

Could baseball players learn more from physics class than spring training?



Lamb, Robert. "Could baseball players learn more from physics class than spring training?" 23 February 2009. HowStuffWorks.com. <<http://science.howstuffworks.com/science-vs-myth/everyday-myths/baseball-player-physics.htm>> 05 May 2015.

by Robert Lamb

Sure, science can help us analyze baseball, but can it improve player performance? ~ Hulton Archive/Hulton Archive/Getty Images ~ Curiosity Project: Famous Physicists Pictures

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It's the final game of the Major League Baseball World Series. An acclaimed pop star sings the national anthem and, finally, the players saunter out onto the field. The assembled fans cheer wildly when they glimpse their favorite players: star pitcher Nima Arkani-Hamed, home run king Edward Witten and, of course, head coach Stephen Hawking. Will Witten finally eclipse Albert Einstein's record of most career hits? Only time will tell.

If you're missing baseball cards for these individuals, don't fret. There's no need to adjust your fantasy baseball league stats just yet.

They're all gifted physicists, yet despite their understanding of the properties involved with the sport, no Major League Baseball team has ever drafted them.

Film and literature contain countless examples of gifted minds applying pure science to a given scenario in order to come out on top. Androids and aliens crunch a few numbers to dominate pool and poker tables. Geniuses and meta-humans apply cold, hard logic to social situations to achieve everything from dating success to the manipulation of whole peoples. From Rain Man and John Nash to Spock and the fictional fantasy hero Anasûrimbor Kellhus, the message seems to be that science trumps skill and physical training every time.

It's easy to fall into the trap of attributing near mystical powers to science. After all, the scientific method has landed humans on the moon, prolonged life expectancy and filled our lives with countless time-saving gadgets.

So why couldn't a talented physicist improve a baseball team's chances of victory, if not on the field then at least in the dugout? Solid physical laws underlie everything from a swing and a miss to a grand slam. Is all that strength and endurance training just a waste of time? Might baseball players learn more from physics classes than spring training?

Physics at Bat

The properties of physics underlie everything that happens in the physical world. You drink a cup of coffee? Physics. You hammer a nail? Physics. You chase a cat around with a stick? You guessed it: physics. As such, a number of physical laws determine everything that happens on the baseball field.



The most important interaction on the baseball field occurs between the pitcher and the batter. The pitcher throws a 90 mile-per-hour (145 kilometer-per-hour) ball 60 feet 2 inches (18.4 meters) at a batter, who then has less than 0.4 seconds to react before it slams into the catcher's mitt. The pitcher aims for an imaginary square 15 inches (38 centimeters) wide above the home plate. The batter then attempts to hit the ball with the bat's center of mass, a 2-inch (5-centimeter) section toward the bat's center, known as the sweet spot. Even the best Major League batters only hit it 38 percent of the time, at best.



The Toronto Blue Jays warm up during annual spring training in Florida. ~ AP Photo/Frank Gunn

So just how do you learn to throw the perfect fastball or hit that game-saving homer? Throughout the history of the game, the answer has been what

it is for any athletic competition: practice and training. On one hand, a player needs to have the physical prowess to put that much energy into a pitch or swing, but it takes reflex and well-rehearsed movements to channel it correctly. This means particular stances and full-body movements that throw the most kinetic energy into a swing or pitch. A competent pitcher should know exactly which grip to place on the ball to deliver a fastball, changeup, breaking ball or knuckleball.

The goal of spring training is to get everyone in shape and back in form for the upcoming season. For the longest time, hitting and pitching instruction stressed intuitive thinking and repetition through hitting and pitching drills -- not science. They simply replicated what works and repeated it until the movements became second nature. Physics, however, adds an entirely different dimension to the process.

The Physical Laws Behind Baseball

You can think of the relationship between physics and baseball much like that between sailors and the sea on which they sail. You don't need to understand what goes on under the waves or up in the clouds to effectively navigate the vessel. And in baseball, you don't have to understand the underlying physics to excel. Yet, no matter what the play, there are always physical reasons for its success or failure. As such, baseball gurus have put a great deal of effort into mapping out the physics of everything from throwing a rising fastball to catching a home run in the stands as a fan.

Compared to many other sports, professional baseball has dragged its feet in applying science to its training methods. For years, folklore and gut instinct prevailed over physics, but swing and batting mechanics have steadily found their way into the game. Meanwhile, physics has led to drastic changes in such sports as pole vaulting and javelin throwing.

Take hitting a baseball for example. The method for hitting the ball is based on a combination of stance, windup and swing. However, there are swing mechanics behind what makes that swing possible -- the bevy of equations concerning velocity, timing and the cherished sweet spot on the bat.

Bat velocity is the speed at which the bat makes contact with the ball. Bat quickness is the time it takes to swing the bat from the launch position to the contact point. With most players, the greater their bat velocity, the poorer their bat quickness. In other words, the players who hit hardest, tend to connect less often, and the players who connect the most do so with less velocity. Analysts attribute this to the fleeting moment in which a batter has to read the pitch and decide how to react. This factor is called decision time. The quicker the swing, the more decision time a player has.

Mechanically, a player needs to increase his decision time and arrive at the point of contact with peak velocity. Now, this bit of information won't do much good if it's kicking around a player's head right before the pitch. The true benefit of this physics knowledge is in encouraging

swing techniques that stress bat quickness. By training muscles to contract rapidly and forcibly, analysts insist that physical exercise can couple quickness with improved bat velocity [source: Lund].



San Francisco Giants' second baseman Jeff Kent bunts the ball during 2001 spring training in Scottsdale, Ariz. ~ AP Photo/Eric Risberg

Physics and Baseball Training

So, could a baseball player learn more from physics class than spring training? The answer isn't a matter of choosing one or the other, but rather in applying a useful understanding of physics to the training a baseball player endures. Physics can help maximize the effectiveness of exercise and provide a framework for critiquing and improving technique.

That being said, baseball players often stress the dangers of overthinking on the field as well. Remember, batters have mere seconds in which to read a pitch and decide how to swing. That doesn't leave a lot of time for mental calculation. Training has to kick in at some point, as well as eyesight and good old-fashioned player confidence. Some players even insist that the least intelligent batters score the highest batting averages [source: CNET TV].

Ultimately, as with any sport, baseball players and their trainers have to hit a balance between technology and tradition. With all due respect to physicists, it's one thing to understand the physical laws that underline an effective pitch, another to duplicate them. Likewise, as we explored on the last page, sheer bat velocity doesn't count for very much if the player doesn't have the time to channel it into a hit. There's an old saying about "working smart, not hard." In baseball, as in life, the advantage is in achieving a balance of both.

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