

GOLF: How Technology has shaped the Game?

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Golf is a game that has been around for centuries. Its history lies in Scotland and has increased in popularity to the point where tournaments are hosted in which the winner can receive over a million dollars. The history of the technology has been long and extensive. The materials started out being very primitive and are now very advanced. Golf, in general, is defined by physics and manufacturers are using this to develop better technology that will have a greater impact on the future of the game.

INTRODUCTION

Golf is one of the oldest games played in our current sports landscape. It is a relatively simple game. The main objective is to hit, using different “clubs”, a small ball into a small hole in the ground, known as the “cup”, in the least strokes possible. This is repeated on 18 different holes consisting of different lengths and sizes. Each hole has a different par rating representing the normal number of strokes it should take to make the ball into the cup, depending on its length. The most common are par 3, 4, and 5. The game materials used have evolved drastically from its beginnings as we now see very advanced clubs and golf balls being used by professionals on a weekly basis. The popularity of the game, through sports broadcasts and the increase in number of golf courses, has made it a very popular game to play for players of any skill set and, with the help of golf manufacturers, improvements to the golf clubs and golf balls have helped make it easier for people to play. These technologies include the oversized driver and the hybrid iron clubs. As the technology improves, golf becomes even more exciting and fun to play for those at every level.

HISTORY OF GAME

It is generally accepted that the game of golf was developed in Eastern Scotland in the 1400s [2]. The oldest known picture of golf has been found in a Flemish manuscript of 1500-1520, at a British museum. It shows two men putting at the cup while another man, nearby, is addressing his impending tee shot [1]. This proves that the game and its rules have been relatively unaltered for nearly 500 years. Gowf, as it was originally known in Scotland, was becoming so popular that an act of parliament was created to prevent the game from being played on Sunday to preserve archery [1]. Popularity continued to rapidly grow to the point that during 1750-1850, good players began to gather for “meetings”, which started the tournament format that we know of today (most notably stroke-play and match-play) and basically created the distinction between amateurs and professionals [1]. The first Open Championship (British Open) was held in 1860 and the PGA was founded in 1916 [3]. The game has since been expanded all over the world with a high influx of players in the United States and a large emergence in East - Asian countries. Professional golf has become so profitable that winners of larger tournaments can make over 1 million dollars per event.

CLUBS

During the early stages of the game of golf’s development, golf clubs were very primitive, being made by hand. They were originally of wooden material and varied greatly in shaft length and face loft. However, blacksmiths began to develop clubs made of metal, where the term “irons” come from, which resulted in heavy and crude clubs that were difficult to use [4]. This was, originally, unsuccessful until drop forging, the process of raising a hammer and then dropping it onto the material to deform it to a certain shape, was developed in the early 1800s [4] which resulted in better irons and the ability for mass production.

It wasn't until around 1910 that factories began to mass produce wooden golf clubs because of the increase in popularity of the game [4]. Grooves were added to the club face around 1908 to achieve increased backspin and longer distance. Steel shafts completely replaced the previous wooden shafts by the mid-1930s. Since the 1980s, computers with computer-aided design (CAD) software have been widely used to design modern golf clubs. Club design specifications have since been regulated by both the United States Golf Association (USGA) and the Royal & Ancient Golf Club of St. Andrews (R&A), which has become a limitation for new technology by manufacturers.

BALLS

Similar to, and possibly more than, the clubs, golf balls have seen many changes throughout the game's history. Just like clubs, the ball originally was made of wood. In 1618, the "featherie" was introduced [5], which was a handcrafted ball characterized by being composed of goose feathers tightly packed into a horse hide sphere. These tended to be rather expensive, sometimes even costing more than the average club. In 1848, the "guttie" replaced the "featherie" [5]. It was made from the rubber-like sap of the gutta tree, which was heated and then formed into a sphere. These were cheap and could be easily repaired; however, they didn't travel as far as the "featherie". In 1880, a raised spherical bump pattern called "bramble" was added to the "guttie", which replicated the distance of the "featherie". Mass production soon started. Around 1900, the one-pieced rubber core ball was universally adopted and the dimple pattern was added in 1905 to achieve a ball that resembles the modern form [5]. The ball was standardized by both the R&A and USGA according to size, weight, and shape. However, they were different until around 1990. The current standards are a weight of no more than 45.93 grams, a diameter of no less than 42.67 mm, and a spherical symmetry [6].

PHYSICS

The basic physics that describe the game of golf deal with the principles of momentum and energy conservation. The velocity of the club head imparts an impulse on the ball at impact. Energy is then transferred from the club head to the ball and the ball is given an initial velocity, spin, and launch angle. The coefficient of restitution helps describe the relationship between the club head speed and the ball's initial velocity [6]. A harder ball will produce greater distance because the ball deforms less and energy is transferred more efficiently. Another characteristic of the club that affects the motion of the ball is the lie angle, which is the angle between the club shaft and the club face. For example, a club like the driver has a small lie angle and will produce the most distance, which is why it is usually the first club used on the hole. The "irons" have larger lie angles, which allow for higher trajectory shots and more spin. The irons are classified by their number generally ranging from 3-9 with the 9 iron having the largest lie angle. Some specialty clubs exist that produce even more spin and control. These are the wedges, similar to the 3-9 irons, but are used for more precise shots such as sand shots and pitching around the greens.

The grooves on the clubs are either square shaped or v-shaped; they help control the spin of the ball. This works because the grooves grip the ball during impact, which increases the generation of backspin and will allow the ball to gain loft and stay in the air longer. Without the grooves, players would not be able to as easily control the distances that the ball goes. The golf ball dimples also play a vital role in the motion of the ball. Dimples delay boundary layer (the thin layer of air surrounding a ball during flight) separation and decrease wake turbulence [7]. The effect is a ball that feels less drag and an increase in lift and allows the ball to travel further. By

knowing the physics behind the game of golf, manufacturers are creating new technology that will further advance the accessibility and easiness of the game.

MODERN TECHNOLOGY

BALLS

There are many different golf balls currently on the market. The main differences between each of them are the types of core that they use. Almost all balls use some sort of urethane (a hard plastic-like material) blend as the outer cover, which helps with spin control. They usually have around 300-450 dimples on their surfaces to control variability in shot trajectory [7]. Most are made with solid cores, which rebound to provide better velocity and energy transfer. These solid cores are usually soft or hard, which determines the distance and spin. Hard cores will give a longer roll whereas soft cores will have a longer air time, but with a shorter roll. These two-piece balls are now made with low compression rates (around 30-70) [7] because of the softer covers. The effect is a lower driver spin and allows for higher launch and lower spin for farther carry. A new technology is the introduction of LDP balls (low drag performance) introduced in 2008 by TaylorMade and replicated by many others shortly after [7]. This technology is characterized by dimples designed with unique depth and edge angles. It has been shown that this creates better performance and longer distance. The drag has been shown to be reduced and the lift is maintained longer than compared with the old golf balls. This creates more consistency with iron club distances and reduces the negative effects of off-center hits.

DRIVERS

The drivers and fairway woods have been the most affected by new technologies. Once the transition to metal began, a more stable face was achievable and mass production soon began. The metal drivers create a greater moment of inertia resulting in straighter trajectories on miss-hits. Oversized drivers were introduced in 1991 with Callaway's Big Bertha [8]. These oversized drivers had bigger volumes, which allowed for larger impact areas. With the introduction of titanium as the common material for the driver head, drivers became lighter and stronger with more elasticity. This allowed the club to be swung faster and increase the club head speed at impact. The titanium heads also produce a spring-like effect with the ball springing off the club face. Current driver models tend to be composed of a titanium face and a carbon graphite composite top, which makes the driver the lightest club in the bag. Making it even easier to custom fit a club to a player is the ability to buy drivers with different lofts and launch angles that correspond to different swing speeds. Newer drivers are even adding weight ports to the base, which changes the center of gravity of the club. This is meant to compensate for players who hit slices, draws, or low/high shots (non-normal trajectories than the basic straight shot). They can be moved and adjusted to fit a certain player's swing preference.

IRONS

The major advancements in the irons have been the introduction of steel and graphite shafts. These allow for a smoother swing with a better momentum/energy transfer. A newer trend has been the introduction of hybrid clubs. These are clubs that mix the characteristics of a fairway wood and a long iron. They have a larger sweet spot and will produce a little more distance, but still retain the spin associated with normal irons. They are generally used as a replacement for long irons as they are easier to swing and have less margin of error (reduces the miss-hit).

PUTTERS

Putters are clubs that are used on the greens to hit the ball into the cup without much force. The basic action involves a pendulum motion of the club for smooth energy transfer to the ball so that it rolls rather than is pushed. Manufacturers are making many styles of putters including mallet putters (the more exotic putters with abnormal designs), belly putters (those that rest upon the belly), and blade putters (most common). The variety of choices allows the player to find a club that gives him the best ability to maintain that smooth pendulum motion. When making putters, manufacturers think of weight distribution, length, and center of mass/gravity. These factors all influence the path that the ball takes and will, hopefully, allow the player to make more consistent putts.

IMPACT

Advancements in the technology in the game of golf have had a tremendous impact on the way that golf is played. Players can now hit the ball faster, generate more spin on their shots, and hit a larger variety of shots. These improvements are making the game easier to play for amateurs and evening the playing field for professionals. Those who can take advantage of these new technologies will see better scores and have more fun playing the game. As technology continues to be developed it will be interesting to see how golf's governing bodies and its players adapt. As long as there are people trying to play better golf, there will always be room for improvement in the game and its materials needed to play it.

REFERENCES

1. History of golf. (1895, Jun 30). *The Washington Post (1877-1922)*. Retrieved from <http://search.proquest.com/docview/139621989?accountid=14749>
2. History of Golf [online]. Available: <http://www.golfing-scotland.com/history.asp#top>

3. History [Online]. Available: <http://www.pga.com/pga-america/pga-information/pga-america-history>.
4. D. Nicholls (1998, February). *The History of the Golf Club*. [Online.] Available: <http://www.home.aone.net.au/~byzantium/golf/ghistory.html>
5. Golf Europe. (1995-2013). *A History of the Golf Ball*. [Online]. Available: http://www.golfeurope.com/almanac/history/golf_ball.htm
6. J. Fritts (2002, Nov. 16). *The Physics of Golf*. [Online]. Available: http://ffden-2.phys.uaf.edu/211_fall2002.web.dir/josh_fritts/index.html
7. CBS Sports. (2008, Aug. 22). *The Advances in Golf Ball Technology*. [Online]. Available: <http://www.cbssports.com/golf/story/10946668>
8. GolfClubRevue. *Golf Club Drivers*. [Online]. Available: <http://www.golf-club-revue.com/golf-club-drivers.html>

Golf has been around since the 15th century, so it's had a lot of time to progress over the last 600 years. And as Nike pointed out in a series of ads last year, it really has come quite a long way. Hickory wood shafts dominated the game early because of how light they were to use, but their weight also made them fragile. In the late 1920s the USGA and R&A changed their policies, allowing for steel shafted clubs to be used in competition and, later on, graphite. The advancements in technology - combined with pro golfers actually being in good shape these days - has led to an explosion in distance. With the way the golf ball is designed these days, it simply flies way further than ever before and the club changes have made mishits far less penal than at any other point in history. While you still have to swing a golf club yourself, Technology has certainly had a big impact in the past 15 - 20 years. Changes shoes, balls, clubs, and equipment have made the game to be not only easier but also more enjoyable. By listening to commercials from manufacturers, you'll be able to improve your game drastically through stepping up the equipment(s) you use. Currently, the components inside a golf club are stronger and lighter compared to how they were 2 - 3 years ago. The average driver can weigh 50 grams lighter in comparison to previous generations of equipment. Most golfers prefer two-piece balls. As a golfer improves his or her game, he or she is most likely to utilize balls with a higher number of layers.

#3: Hybrid Golf Clubs.

How Golf Simulators Work?

Golf Simulator is one of the most popular and favorite pastimes for golf passionates when they are away from golf courses. And it is gaining popularity every day. Golf can't be played under the rain, as a result, many golfers pass a boring time in the rainy season while missing golf. They love to play in golf simulators at that time. Just like Computers, PlayStations, or even Telephones, Golf Simulators have come a long way with technological advancements. A complete golf simulator package includes. Golf Simulator is a package combining hardware and software. From Golf-In-A-Box to OptiShot Pure, their technology has covered everything regardless of your skill level. Read our OptiShot 2 Golf Simulator Review. 2. TruGolf.