

***From Gruden to Belichick:
The AI of John Madden Football***

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"They knew where we were going, what we were doing...They were in our playbook."

-Oakland guard Frank Middleton, on the Tampa Bay Buccaneers' defense (AP)

"[Belichick's] game plans change drastically from week to week and are particularly effective at exploiting mismatches in pass protection and coverage. He is known to help design a defensive strategy for any given week and then disguise it with a new package of blitzes and stunts."

-*The Houston Chronicle* on New England Patriot's coach Bill Belichick.(Duarte)

Super Bowl XXXVII pitted the NFL's #1 rated offense, the Oakland Raiders, against its #1 rated defense, the Tampa Bay Buccaneers. In the end, defense prevailed, with the Buccaneers intercepting Oakland quarterback and regular season MVP Rich Gannon a super bowl record five times. After the game, many of the Oakland players commented on how it seemed the Tampa defense knew what play they were going to run before they hiked the ball. Tampa's coach, Jon Gruden, was the coach of the Raiders the year before, and thus had an extensive knowledge of their offense. Tampa safety John Lynch even stated after the game, "Every play they ran, we've run in practice."(AP) The next year, however, a new defense would storm through the NFL playoffs, disrupting playoff record-setting quarterback Peyton Manning and winning the super bowl in an entirely different way. While Tampa's defense was certainly good, their knowledge of their opponent's playbook played a large role in the dominance they displayed in the super bowl. New England, on the other hand, relied on complicated defense designed by their coach, Bill Belichick.

These two varied approaches provide an excellent illustration of a dichotomy that exists in gaming AI; while some developers allow the computer opponent to "cheat" by using information and movements unavailable to the player, others try their best to create

a truly intelligent opponent. The use of “cheating” AI, though it is present in nearly every computer game, has been somewhat controversial. At the Game Developer’s Conference (GDC) in 1998, Stephen Woodcock, the moderator for the artificial intelligence roundtable, noted that “The foremost topic on the minds of most of the people present was that of building a ‘cheating AI.’” He states that the general consensus they reached was that this type of cheating should be avoided at all costs. In another discussion, however, it was mentioned that “a vocal minority of developers felt the move towards developing better strategic AIs was primarily a waste of time.” (Woodcock 1) These developers felt that “well-placed but thoroughly plausible unit placements (via judicious cheating on the part of the AI) would go a long way towards providing the player with an enjoyable gaming experience.” (Woodcock 1) The presence of “cheating” in game AI has not been the only issue discussed at these conferences. Many developers at the 1998 GDC felt that “too many games are still being developed without much consideration to the implementation of the computer opponents until very late in the production cycle.” (Woodcock 2) Artificial intelligence and its implementation has been an issue that has come to the forefront, especially with the recent improvements to graphics hardware have taken more and more of the visual processing load off of the CPU. However, while many game developers have looked at the progression in AI made by others in strategy and first-person shootersⁱ, or even in real-world applications such as robots, one genre has been entirely ignored: the sports game.

Sports games have, on the whole, been ignored by many in the gaming industry. Ernest Adams states that “sports games don’t get the respect from the developer community that they deserve.” He elaborates by saying that “With most other kinds of

games, if...the AI isn't smart enough to beat the player, it's possible to change the game itself to compensate for these problems. With sports games you can't do that." One title in particular stands out among sports games for the level of its artificial intelligence. EA Sports' Madden series has made a few significant innovations in the field of artificial intelligence that other games could certainly learn from. A good balance involving customizability and a limited amount of cheating AI has enabled the Madden series to please its community with a challenging, but not altogether impossible "hardest" difficulty level. By examining the development of the Madden series' AI, other genres could learn a great deal from how EA has learned from its mistakes by listening to its community in the development of the game's artificial intelligenceⁱⁱ.

In looking at the development of Madden's artificial intelligence, we will first examine the development of the Madden series on the whole, and then look at the improvements in artificial intelligence over the years. Finally, it is important to take a look at the community's view of the "cheating" present in Madden's artificial intelligence and listen to EA's response concerning how much of this "cheating" is actually present, and how much is myth.

The Development of John Madden Football

In 1986 Electronic Arts decided that it wanted to produce a football game. However, Trip Hawkins, one of the founders of EA knew that they needed some guidance from a football guru. Even in 1986, John Madden was known as one of the preeminent football commentators. The story of how Trip was able to get in contact with

John Madden varies depending on which source is used, with some indicating they met on an Amtrak train (Todd), while others insist that Trip had to track down John Madden in a parking lot as he left work (Holmes). Regardless of how they met, Madden agreed to help EA develop its football game on one condition: it had to be 11 on 11 football. "If it's not 11-on-11, it's not real football,' Madden said."(McClusky) EA had planned to release a football game that was seven on seven, but Madden simply stated that he wouldn't put his name on a product that wasn't real football. His inflexibility would serve as the impetus for EA Sports' later slogan "If it's in the game, it's in the game", denoting its attention to detail and realism within the sports genre.

The first version of Madden, John Madden Football, featured, as required, 11 on 11 football, but with only 16 of the actual 28 NFL teams. In addition, the initial version introduced the traditional play-calling screen that is still in use in all football games to this dayⁱⁱⁱ. However, this first version of Madden lacked the NFL and NFLPA licenses^{iv} that would allow later versions of Madden to use actual team and player names. (Holmes) Later versions of Madden, however, would greatly improve upon the features of the initial John Madden football.

The second version of Madden, John Madden Football '92, expanded the number of teams to the full 28 teams. Electronic Arts gained the NFL license for its '94 version and the NFLPA license for its '95 version. In addition, 1995 saw the introduction of "windowless"^v passing, a feature now present in all football video games. Madden '99 saw the introduction of Franchise mode, in which players could develop a team from season to season for up to fifteen years (Holmes). Madden 2003, in what ESPN Page 2 columnist Bill Simmons called "the most important video game ever released", added

online play capabilities to its PlayStation2 version. Simmons stated it best when he said, "How could anything this life-altering cost \$40?" The latest release in the series, Madden 2004, saw the introduction of Owner mode, in which players can control ticket and hot dog prices, hire and fire coaches, and build new stadiums, and the "Playmaker" feature, which allows dynamic blocking^{vi} and takes play-changing at the line^{vii} to the next level.

Thanks to its continual development of more features, Madden is the top-selling sports game of all time, with over 30 million copies sold (McClusky). While the addition of features have been important its success, Madden would not be nearly as popular without improvements to the artificial intelligence. The increasing complexity of the playbooks, graphics and animations, and control options, have allowed today's madden players to be more effective than ever, and without a competent computer opponent, Madden could never have achieved the popularity it has today.

The Development of AI in Madden

The artificial intelligence in the most current Madden is regarded as very competitive. While it still cannot accurately simulate the level of a human opponent, it does a very good job of providing competitive games at any level of play, and an excellent job of complementing the play of humans^{viii}. However, this level of play has not always existed. In fact, in the early days of Madden, the computer opponent was quite primitive. However, the development of two key facets, a learning algorithm and AI "sliders", played key parts in bringing Madden's AI to the level it is today.

The first two releases of Madden had similar issues with their artificial intelligence. The offense was too predictable and the defense played too conservatively. However, both of these issues were addressed in the release of Madden '93, which featured a more intelligent and aggressive AI (Holmes). The release of Madden '95 saw the computer's skill in play calling vastly increase. No longer could a player rely on the computer using a small selection of the playbook, as the CPU began to pick a wide variety of plays that one could see actually being called in the NFL (Holmes). The release of Madden '96 for Super Nintendo brought with it the innovation of having multiple skill levels. There was a rookie mode for beginners and tougher play modes for more experienced players (Holmes). However, none of these updates addressed the central problem for Madden: an ineffective running game.

For too long running the ball in Madden was an exercise in futility, while passing was almost always the best option to move the ball down the field. While the ease of passing the ball was mainly due to poor defensive back AI, the difficulty in the running game was primarily due to poor blocking by the offensive line. Runs up the middle were nearly impossible, as running lanes simply did not exist. However, the release of Madden '97 addressed this issue directly. Nolan Holmes' "History of Madden" states that this was "the first Madden in which players made good-quality blocks, allowing the runner to burst into the clear in realistic fashion." The running game is an issue that Electronic Arts has continued to address, to the point where Madden's running game is now widely regarded as the best in any video football game.

Despite Madden '97's focus on the running game, the artificial intelligence was still seen as the weakest aspect of that installment. It was (and had been in previous

versions) quite possible for a player to win multiple games using as few as one running and one passing play. The computer opponent obviously had no way of keeping track of the player's play-calling. Madden '98 addressed this issue by featuring a defense that would effectively counter any attempts by the player to run a certain play multiple times in a row. This was the beginning of what is today a very powerful defensive play-calling algorithm that forces players to use a diversified attack plan. It is extremely difficult, if not outright impossible, to win on the harder levels of today's Madden using only three or four plays.

While Madden '97 and '98 made the running game a viable option and forced players to diversify their play calling, passing the ball was still an overly effective method to move the ball down the field. In Madden '99, this ability was made much more difficult. Many reviews of Madden '99 commented on the game's impressive defensive AI. GameSpot's Stephen Poole states in a review of Madden '99:

This is far and away the most challenging computer opponent ever in a Madden game for the PC, leading some gamers to think their sudden inability to score as easily or as regularly as in past titles is because the computer is cheating - understandable, given how quickly defensive backs can converge on receivers while the ball's in the air and how quickly holes close at the line of scrimmage. But the more time I spend with Madden NFL 99 (and I've already invested quite a bit), the more I become convinced that it's simply a lot more realistic than previous versions...once you start playing with some guile by making appropriate substitutions and working all areas of the field, you'll start seeing enough success that frustration turns to challenge.

In addition to its improved defense against the pass, Madden '99 also improved the AI's situational awareness. Kevin Dick of Game-revolution.com described a situation in a review of Madden '99 in which he "recently played a game with San Francisco in Atlanta, and the bastards ran the clock down on me. They even ran the 'QB kneel' in the fourth quarter 'cause they knew I was out of timeouts." However, while Madden '99's

defensive AI was greatly improved, the offensive AI still struggled in the running game (Abner). The release of Madden 2000 finally addressed many of the AI issues gamers complained about with the introduction of a revolutionary idea: customizable AI.

In Madden 2000, Electronic Arts introduced a bold new concept to its artificial intelligence. They gave gamers access to sliders that changed certain attributes about the CPU AI. One could adjust the reaction time of defensive backs to throws, how aggressively the defense plays the run or the pass, how often the computer attempted to throw or run the ball on offense, how accurate CPU quarterbacks could throw the ball, and a number of other traits. The addition of sliders allowed players to change the game to provide an easier or more difficult opponent that worked for or against the player's skills. In addition, Madden 2000 took another step forward in providing a decent running game. CDMag's William Abner, in a review of Madden 2000, states that "running the ball is a delight as offensive linemen open up holes and running backs break tackles. The computer also has a much better grasp on the running game and can grind up yardage even on the most grizzled Madden gamer." The advancements and innovations made in Madden 2000's artificial intelligence brought Madden AI to the level it is today. By listening to its community and giving gamers the chance to adjust attributes of its artificial intelligence, EA greatly enhanced the Madden series in the view of its followers. Recent updates to the game have made minor enhancements, but many would agree that the reputation of Madden's AI is based primarily upon the improvements in Madden '99 and 2000.

Improvements to the AI in the last four versions of Madden have been more subtle than those introduced from 1997-2000. The improved play of defensive backs,

both in intercepting passes and in play away from the ball, has been noted in multiple reviews. In addition, the running game has continued to improve, as many sites have noted a marked increase in the ability to see the formation of holes and vast improvement in moving blockers such as the tight end, fullback, and offensive linemen^{ix}. Finally, the computer's play on the defensive line, especially at the end position, has improved dramatically (most noticeably in 2004). It is no longer safe to drop back ten to fifteen yards to get out of the reach of defensive linemen. The computer quickly recognizes this strategy and will either rush around the ends or bring blitzes from outside linebackers or cornerbacks. There is a much greater reward for stepping up in the pocket to throw the ball.

Madden's artificial intelligence has made great improvements in its fifteen year history. The community, however, is still a bit hesitant about the performance of the computer in certain situations. Accusations of the use of "cheating AI" in Madden have been present throughout the game's history. Whether or not these arguments are well-founded will be investigated later, but no history would be incomplete without an in-depth look at the community's reaction to this aspect of Madden's artificial intelligence.

"Cheating AI" in Madden - Fact or Fiction?

The topic of cheating AI is one of the more intense debates in gaming circles worldwide. The Madden series has been fairly good about avoiding this controversy, as very few reviews commented on it seeming like the computer knew what the player was going to do, but controversy still exists within the Madden community. There have been

two types of "cheating" that many feel exist in Madden. The nature of the computer to make improbable comebacks has garnered quite a bit of attention along with a noticeable improvement of the computer players' physical attributes on harder skill levels.

The subject of the computer's ability to make improbable comebacks and force nearly impossible turns of events in order to win games has been a topic of considerable debate within the Madden community. This debate has even gained recognition from sports authorities such as ESPN. ESPN columnist Bill Simmons provides an excellent description of this phenomenon in his recollection of the history of video game football:

This era <late 90's> also witnesses the dawning of the "No Bleeping Way Game," where you are playing out a "season" against the computer and doing a little too well, so the computer gets ticked and makes sure there is no bleeping way you are winning the next game -- dropped passes, improbable kick returns, random fumbles and so on. God, I hate the No Bleeping Way Game.

In a different article, Simmons mentions, "Everyone knows that football games have an "All right, this guy's playing like a wuss" trigger that activates something bad to happen." Many in the Madden community have debated the existence of an AI feature that allows the computer to perform incredible feats in close games in the fourth quarter. Some players have mentioned running backs breaking five sure tackles on the way to a game-winning fifty yard run, while others have mentioned muffed punts with less than two minutes to play and fumbles when attempting to run out the clock. Other players, however, merely point to a lack of experience on the part of these players, stating that they never come across such game play issues (boards.ea.com). If anything, this level of intense devotion shows the passionate following that the Madden series has been able to garner. The mere ability of the computer to perform such feats has caused many to talk about such instances with other people, further validating the social impact of Madden and its artificial intelligence. While the existence of "cheating" by the computer by

forcing inexplicable events is debatable, the presence of another type of cheating is undeniable.

When EA introduced different levels of play, something had to be done in order to make one level harder than another. One method of creating these different levels of play involved improving the physical attributes (speed, awareness, catching and throwing ability) of computer players, while decreasing the physical attributes of players on the human team. It is not uncommon to see a defensive lineman catch Michael Vick from behind^x. The existence of this feature has been somewhat controversial, as many players feel that it cheapens the experience by making up for the computer's lack of intelligence by giving it an unfair advantage. Many human players have expressed a desire to be defeated by more realistic play-calling and smarter defenses instead of physically superior teams. In addition to improved physical attributes, some players even feel that the computer can execute certain moves that are unavailable to human players. A post on EA's Madden message board by konami1238 asks, "am I imagining things or are AI's stud RB's [running backs] able to stutter-step through holes in a way that my control panel does not allow?"

The aforementioned ways in which the computer "cheats" have caused a mixture of reactions from the community. A voice that is rarely heard, though, is that of the game designer.

EA's response to AI Questions

Tim Martin, editor of sports-gaming.com, conducted an interview with Jeremy Strausser, the lead producer on EA's Madden 2004, a few months before the release of Madden 2004. He covered a variety of topics, including a few questions pertaining to the issue of AI in Madden. Strausser debunks a few of the "cheating" myths and confirms others. Finally, Strausser specifically addresses how changes are made to the game's artificial intelligence from year to year and how community feedback has made EA feel about the quality of its game, especially in the area of artificial intelligence.

The first question Martin asks involves the "comeback" cheating that was mentioned above. Strausser states that "believe it or not there is no special code in the game to make quarterbacks better when losing -- it's a function of the game where it's kind of kicking into play calling that's a little more aggressive." This response effectively debunks Simmons' "no bleeping way game" and the "comeback" myth. While this may disappoint some, many in the madden community have pointed out that playing smart football can effectively combat this perceived feature. In fact, entire websites requiring users to pay for help in stopping various techniques such as the no-huddle offense, blitzing, and Jerome Bettis^{xi} have sprung up.

On the subject of "cheating" by the computer on harder levels of Madden, Strausser responds that, "All-Madden really is boosting CPU awareness, speed, reaction time and how many times things get recalculated in a certain play. All-Madden is insanely hard and we make it that way intentionally." Electronic Arts takes a mixed approach in how to make the All-Madden difficulty level the hardest. While Strausser states the computer does compute more information in its decision-making, he also admits to increasing the attributes of the CPU team. Strausser also says that "there is a

way to go about doing that without cheating and not just giving them your plays", showing that Electronic Arts strives to avoid implementing a computer player that uses the method of Tampa Bay spoken of above, and instead works towards achieving the status of Belichick and his New England Patriots.

The overall impression that Strausser gives throughout his interview is that the artificial intelligence of Electronic Arts' Madden football series has reached a level where only tweaking and tuning is strictly necessary. He admits that certain aspects of the AI may need to be revamped in the future, but he believes that overall it is already at a very high level with which many are pleased. Even NFL players feel that the game provides an excellent approximation of reality. Washington Redskins running back Clinton Portis says that "In some ways, you can put on a game tape, and play Madden, and if you've got a good tape, you wouldn't know the difference." (McClusky) Safety Sammy Knight says "It's as close to NFL football as you can get from a video game. It really feels like you're in the game. It requires you to think, then react the same way as if you are in a (real) game."(McClusky) It would appear that Strausser's satisfaction with his company's product is well-founded.

AI the Madden Way

Electronic Arts' Madden football series has made many advances throughout its history, especially in the area of artificial intelligence. While other genres have often taken the spotlight when it comes to their advances in AI, the sports genre, and the Madden series in particular, has had many of its innovations ignored.

While there were many advances in AI for the Madden series, perhaps its greatest AI innovation was the introduction of sliders that allowed the user to adjust the AI to perform in different ways. This innovation is something that other genres could easily incorporate to add a level of customizability and user interaction that has not been seen before. It also shows the level of trust the designers have in their community and how responsive they are to the Madden community.

In addition to its innovations in customizable AI, the Madden series has also done an admirable job of avoiding "cheating" AI. The accolades of pro athletes and the propagation of myths concerning perceived "cheating" by the computer only serves as a testimony to the high level of intelligence present in Madden's computer opponents. While other genres are known for their prodigious use of cheating AI by allowing computer-controlled opponents to know their enemies' locations, see through walls, and use other methods unavailable to humans, Madden has largely strayed away from this method of winning.

On the whole, other genres could learn quite a bit from both the Madden series' artificial intelligence and its design process in general. EA has taken steps to listen to its audience and improve upon their complaints with every release. EA has added customizability to its artificial intelligence, allowing users yet another method of control and putting a lot of the emphasis on allowing a person to design a game play experience that is exciting for him. In addition, the Madden series has shown how putting AI at the center of the development cycle can result in exceptional game play. Strausser states in his interview that "when we tune or tweak something, it is adjusting the variables and creating new animations and writing whole new AI routines." The entire development

team is involved in AI changes in the Madden series. If other genres paid more attention to the advances in artificial intelligence made in the sports genre, and especially in the Madden football series, perhaps more games would have Bill Belichick-type intelligence instead of playing off knowledge of its opponent like Tampa Bay.

ⁱ *Half-Life*, the *Unreal Tournament* series, and *Black and White* are exceptional examples of these genres being lauded for their achievements in artificial intelligence.

ⁱⁱ Earnest Adams feels that “These people (sports gamers) know the game well; they’re not just casual watchers. Attention to the detail of the sport is critical.”

ⁱⁱⁱ An “A-B-C” window that features three plays side-by-side. The player can scroll up or down to see different plays, then press A, B, or C to select one of the three plays present. This format helped minimize cheating in two player games as one player was never sure exactly which play his opponent chose.

^{iv} Without the consent of the National Football League, EA could not use the actual names of the teams or stadiums, and without the National Football League Players’ Association license, they could not use real player names.

^v Before this innovation, passing “windows” for each of the available receivers existed on the screen. The new “windowless” passing was made available with better viewing angles and letters which “followed” the players to tell the user which button to press to pass to that player.

^{vi} See Appendix A for definitions of football terms.

^{vii} Players can now change plays with using audibles, a key feature that allows player to be more effective in adjusting to strange defensive packages and impending blitzes.

^{viii} The computer must simulate the actions of the ten players which the human does not control.

^{ix} On “sweep” plays where the interior linemen “pull” out of their block and run around the end of the line to provide extra blocking for the running back.

^x In real life this occurs with same frequency as pigs flying.

^{xi} Known as “The Bus” in real life, video game Jerome Bettis is known for his ability to break multiple tackles with relative ease.

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Appendix A: Football Terms

Taken from http://www.firstbasesports.com/football_glossary.html

audible: verbal commands shouted by the quarterback to his teammates at the line of scrimmage to change a play on short notice.

backfield: the area behind the line of scrimmage.

backs: the running backs; the halfback and the fullback.

blitz: a play where the defensive team sends players rushing towards the line of scrimmage as soon as the ball is snapped to try to sack the quarterback.

blocking: the act of preventing a defensive player from getting to the ball carrier; blockers use their arms and bodies but may not hold an opponent.

call a play: instruct players to execute a pre-planned play.

complete pass: a forward pass to a teammate who catches it in the air.

controlling the game clock: the use of tactics by an offensive team to either save or use up time on the game clock, which often dictates its choice of plays.

cover or coverage: preventing a player from gaining yards; in pass coverage, a defender follows a receiver to prevent him from catching a pass; in kick coverage, members of the kicking team try to prevent a long kick return.

dead ball: a ball becomes dead when a play is over and becomes live as soon as it is snapped for the next play.

down: one of 4 chances a team on offense has to gain 10 yards; also, the state of a player who has just been tackled; also, a ball that a player touches to the ground in the end zone to get a touchback.

drive: the series of plays a team puts together in an attempt to score.

drop back: when a quarterback, after taking the snap, takes a few steps backward into an area called the pocket to get ready to pass.

eligible receiver: a player allowed by the rules to catch a forward pass; all offensive players are eligible except linemen and the quarterback, who must notify the referee if they wish to become eligible and stand at least one yard behind the line of scrimmage before the snap.

end zone: the area between the end line and goal line bounded by the sidelines, which a team on offense tries to enter to score a touchdown.

franchise: a team; the legal arrangement that establishes ownership of a team.

fumble: when a ball carrier loses possession by dropping the ball or having it knocked away before a play ends; the first player to regain possession of the loose ball is said to make the recovery, and his team becomes the offense.

goal line: a line drawn across the width of the field, 10 yards inside each end line, which a team must cross with the ball to score a touchdown.

interception: a pass caught in the air (picked off) by a defender whose team immediately gains possession of the ball and becomes the offense.

line of scrimmage: an imaginary line which no player may cross before the snap; each team has its own line of scrimmage, separated by the neutral zone.

lineman: a player who starts each play within 1 yard of his line of scrimmage.

NFL (National Football League): the major professional football league in the U.S. with 32 teams; its headquarters are in New York.

pass defender: a defensive player who covers an opposing receiver.

pass patterns or pass routes: pre-determined paths receivers follow to help the passer quickly locate them so he can more easily get them the ball.

pass protection: blocking by offensive players to keep defenders away from the quarterback on passing plays.

pass rush: a surge by defenders to get past blockers and sack the quarterback.

play: a spurt of action that begins with a snap and ends with a dead ball.

playoffs: the post-season tournament that determines the NFL champion.

pocket: the area behind the offensive line, where the quarterback is protected by his blockers.

point-after-touchdown (PAT): a place kick taken from the opponent's 2-yard line (3-yard line in college); awarded to a team that has scored a touchdown, it is worth 1 point if it goes through the goalpost.

possession: to be holding or in control of the football.

punt: when a player 10 yards behind the center catches a snap, drops it and kicks it before it hits the ground; an opponent tries to catch and advance it the other way.

quarterback: the leader of a team's offense, he takes the snap from the center and either hands the ball to a running back to run with, passes it to a receiver or runs with it himself; he also communicates each play to his teammates.

reading the defense: recognition by the quarterback of the defensive formation; he may then call an audible to adjust the offense.

receiver: an offensive player who catches or attempts to catch a forward pass.

return: an attempt by a player who has just caught an interception, punt, or kickoff to advance the ball the other way.

roll out: when a quarterback runs parallel to the line, looking for a receiver.

rush: a running play; also, a pass rush.

sack: a tackle of the quarterback behind his line of scrimmage.

scrambling: evasive movements by a quarterback to avoid being sacked.

series: the group of 4 downs a team has to advance 10 yards.

sideline: the boundary line that runs the length of the field along each side; a ball carrier or ball that touches or crosses the sideline is out of bounds.

Super Bowl: the championship game of the NFL, played between the champions of the AFC and NFC at a neutral site each January; it is the culmination of the NFL playoffs.

tackle: a player position on both the offensive and defensive lines; there is usually a left and right offensive tackle, and a left and right defensive tackle; See also tackling.

tackling: contacting a ball carrier to cause him to touch the ground with any part of his body except his hands, thereby ending the play.

touchback: when a player who gains possession of a ball in his own end zone kneels to the ground and automatically starts the next play at his own 20-yard line; also awarded if his opponent kicks the ball across the end line.

touchdown (TD): when a team crosses the opponent's goal line with the ball, catches a pass in the opponent's end zone, or recovers a loose ball in the opponent's end zone; earns a team 6 points.