



A brief tutorial on American baseball

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The science of baseball:

Baseball is a game of physics and geometry, a game of aerodynamics and particle collisions and ballistic trajectories rather than kicking and grabbing and knocking people down. It's a game played with tools that extend the reach and power of your hands rather than a game played with your arms flapping uselessly at your sides. It's a game in which your head is used for thinking rather than as a club to strike the ball. And more than perhaps any other game, it is a game of statistics with really good sample sizes. The game unfolds in a sequence of measurable discrete moves by individual players and there are a large number of plays in a game and a large number of games in a season. A typical starting player accumulates between 500 and 600 at-bats in a season, a fielder gets many hundreds of fielding chances per season, and a pitcher may throw over 100 pitches in a single game. Statistics are kept on every aspect of a player's performance—a number of different measures of hitting (hits per at-bat, total bases per at-bat, strikeout-to-walk ratio, batting average versus right or left-handed pitchers, etc.), a number of different measures of pitching (earned runs, strikeouts and walks per nine innings pitched, blown saves, etc.), measures of running ability (percentage of stolen-base attempts that are successful), measures of fielding ability (number of error-free plays out of total number of fielding chances), and so on. This makes it possible to perform delicate statistical comparisons between the performances of different players, between performances of the same player in different game situations, between performances of the same player in different career stages, between performances of different teams, and between aggregate performances of players and teams in different eras (e.g., the dead-ball era of the early 20th Century versus the live-ball era that is said to have begun in 1919 with the emergence of home-run-hitters like “Babe” Ruth, the era of the designated hitter, the steroid era). The statistical properties and tendencies of the players are well known and are taken into account in strategic decisions made by their opponents on a play-by-play basis. The importance of statistical and game-theoretic reasoning in baseball makes it more of a thinking person's game than football or basketball. This is all explained in the following excellent video: [Goofy: How To Play Baseball](#)

History:

The game of baseball evolved in the U.S during the 1800's, arising from a mutation of the English game of “rounders.” The first published rules were written in 1845, and by the late 1860's there were hundreds of amateur baseball clubs around the country. Professional teams began to be organized in the 1870's, and the National League, one of the two major leagues in existence today, dates to 1876. The “modern” rules (essentially the same rules are in effect today) were developed by 1901. Thus, the “modern era” of baseball extends back more than a century, longer than that of any other major professional sport. It was considered to be the “national pastime,” and by the 1920's daily games in major cities drew crowds of tens of thousands to stadiums that were the palaces of their day, of which a few still exist (in Boston and Chicago) or were only recently demolished (in New York). Newer baseball stadiums also seat

tens of thousands but have more comfortable seats and cleaner bathrooms and other amenities. Baseball remained the dominant professional and amateur sport in the U.S. until the 1960's, when television began to increase the relative appeal of professional football and basketball. In terms of total attendance at all games, baseball still dominates: the major league season consists of 162 games, and is followed by the usual many rounds of playoffs, culminating in the "World Series" (which means the U.S. championship.) A baseball team plays nearly every day during the regular season, usually playing 4 consecutive games in each city that it visits while on a "road trip." Occasionally they play two games on the same day (a "double header"). It is possible to play this many games in a season because baseball is not as strenuous or dangerous as most other sports. Most of the time, most of the players are just standing around or sitting down. (The casual version of baseball, known as "softball" because it is played with a larger and softer ball, can be played by almost anyone while drinking a beer at the same time.) During the mid-20th Century baseball was exported to various other countries where the U.S. had a significant military or commercial presence, including many countries in Latin America (even Cuba) as well as Asian countries such as Japan, South Korea, and Taiwan. Baseball is also becoming popular in China, but it hasn't yet caught on in Europe. A large number of players on U.S. teams are from Latin America, with a small but growing number from Asia. For more historical information see <http://en.wikipedia.org/wiki/Baseball>.

In addition to its two major leagues (the National and American leagues), there is a rich "farm system" consisting of many levels of minor leagues. Each major league team typically has a number of "affiliated" minor league teams at various levels of the hierarchy. Players move up or down in the minor league system of their "parent" ballclub according to their level of experience and skill or rehabilitation following an injury. In descending order of quality, the minor leagues are classified (like bonds) as AAA, AA, A, B, C, D. The Durham Bulls, who are probably the best-known minor-league team in the country, are a class AAA team that is currently affiliated with the Tampa Bay Rays. Many players currently playing for Tampa Bay have spent time in Durham, and younger players being developed by Tampa Bay will generally pass through Durham on their way to the major leagues. The Durham Bulls baseball club has been in existence since 1902, when it was called the Durham Tobacconists. At that time the entire U.S. tobacco market and much of the world market was controlled the American Tobacco Company here in Durham, a monopoly formed by James B. Duke, whose family endowed the construction of much of Duke University campus. His statue, in which he holds the traditional tycoon's cigar, stands in front of Duke Chapel. (One of the first uses of the Sherman Anti-Trust Act was to break up the tobacco monopoly, which was finally accomplished in 1911.) The club name was changed to Durham Bulls in 1913 in homage to the Bull Durham Tobacco Company which existed here in the late 1800's and which had been named "Bull" Durham by its owner who mistakenly believed that Durham, England, was the home of a popular British brand of mustard whose label carried the image of a bull. (This is the only connection between Durham, England, and Durham, North Carolina. The N.C. city was named after a local farmer named Durham upon whose tract of land the city was founded.) The current ballpark was built in 1995, adjacent to the old American Tobacco Company factory, which has since been renovated and converted into a mall with restaurants, cafes and art galleries.

If you want to get more of a feel for the game of baseball—especially minor league baseball and the Durham Bulls baseball club—I highly recommend the 1988 movie "Bull Durham."

(http://www.rottentomatoes.com/m/bull_durham/) It is the story of an aging catcher (played by Kevin Costner) who has spent his entire career stuck in the minor leagues and who has the dubious distinction of being on the verge of breaking the record for most home runs ever hit by a minor league player. He becomes the mentor to an up-and-coming young pitcher (played by Tim Robbins) and they get involved in a romantic comedy with Susan Sarandon, who is herself an expert trainer of young baseball players.

The rules of the game:

1. FIELD DIMENSIONS. The playing field is a closed, almost-convex subset of the Euclidean plane and is divided into “fair” territory and “foul” territory. Fair territory is the subset of the positive quadrant bounded by the x and y axes (the so-called “foul lines”), and by the “outfield fence” whose equation is (roughly) $\sqrt{x^2 + y^2} = r$ (330 feet), although the shape of the fence and its distance from the origin vary from one ball park to another. (See Figure 1.) A ball hit over the outfield fence is called a “home run,” about which more will be said later. Foul territory is the subset of the playing field that satisfies $x < 0$ and/or $y < 0$. The team benches are located in “dugouts” (literally, dug-out areas) along the edges of foul territory, in front of the seats. Thus, the players currently sitting on the bench are slightly below field level, and fans in the lower seats can see over them, in fact, not see them at all. During the game, the tops of the dugouts are often occupied by dancing mascots and masters-of-ceremonies who conduct games with members of the audience in between periods and during commercial breaks.

2. FIELD LAYOUT. Within fair territory are four “bases” arranged in a square with sides of length 27.4m (90 feet), one of whose vertices is the origin. The base at the origin is called “home plate”, the one that lies along the x axis (the “right field foul line”) is called “first base,” the one that lies along the y axis (the “left field foul line”) is called “third base,” and the one opposite from home plate is “second base.” The square path that connects the bases in numerical sequence is called the “basepath.” (See Figure 2.) The basepath is covered with dirt, while most of the field is covered with grass. The field is called the “baseball diamond” rather than the “baseball square” because it is conventionally drawn in a 45-degree rotation, as in the figures, which is the way it looks when viewed from behind home plate. In (roughly) the center of the square is the “pitcher’s mound,” from which the pitcher throws the ball to a batter standing at home plate. It is 18.4m (60 feet, 6 inches) from the center of the pitcher’s mound to the back of home plate. First, second, and third base consist of white canvas bags. Thus, you may hear reference to “the first base bag,” and so on. Home plate is a five-sided plate made of hard rubber. There is also a hard rubber block (call the “pitching rubber”) on the top of the pitcher’s mound, from which the pitcher steps off when throwing a pitch. The player who is currently “at-bat” stands in the “batter’s box” which is a rectangle on one side or the other of home plate, depending on whether he is right- or left-handed. The player whose turn at bat comes next is said to be “on deck,” and he stands in the “on deck circle.”

3. SCORING. The objective is to score the most “runs” (points) by hitting the ball and then running around the bases. A run is scored when player makes his way safely all the way around the basepath, i.e., when he “touches all the bases” sequentially, starting and ending at home plate, without being ruled “out” for one reason or another. A player is allowed to run from one base to another only when a ball is “in play” after being struck by a batter (except in the case

where he steals the base, which is discussed below), so a run usually results from a cumulative effort of several players in a succession of plays.

4. TIME INDEX. The game is played in discrete time and is divided into nine periods called “innings.” Each inning is divided into two subperiods, a “top” (first) half and a “bottom” (second) half. (They are called top and bottom because that is how they appear on the traditional scoreboard.) During the top half of the inning, the home team is on defense (‘in the field’) and the visiting team is on offense (“at bat”), and they switch in the bottom half. Within each half-inning the players on the offensive team take turns at batting until three of them have gotten “out.” It has been remarked that innings really should be called outings because each half-inning ends when three players have been outed.

5. LINEUP OF PLAYERS. Each team has 9 players in the active lineup at any given time, each of whom is designated by the position he plays when he is in the field. (See Figure 3.) They consist of a “pitcher” and “catcher,” four “infielders” who are stationed near the bases, and three “outfielders” who are stationed near the outfield fence. The “first-baseman” and “third-baseman” are stationed near first and third base, respectively, and the “shortstop” and “second-baseman” are stationed more-or-less symmetrically on either side of second base. The outfielders are called the “left-fielder,” “center-fielder,” and “right fielder,” as seen from home plate. Usually the same 9 players play both offense (batting) and defense (fielding). However, several decades ago one of the two major leagues created a “designated hitter” position, which is a player who bats in place of the pitcher, in which case there are 10 rather than 9 active players at any time. The Durham Bulls play within that system.

6. EQUIPMENT. The players use different equipment depending on whether they are on offense or defense. A player who is on defense wears a large webbed leather glove on his non-throwing hand. (See Figure 4.) The glove serves not only to make the ball easier to catch but also to prevent broken bones when catching hard-hit balls—the idea is to catch the ball in the webbing of the glove, between your thumb and index finger, rather than against the palm of your hand. (The catcher wears a much a much larger and heavily padded glove as well as an iron mask and a padded vest to protect him from pitches that he fails to catch.) A player who is on offense swings a bat which by rule is a solid piece of wood no more than 7cm (2-3/4 in.) in diameter at its thickest part and no more than 1.07m (42 inches) in length. Different players generally use different-sized bats within these limits to suit their own size and style of hitting. Sometimes they illegally fill the center of the bat with cork, which makes the bat lighter and more elastic and makes the ball more likely to leave the ballpark when it is hit.

7. BALL. An official Major League baseball consists of a round cushioned cork center wrapped tightly in windings of wool and polyester/cotton yarn, and covered by stitched cowhide. In a Major League game, the average baseball remains in play for only five to seven pitches before it is replaced by the umpire, although the one that you and your kids play with may outlive you. By rule the ball must weigh between 141.75 and 148.83 grams (5 to 5.25 ounces) and measure between 7.29 and 7.48 centimeters (2.86 to 2.94 inches) in diameter. It is quite hard and heavy compared to, say, a tennis ball, which is hollow rubber with a diameter of about 6.7cm and a mass of only about 58 grams.

8. THE PITCHER-BATTER GAME. At time t the offensive player whose turn it is to bat stands at home plate, with the catcher crouched directly behind him. (See Figure 5.) There may also be one or more offensive players “on base,” standing on or near one of the other three bases by virtue of having advanced to first base or beyond it in their turn as a batter. A play begins when the pitcher throws the ball to the catcher and the batter seeks to hit it as it goes by him. This existential moment can be modeled as a stage game in a 2-player sequential non-cooperative game, in which the pitcher chooses a randomized strategy (varying the speed and location and angular velocity on the pitch) to induce the batter to swing-and-miss or to hit the ball where it can be caught by a fielder without any runners successfully advancing to the next base ahead of them. The batter has only a fraction of a second to try to detect the speed and up/down/sideways/curving movement of the ball as it leaves the pitcher’s hand, before deciding whether and in what manner to swing the bat. Therefore he will often try to out-guess the pitcher and “look for a particular pitch.” This game-within-a-game theoretically can have any number of stages (consecutive pitches) if the batter keeps hitting “foul balls,” (balls that hit the ground in foul territory), although it usually lasts no more than about 5 stages unless the batter deliberately hits a succession of foul balls into the opposing team’s dugout following some sort of insult.

9. RANDOMIZED STRATEGIES. The pitcher usually does not devise his own random strategy in choosing which pitch to throw in a particular stage of the 2-player game. Rather, the catcher chooses the randomized strategy for the next pitch and signals it to the pitcher via a hand-signal between his legs where only the pitcher can see it. (However, if there is a runner on second base, which is directly behind the pitcher, he will sometimes try to “steal the sign” by looking at what the catcher is doing between his legs, so that he in turn can signal the batter on what pitch to expect next.) So, the catcher is really the first-mover in the game; the pitcher is just following orders. From the catcher’s viewpoint it is a game of incomplete information insofar as the pitcher may make a mistake (a “bad pitch” that is too easy to hit, or even a “wild pitch” that sails over the catcher’s head). However, the pitcher will sometimes “shake off the sign” and indicate by a head-shake that he doesn’t want to throw the indicated pitch, in which case the catcher will signal some other pitch until they can agree. If the catcher doesn’t know where and how soon to expect the ball, he may be unable to react quickly enough to catch it, leading to a “passed ball.” Occasionally (particularly in critical moments of the game) the team manager chooses the pitch strategy and sends a hand signal to the catcher, who relays it to the pitcher.

10. BALL SPEED. The speed of a typical pitch is between 34 m/sec (75mph) and 40m/sec (90mph), although some pitchers throw faster than 45m/sec (100mph). The speed at which a ball leaves the bat when it is struck is usually higher than the speed of a pitched ball, although a player with a good throwing arm (pitcher or otherwise) is often able to stand on home plate and throw the ball over the outfield wall, which is physically equivalent to hitting a home run.

11. THINGS THAT MIGHT FLY INTO THE STANDS. It is quite common for a ball to be hit sharply into the stands when the batter is fooled and swings too soon or too late, in which case the fans seated there will usually try to catch it as a souvenir. This carries some risk of injury to the hands, but it is better than getting hit in the face by a hard ball traveling at over 50m/sec. It is also not uncommon for a batter to break his bat when hitting a ball, in which case the shards of the bat may fly into the stands, which carries a risk of more serious injury. The ball club is not

liable for these kinds of well-understood risks that are part of the excitement of the game. The party deck is a relatively safe place to be seated.

12. THE STRIKE ZONE. The game between pitcher and batter is constrained by the “strike zone” which is an imaginary rectangle centered over home plate that is roughly the width of the plate and which extends from the batter’s knees to the middle of his chest. A pitch that misses the strike zone and which is not swung at by the batter is called a “ball.” A pitch that hits the strike zone and which is not swung at by the batter is a “strike.” (This is one of several ways in which the batter can get a strike against him—it is also a strike if he swings and misses, no matter where the ball is thrown, or if he hits the ball into foul territory.) The ruling as to whether a given pitch is a strike or a ball (i.e., inside or outside the strike zone) is made by the “home plate umpire” who stands behind the catcher and looks over his shoulder. (The umpire sometimes makes “bad calls,” but it is considered to be poor etiquette for the batter or his coaches to “argue balls and strikes.”) The optimal strategy for the pitcher is usually to aim the ball at the boundary (edge) of the strike zone rather than “down the middle.” By throwing at the boundary rather than the middle of the strike zone there is a better chance of fooling the hitter or getting him off-balance so that he misses or hits the ball only weakly, but there is also an increased risk of getting the pitch outside the strike zone (i.e., throwing a ball instead of a strike). Thus, there is a risk-return tradeoff in the pitcher’s strategy as well as a strategic element.

13. OUTCOMES OF A PITCH. At each stage of the mini-game one of several things may happen: (i) the batter fails to swing but the pitch is ruled to be a strike, which case it is a strike against the batter, (ii) the batter swings at the pitch and misses, which is also a strike against him, (iii) the batter swings and hits the ball into foul territory (e.g. into the nearby seats) without it being caught in the air by a fielder—this is also considered a strike if the player has less than two strikes against him already; (iv) the batter hits the ball anywhere and it is caught in the air (“on the fly”) by a defensive player, in which case he is “out” and his turn at bat is over, (v) the batter hits the ball somewhere in fair territory *without* it being caught in the air (this is a so-called “ground ball”, which have one of a number of consequences), (vi) the batter hits the ball over the outfield fence (a “home run,” which allows him and all players who are already on base to run all the way home, thus scoring points), (vii) the batter is hit by the pitch, in which case he is awarded a free trip to first base. Usually it is an accident when a player is hit by the pitch, although sometimes the pitcher will deliberately throw the ball close enough to the player to make him jump or dive out of the way. This is called “brushing him back” to keep him from standing too close to home plate in order to gain an advantage. Sometimes the pitcher will deliberately try to hit the player in retaliation for something that happened earlier in the game, such as when the preceding player has just hit a home run. If the pitcher succeeds in hitting the batter’s head with the pitch, this is called “beaning.” The batters wear protective helmets, so usually this does not result in serious injury.

14. TERMINATION OF THE PITCHER-BATTER GAME. The mini-game between pitcher and batter terminates when one of the following occurs: (a) the batter puts the ball “in play” by hitting it into fair territory (whatever may happen subsequently) or by hitting it into foul territory and having it caught there before it hits the ground, (b) the batter accumulates three strikes against him (by swinging and missing, by failing to swing on pitches that are ruled to be strikes, and/or by hitting foul balls), in which case he is out (“three strikes and you’re out!”), (c) the

pitcher accumulates 4 balls (misses the strike zone 4 times without getting the batter out), in which case the batter gets to “walk” to first base and any runners immediately ahead of him on the bases also get to advance by one base.

15. **RUNNING THE BASES.** If the batter succeeds in putting the ball “in play” by hitting it into fair territory, he then proceeds to run to first base (and beyond if possible) while the defenders (fielders) try to catch or pick up the ball. If the ball is caught in the air the batter is out. If it hits the ground without being caught, the fielder who gets to it first will usually try to throw it to another fielder who is standing on a base to which a runner is required to advance. Most often this means throwing the ball to first base ahead of the batter who just hit the ball, in which case the batter is said to have “grounded out to first” if the ball gets there before him. However, if other runners are already on base, they are “forced” to run to the next base ahead of them if all the bases behind them are already occupied. A base is not allowed to be occupied by more than one runner at a time. For example, a runner who is already on first base is required to run to second base if the batter hits a ground ball. A runner who was on 2nd base is required to run to 3rd base when a ground ball is hit if-and-only-if there was also a runner on 1st base, because the latter runner is required to run to 2nd base as the batter runs to 1st base. A runner who is forced to run to the next base is out (“forced out”) if one of the fielders tags the base while holding the ball before the runner gets there. If there are runners on base when a ground ball is put in play, the defensive team usually will try to get the “lead” runner if possible (i.e., the one on the highest-numbered base, who is closest to scoring a run). In some cases, the defensive team may record two outs on the same play (a “double play”) if, for example, they throw the ball to second base just ahead of the runner who is being forced to go there, and then throw the ball from second base to first base just ahead of the runner (the batter who just hit the ball) who is being forced to go there.

16. **EXTRA BASES.** If the ball is very well hit but not a home run (e.g., if it is hit into the “gap” between two of the outfielders) the batter may be able to run all the way to second or third base before the ball is retrieved, which is called hitting a “double” or a “triple” or getting an “extra-base hit.”

17. **GETTING TAGGED OUT.** A player who is running between bases can also be “tagged out” by being touched by the glove of a fielder who is holding the ball in the glove (or touched by the ball held in his bare hand). For example, if a ground ball is hit to a fielder standing between two of the bases, he may be able to tag a runner who is trying to run from one base to the other.

18. **STEALING OF BASES.** A player who successfully reaches first base (or a subsequent base) by virtue of getting-a-hit or taking-a-walk is said to be “on base,” and he normally waits on or near the base while the mini-game unfolds between the pitcher and the next batter. He is “safe” while waiting on the base in between plays. However, if he wanders too far away from the base he can be tagged out (“picked off”) if the pitcher turns around and throws the ball to a nearby fielder who then tags the careless player with the ball before he gets back to the base. He can also try to “steal” a base by spontaneously running for the next base while the pitcher is not looking or is in the middle of his “windup” for throwing the next pitch. This is a risky strategy, so it is not employed too often by too many players. (Base-stealers are usually among the fastest

runners.) Often the catcher is able to catch the pitch and throw it quickly to the fielder guarding the base, in which case the base-stealer may be tagged out before he gets there. Or, if the batter hits the ball and it is caught in the air, the base-stealer is required by rule to retreat to the original base, and he is out if he is tagged with the ball while running back or if the ball is thrown to the fielder at that base before he gets back. The decision as to whether or not to attempt to steal a base is something else that is often made by one of the coaches and signaled to the player. Sometimes both the runner and batter will be signaled to coordinate on a “hit-and-run” play in which the runner attempts to steal and the batter swings at the pitch no matter what. The advantage of this strategy is that it gives the runner a head start in the event of a hit, thus preventing a “force-out” and increasing the possibility of the runner getting an extra base. It also serves to bother the catcher so that he can’t throw out the base-stealer even if the batter fails to hit the ball when he swings at it. The downside is that the runner will almost certainly be out if the ball is hit sharply and caught in the air by one of the infielders, who then throws the ball back to the base to which the runner is required to retreat. This is another form of double-play.

19. SLIDING INTO A BASE. A runner who is approaching a base to which he was not forced to run (either because he is taking trying to take advantage of a hit without runners behind him or is attempting to steal the base) will be out only if he is tagged out before he reaches the base. In situations where the runner sees that the fielder guarding the base is going to receive a throw from another fielder just in time to tag him, he will often try to evade the fielder’s glove by “sliding” feet-first or even head-first into the bag, which is usually an exciting play. One of the most exciting plays occurs when a runner slides into home plate in an attempt to score a run. In this case the catcher, who wears a lot of protective equipment anyway, will try to “block the plate” by positioning himself in front of it while receiving the throw. The runner may then try to slide under the tag or he may try to “bowl over” (collide with) the catcher in hope of knocking the ball loose. If the catcher drops the ball during the collision, the batter is safe. This is about the only situation in which two baseball players ever collide with each other during a game.

20. SUBSTITUTION OF BATTERS. There are 9 places in the “batting order” (rotation), and a given player occupies the same place in the order for as long as he is in the game, i.e., he comes to bat every ninth batter. If a substitution is made, the new player goes into the same place in the order as the person he is replacing. This sort of substitution is often made at critical moments late in the game when it is important to have a good hitter at bat, e.g., because there are runners on base who are in a position to score if the batter gets a hit. A player who is substituted for hitting purposes is called a “pinch hitter,” and he is often someone good at hitting but perhaps not so good at fielding or running.

21. SUBSTITUTION OF PITCHERS. It is also common to substitute for the pitcher at one or more points in the game. In fact, nowadays it is relatively rare for a starting pitcher to pitch a “complete game.” Usually the starting pitcher stays in the game for somewhere between 6 and 8 innings if he is pitching reasonably well, and then he is replaced by a “relief pitcher,” who may in turn be replaced by another relief pitcher before the game is finished. Relief pitchers tend to be highly specialized: some are “middle-inning relievers” and others are “closers” who go in finish the game, which is called a “save” if the other team has runners on base with the potential of tying or winning the game in the event of a hit.. Sometimes a very specialized relief pitcher is sent in to pitch to a single batter, and sometimes the batter is immediately replaced by a pinch

hitter who is well-matched against the new pitcher, and so on. If the starting pitcher is not pitching well, he may be replaced (“yanked,” “sent to the showers”) early in the game and replaced by a middle-inning reliever.

22. RIGHTIES VS. LEFTIES. Pitchers, like batters, are typically either right-handed or left-handed, although some batters are ambidextrous “switch-hitters” who can bat from either side, and very rarely there are pitchers who are able to pitch with either hand. It is an advantage for the pitcher to pitch to a batter of the same handedness, because this means that the pitched ball passes in front of the pitcher’s body as seen by the batter, which makes it harder for the batter to judge its speed and rotation. This fact also plays a role in strategic choices about which pitchers should be used to pitch against which batters, and vice versa.

23. ERRORS. Fielders are expected to make good catches and good throws and good decisions when the ball is hit to them. If they don’t, and if this allows runners to take extra bases or score extra runs that they didn’t really “earn,” then this is judged to be an “error” by the fielder. If a batter gets on base because of a fielder’s error, he does not get credit for an at-bat or a hit in his personal statistics. One of the game officials is an “official scorer” who makes judgments on whether a play should such as a dropped ball or an inaccurate throw should be regarded as an error or simply as a good effort that didn’t work out.

24. OVERTIME. If the game is tied after nine innings, it goes to overtime (“extra innings”), which ends when one team is ahead at the end of an inning.

26. SUMMARY. There are a number of other arcane details, but that’s it in a nutshell. For the players, the idea is to pitch-it-where-they-can’t-hit-it and hit-it-where-they-can’t-catch-it and run-home-before-they-get-you-out. For the spectators, the joy of baseball is that it is a game that unfolds at a leisurely pace on a summer evening (or in bygone days, on a summer afternoon) and draws upon primal instincts for using your hands to throw stones and hit things with clubs.

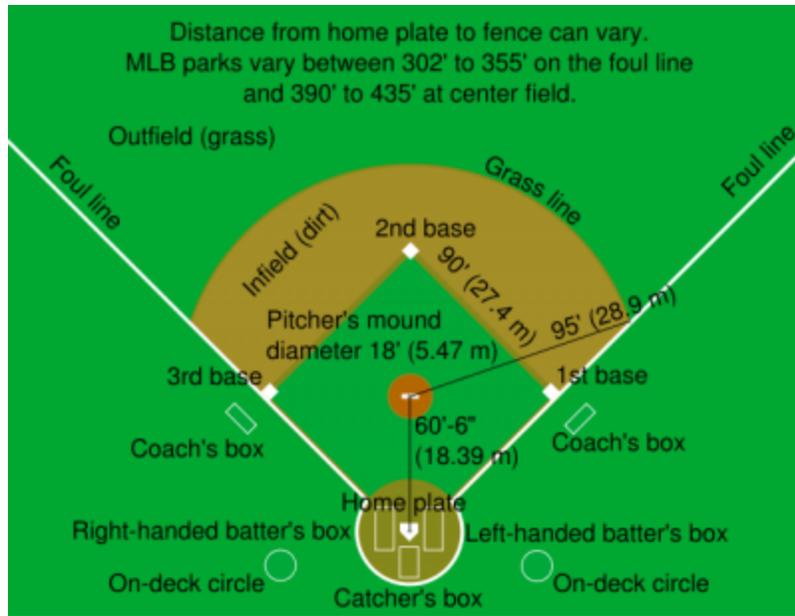


Figure 1. Field dimensions

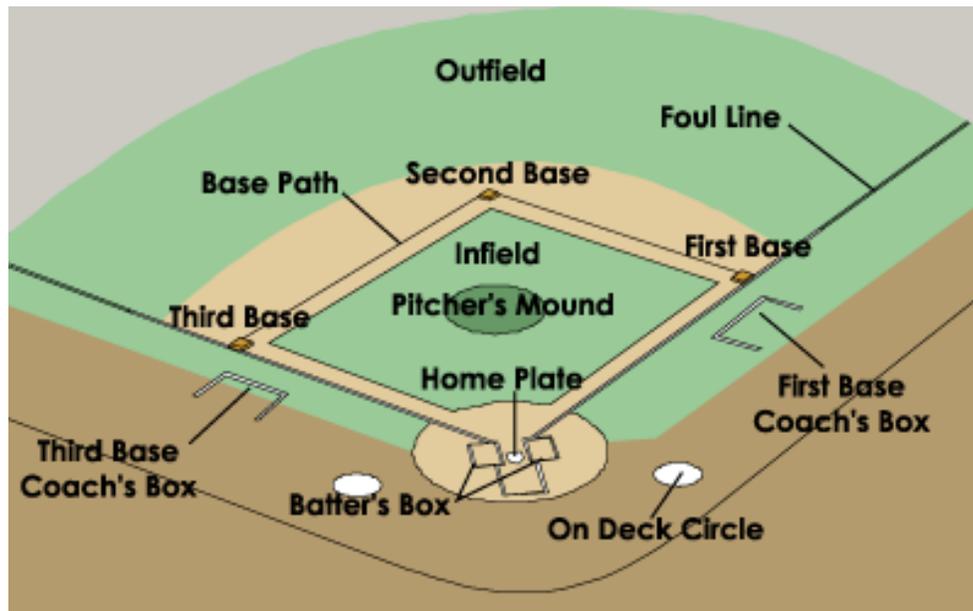


Figure 2. Field layout

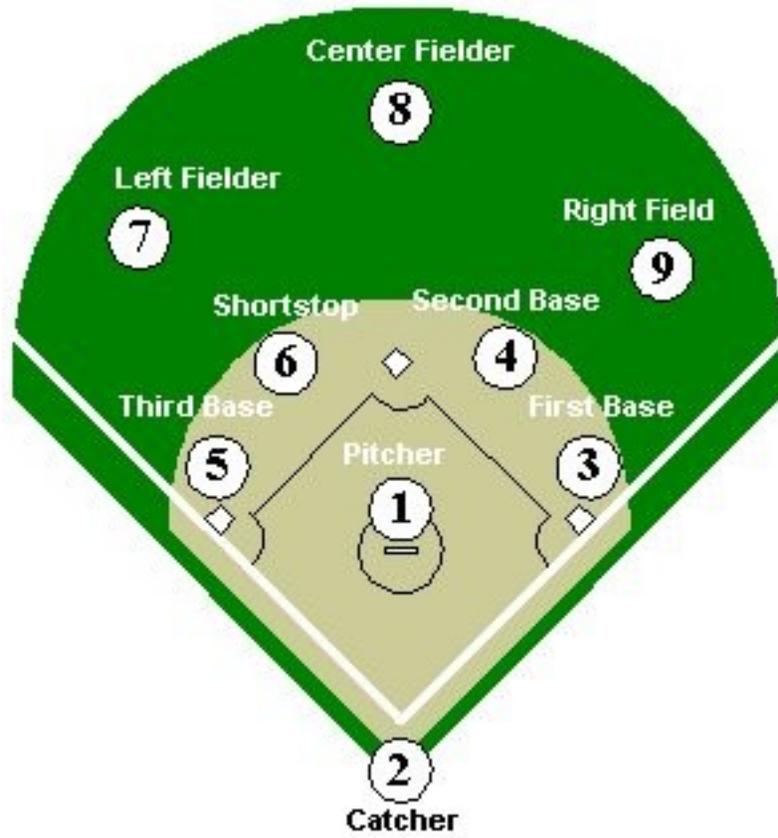


Figure 3. Player positions



Figure 4. Equipment



Figure 5: The pitcher-batter game