locke 353, McCullough 19, Glover 54, Weir 2, TOTAL--1,708. Opponents--1,926.

PLAYER	Batters Faced Per Inning	Strikeouts Per 9 Inn.	Walks Per 9 Innings
Ted Siler	4.12	10.42	3.34
Tommy Locke	4.38	9.93	3.57
Steve Wiler	4.51	7.29	6.11
David Hughes	4.59	8.91	5.85
Randy Hunt	4.70	13.19	4.91
Tim Nichols	5.07	15.28	7.28
Kris Weir	3.00	0.00	0.00
Frank Glover	6.23	8.31	11.42
Steve Carnal	6.00	6.23	19.28
John McCullough	9.50	13.50	31.50
UNION TOTALS	4.57	10.42	5.34
Opponents	5.38	4.93	6.74

1985 SEASON RESULTS (final--all games):

G		RESULT	OPPONENT
1	W	8-0	Rust MS *
2	W	11-0	Rust MS *
3	L	17-13	Ole Miss
4	L	14-2	SE MO St *
5	L	6-2	SE MO St *
6	L	19-2	Miss State
7	W	12-5	Rust MS
8	W	2-0	Rust MS
9	W	12-6	Trevecca TN *
10	W	12-3	Lane TN *
11	W	5-1	Lane TN *
12	W	14-4	Carroll WI *
13	W	8-7	CBC TN (11 inn.)
14	W	13-3	Olivet IL #
15	W	14-4	S. Falls SD #
16	W	16-0	E Nzrene MA #
17	W	18-5	Eastern PA #
18	W	4-1	Olivet IL #
19	W	12-0	S. Falls SD #
20	W	14-4	E Nzrene MA #
21	W	11-1	Lakeland WI *
22	W	4-1	Lakeland WI *
23	W	18-8	Lakeland WI *
24	W	6-1	Belmont TN
25	W	11-1	Lakeland WI *
26	W	11-8	Rhodes TN
27	L	9-5	D Lipscomb TN *
28	W	18-12	Bethel TN
29	W	8-5	CBC TN *
30	L	7-4	Cumberland TN
31	W	9-5	Frd-Hrdmn TN *
32	W	26-6	Frd-Hrdmn TN *
33	L	4-3	NE Illinois *
34	L	26-12	Trevecca TN
35	W	11-0	Rhodes TN *
36	W	7-3	Rhodes TN *
37	W	13-12	TN-Martin
38	W	12-2	Lane TN
39	L	7-6	D Lipscomb TN
40	W	4-1	Bethel TN *
41	W	3-2	Belmont TN *
42	W	23-2	Lambuth TN
43	W	13-2	Bethel TN *
NAIA District 24 Tournament:			
44	W	11-0	LMU TN
45	W	8-1	Trevecca TN
46	W	2-0	King TN
47	W	10-9	Belmont TN
NAIA Area 5 Tournament:			
48	W	9-3	Birm Sthrn AL
49	L	6-4	GA College
50	L	9-2	Harding AR

*--home games.

#--Christian College Tournament in Florida.

Individual statistics include one tie game not listed in the team's season results.
Union won the NAIA District 24 Tournament championship, played at Trevecca Nazarene College in Nashville.
Union finished 3rd in the NAIA Area 5 Tournament at Harding University in Searcy, Arkansas.

Union records broken in the 1985 season:
Most home runs, game: Pete Williams 3 (ties record)
Most singles, season: Rod Hari 67
Most runs scored, season: Rod Hari 68
Most stolen bases, season: Rod Hari 31
Most runs batted in, season: Barry Bishop 82
Most walks, season: Kris Weir 54
Most home runs, career: Barry Bishop 36
Most runs batted in, career: Barry Bishop 205
Most pitching strikeouts, season: Ted Siler 100
Most team home runs, season: 55
Most team runs scored, season: 490
Most team runs batted in, season: 432

SCORING BY INNINGS	1	2	3	4	5	6	7	8	9	EX	TOTAL
Union	86	72	79	90	45	59	23	18	18	1	480
Opponents	48	31	21	43	26	32	22	34	5	0	261

Union outscored its opponents 420-200 in the first 6 innings, but was outscored 61-60 from the 7th inning on.

UNION BATTERS LEADING OFF INNINGS:

PLAYER	Chances	On-Base	Pct	AB	R	H	AVE	BB	HP	E
G. Ward	11	7	.636	9	4	5	.556	1	1	0
K. Weir	31	18	.581	21	9	3	.143	10	0	5
S. Treadway	19	10	.526	14	5	2	.143	5	0	3
F. Williams	21	11	.524	18	9	6	.333	2	1	2
P. Williams	76	37	.487	57	25	16	.281	19	0	2
R. Hari	27	13	.482	22	8	8	.364	5	0	0
M. Tutor	18	8	.444	17	6	6	.353	1	0	2
B. Webb	32	13	.406	22	8	3	.136	9	1	0
N. Thagard	30	12	.400	27	9	8	.296	3	0	1
T. Fry	29	11	.379	28	8	9	.321	1	0	1
B. Teague	11	4	.364	10	2	2	.200	1	0	1
B. Bishop	28	10	.357	25	6	7	.280	3	0	0
J. Wyatt	28	10	.357	28	4	9	.321	0	0	1
UNION TOTALS	361	160	.443	298	103	85	.285	60	3	18

Extra-Base Hits: DOUBLES--P. Williams 4, Fry 3, Thagard 2, Webb 2, F. Williams 1, Tutor 1, Ward 1, Treadway 1, Weir 1, Wyatt 1, Hari 1. TRIPLES--Wyatt 1. HOME RUNS--P. Williams 3, Ward 2, Fry 1, Bishop 1, Hari 1.

UNION HITTERS WITH TWO STRIKES:

PLAYER	Batting Ave.	BB	Extra-Base Hits
R. Hari	.400	1	2 HR
B. Bishop	.333	5	3 HR, 2 3B, 1 2B
J. Wyatt	.286	2	1 3B
P. Williams	.282	12	1 HR, 1 2B
F. Williams	.269	3	1 HR, 2 2B
T. Fry	.214	6	1 HR, 1 3B
S. Treadway	.211	2	2 2B
K. Weir	.200	15	none
M. Tutor	.179	5	1 HR
B. Webb	.167	7	1 HR
N. Thagard	.167	1	none
G. Ward	.133	1	2 HR
B. Teague	.111	1	none

UNION BATTERS WITH TWO OUTS:

PLAYER	AB	H	AVE	2B	3B	HR	RBI	BB	HP
T. Weiler	5	3	.600	2	0	1	7	1	0
R. Hari*	65	33	.508	2	1	2	20	4	0
B. Bishop	66	27	.409	8	0	6	26	9	0
T. Fry	60	22	.367	6	1	3	20	4	1
F. Williams	30	10	.333	1	3	1	10	1	2
P. Williams	40	11	.275	2	0	1	9	4	0
N. Thagard	42	11	.262	1	0	2	11	9	0
M. Tutor	29	7	.241	3	0	2	10	8	0
B. Teague	17	4	.235	1	0	1	4	4	0
K. Weir	40	9	.225	4	0	0	8	5	3
B. Webb	40	9	.225	0	0	3	7	5	0
J. Wyatt	40	9	.225	1	2	0	3	4	0
G. Ward	16	3	.188	1	1	1	4	1	0
S. Treadway	18	3	.167	2	0	0	2	1	0
S. Wilder	1	0	.000	0	0	0	0	0	0
D. Hughes	1	0	.000	0	0	0	0	0	0
UNION TOTALS	510	161	.316	34	8	23	141	60	6

*--Hari had 20 hits in his first 32 at-bats in two-out situations (a .625 average), with 13 runs batted in.

UNION PITCHERS AGAINST LEADOFF MEN IN INNINGS:

	Leadoff Men Faced	Times On Base	Pct.	BB	HP
J. McCullough	2	0	.000	0	0
T. Nichols	53	12	.226	5	1
T. Locke	82	25	.305	8	0
T. Siler	86	27	.314	8	0
R. Hunt	28	9	.321	4	0
S. Wilder	42	16	.381	8	0
D. Hughes	67	27	.403	14	0
F. Glover	8	5	.625	4	0
S. Carnal	4	3	.750	3	0
UNION TOTALS	372	124*			

*--earned times on base (total does not include the 29 leadoff men who reached on errors).

Comments:

(1) 68 of the 124 baserunners scored--54.8%.

(2) 68 of the 372 leadoff men scored--18.3%.

(3) When the leadoff man reached base, opponents averaged 1.39 runs per inning (153 innings, 212 runs).

(4) When the leadoff man did not reach base, opponents averaged only 0.22 runs per inning (219 innings, 49 runs).

(5) Home runs allowed to leadoff men: Siler 3, Locke 2, Nichols 1, Glover 1 (total: 7).

UNION HITTERS' OFFENSIVE EFFICIENCY RATINGS (with team rank):

PLAYER	On-Base Pct.	Runs Created*	Total AVE#
Kris Weir	.513 (1)	30 (5)	1.240 (4)
Rod Hari	.489 (2)	67 (2)	1.526 (2)
Barry Bishop	.488 (3)	70 (1)	1.636 (1)
Mark Tutor	.465 (4)	22 (7)	1.013 (8)
Neil Thagard	.439 (5)	28 (6)	1.022 (7)
Tony Fry	.437 (6)	55 (3)	1.440 (3)
Pete Williams	.437 (7)	35 (4)	1.068 (5)
Fred Williams	.429 (8)	21 (8)	1.000 (9)
Brady Webb	.422 (9)	17 (10)	0.966 (10)
Grant Ward	.365 (10)	9 (11)	1.059 (8)
Scott Treadway	.358 (11)	9 (11)	0.741 (11)
Jeff Wyatt	.336 (12)	18 (9)	0.689 (12)
Bart Teague	.333 (13)	6 (14)	0.650 (13)
+Tom Weiler	.636	8 (13)	3.750

+--too few at-bats to rank in the 1st and 3rd categories.

*--Runs Created (devised by Bill James) measures the number of runs a batter produces through his various offensive contributions; it is computed by the following formula: (H + BB - CS)(TB + .7SB) / (AB + BB + CS), where H=hits, BB=bases on balls, CS=caught stealing, TB=total bases, & AB=at-bats.

#--Total Average (devised by Thomas Boswell) measures the ratio of the bases gained for the team to the number of outs used by the player; it is computed by the following formula: (TB + SB + BB + HBP) / (AB - H + CS + DP), where HBP=times hit by pitches and DP=times hit into double plays.

UNION PITCHERS IN TWO-OUT SITUATIONS:

	IP	BF	H	R	ER	BB	HP	HR	ERA
Ted Siler	27.2	115	16	21	6	8	0	0	1.96
Steve Wilder	15.2	67	13	8	4	8	1	1	2.30
David Hughes	20.1	92	10	12	7	6	0	3	3.13
Tommy Locke	25.0	107	20	15	9	7	1	0	3.24
Randy Hunt	9.7	44	10	10	5	4	0	1	4.66
Tim Nichols	16.0	92	18	17	9	22	0	0	5.06

UNION BATTERS' GAME-WINNING RBIs--Barry Bishop 11, Rod Hari 7, Tony Fry 4, Kris Weir 3, Brady Webb 3, Grant Ward 2, Jeff Wyatt 2, Fred Williams 1, Neil Thagard 1, Pete Williams 1, Mark Tutor 1, TOTAL--36. (Errors produced the GW-RBI in 3 Union victories.)

UNION PERFORMANCES BY HALVES OF THE SEASON:

BATTING		G	AB	R	H	2B	3B	HR	RBI	AVE	K	BB	SB
Hari	1st	26	87	32	43	2	0	2	23	.494	6	11	18-19
	2nd	25	108	36	41	4	2	7	37	.380	6	11	13-15
Bishop	1st	26	83	10	37	10	5	6	39	.446	12	14	3-3
	2nd	25	97	16	38	8	1	6	43	.392	13	10	1-1
Fry	1st	23	77	23	29	9	2	7	39	.377	10	4	7-7
	2nd	24	78	21	32	10	3	4	29	.410	7	7	2-3
F. Williams	1st	15	34	17	13	3	1	0	1	.382	7	5	2-3
	2nd	22	59	16	20	6	2	1	19	.339	9	3	1-2
Tutor	1st	21	49	26	16	4	0	3	16	.327	9	13	0-1
	2nd	20	55	14	19	3	0	0	12	.346	10	11	0-1
Thagard	1st	24	74	20	24	4	0	3	16	.324	7	13	4-5
	2nd	23	57	6	20	4	0	1	13	.351	8	11	1-2
P. Williams	1st	25	76	29	22	2	1	4	22	.290	6	16	4-6
	2nd	24	88	35	30	7	0	0	12	.341	8	19	12-14
Weir	1st	26	70	36	23	7	0	0	17	.329	11	24	6-7
	2nd	24	67	28	19	4	1	0	14	.284	11	30	4-6
Wyatt	1st	16	42	6	11	3	0	0	6	.262	4	3	1-1
	2nd	22	85	16	27	4	4	0	16	.318	5	4	1-1
G. Ward	1st	21	26	14	6	1	1	1	7	.231	9	3	4-4
	2nd	15	19	11	6	1	0	2	3	.316	4	3	0-1
B. Webb	1st	22	46	18	11	1	0	1	8	.239	9	13	4-6
	2nd	24	67	20	17	4	0	2	11	.254	9	16	4-6
Treadway	1st	16	43	9	12	6	0	0	6	.279	4	8	0-1
	2nd	12	26	6	5	1	0	1	4	.192	5	4	1-1
Teague	1st	17	20	11	6	1	0	1	6	.300	1	6	1-1
	2nd	13	33	7	7	0	0	0	5	.212	4	1	1-1
Weiler	1st	10	5	2	3	1	0	2	6	.600	1	1	0-0
	2nd	6	4	0	2	1	0	0	2	.500	0	1	0-0
UNION	1st	26	726	256	256	54	11	31	214	.353	97	134	55-65
	2nd	25	845	234	283	57	13	24	218	.335	99	134	41-54

PITCHING		G	BF	IP	H	R	ER	K	BB	W	L	ERA
Siler-------	1st	8	154	36.1	28	24	8	39	17	4	2	1.98
	2nd	6	202	50.0	30	20	11	61	15	5	1	1.98
Wilder------	1st	8	92	20.1	22	16	8	19	11	2	0	3.54
	2nd	8	114	25.1	21	11	3	18	20	2	0	1.07
Locke-------	1st	7	142	32.2	24	16	8	41	17	4	1	2.20
	2nd	8	211	48.0	52	29	20	48	15	4	2	3.75
Hughes------	1st	6	139	29.2	24	27	11	36	19	4	1	3.34
	2nd	7	158	35.0	22	21	13	28	23	2	3	3.34
Hunt--------	1st	5	61	14.1	11	12	7	24	4	2	0	4.40
	2nd	7	77	15.0	19	10	8	19	12	1	0	4.80
Nichols-----	1st	9	116	24.2	17	19	11	46	22	4	0	4.01
	2nd	8	141	26.0	36	30	20	40	19	3	1	6.92
Glover------	1st	4	33	6.0	4	6	1	8	8	1	0	1.50
	2nd	3	21	2.2	8	7	2	0	3	0	0	6.75
Carnal------	1st	4	16	3.0	2	3	2	3	5	0	0	6.00
	2nd	2	10	1.1	1	5	5	0	5	1	0	33.76
McCullough--	1st	3	14	2.0	4	5	4	3	5	0	0	18.00
	2nd	1	5	0.0	3	5	4	0	2	0	0	----
UNION-------	1st	26	767	168.0	136	123	60	219	108	21	4	3.21
	2nd	25	941	206.0	190	123	86	214	114	18	7	3.76

UNION PERFORMANCES AT HOME AND ON THE ROAD:

BATTING		G	AB	H	2B	3B	HR	RBI	K	BB	AVE	OBP
Hari	Home	22	78	35	3	1	2	23	7	6	.449	.488
	Road	29	117	49	3	1	7	37	5	16	.419	.489
Bishop	Home	22	71	29	8	2	4	38	9	12	.409	.494
	Road	29	109	46	10	4	8	44	16	12	.422	.484
Fry	Home	20	57	21	10	2	2	24	5	2	.368	.400
	Road	27	98	40	9	3	9	44	12	9	.408	.458
F. Williams	Home	16	41	17	4	2	0	13	8	5	.415	.500
	Road	21	52	16	5	1	1	7	8	3	.308	.368
Tutor	Home	14	32	9	2	0	1	10	8	7	.281	.410
	Road	27	72	26	5	0	2	18	11	17	.361	.489
Thagard	Home	20	47	16	3	0	2	12	5	10	.340	.456
	Road	27	84	28	5	0	2	17	10	14	.333	.429
P. Williams	Home	21	55	19	5	1	0	12	2	15	.346	.486
	Road	28	109	33	4	0	4	22	12	20	.303	.411
Weir	Home	20	48	15	2	0	0	11	6	20	.313	.529
	Road	29	89	27	9	1	0	20	16	34	.303	.504
Wyatt	Home	19	57	15	4	2	0	8	3	3	.263	.300
	Road	19	70	23	3	2	0	14	6	4	.329	.365
Ward	Home	14	19	1	0	0	1	1	7	3	.053	.182
	Road	22	26	11	2	1	2	9	6	3	.423	.500
Webb	Home	19	39	12	3	0	2	9	7	12	.308	.471
	Road	27	74	16	2	0	1	10	11	17	.216	.396
Treadway	Home	16	39	11	5	0	1	9	5	8	.282	.404
	Road	12	30	6	2	0	0	1	4	4	.200	.294
Teague	Home	15	24	8	0	0	0	3	3	5	.333	.448
	Road	15	29	5	1	0	1	8	2	2	.172	.226
Weiler	Home	7	2	1	1	0	0	2	0	2	.500	.750
	Road	9	7	4	1	0	2	6	1	0	.571	.571

PITCHING		G	IP	H	R	ER	K	BB	W	L	ERA
Siler	Home	7	43.1	25	22	11	62	17	4	2	2.27
	Road	7	43.0	33	22	8	38	15	5	1	1.67
Wilder	Home	6	14.0	15	9	2	16	1	1	0	1.29
	Road	10	31.2	28	18	9	21	30	3	0	2.60
Locke	Home	5	32.0	27	13	7	37	11	5	0	1.97
	Road	10	48.2	49	32	21	52	21	3	3	3.89
Hughes	Home	5	25.0	24	21	11	23	15	2	2	3.96
	Road	8	39.2	22	27	13	41	27	4	2	2.95
Hunt	Home	7	16.2	13	8	8	25	7	2	0	4.32
	Road	5	12.2	17	14	7	18	9	1	0	4.97
Nichols	Home	5	13.0	5	1	0	24	8	2	0	0.00
	Road	12	37.2	48	48	31	62	33	5	1	7.41
Glover	Home	4	5.0	3	3	0	6	8	1	0	0.00
	Road	3	3.2	9	10	3	2	3	0	0	7.36
Carnal	Home	3	3.0	0	0	0	2	4	1	0	0.00
	Road	3	1.1	3	8	7	1	6	0	0	37.79
McCullough	Home	2	1.0	0	2	2	2	4	0	0	18.00
	Road	2	1.0	7	8	6	1	3	0	0	54.00

UNION SWITCH-HITTERS:

PLAYER		AB	H	AVE	POWER
Thagard	RH	38	12	.316	2 HR, 2 2B
	LH	93	32	.344	2 HR, 6 2B
Webb	RH	37	8	.216	1 HR, 2 2B
	LH	76	20	.263	2 HR, 1 3B, 3 2B

UNION RECORD WHEN BULLDOGS SCORE FIRST: 25-4 (.862)
UNION RECORD WHEN OPPONENT SCORES FIRST: 14-7 (.667)
The team scoring first won 64% of the games.

COMPARISON OF PERFORMANCES, WINS vs. LOSSES:

PER-GAME AVERAGES	AB	R	H	HR	K	BB	AVE	ERR
Union Victories	30.88	10.88	11.20	1.25	3.30	5.35	.363	2.08
Union Defeats	30.54	5.00	8.27	0.45	5.91	4.91	.271	4.45

Summary: Despite the at-bats remaining virtually the same, UU scored less than half as many runs in the losses, with hit production dropping by a third and homers by two-thirds. Union made over twice as many fielding errors when losing, and the batting average in losses dropped by 92 points.

COMPARISON OF PITCHING, WINS vs. LOSSES:

PER-GAME AVERAGES	IP	H	R	ER	K	BB	ERA
Union Victories	7.20	5.40	3.43	1.73	8.68	3.30	2.16
Union Defeats	7.82	10.00	11.27	7.00	7.82	8.18	8.06

Summary: UU pitchers allowed over 3 times as many runs, twice as many hits, and 4 times as many earned runs when losing. Union walked an average of 8 batters in each defeat. The opponents batted .295 in games they won, and .201 in games they lost.

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