RUNNING HEADER: HAWK EYE SYSTEM

Human Lineman vs. the Hawk-Eye System

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**Abstract**

With the introduction of automated tracking systems like the Hawk-Eye to many different sports such as tennis, there have been several mixed reactions among the fans and players as to the effectiveness and accuracy of these systems. The purpose of this research is to compare the effectiveness between the Hawk-Eye electronic system and a human lineman to determine which of the two is more accurate and reliable than the other, in the game of tennis. This research paper utilizes 10 research articles, a multiple question survey, and a face-to-face interview to review the effectiveness of the two options to determine if the electronic system is more accurate than the human lineman. After conducting the research and collecting all the data, the study does give evidence to the Hawk-Eye system being more accurate in determining the location of the ball as well as finalizing difficult or challenged calls compared to the human lineman.

**Literary Review**

This study reviews 25 different articles but utilized ten to research the different aspects of the Hawk-Eye system and its relationship to both tennis players and spectators. John Crim (Crim, 2013) introduced the basic layout of a tennis court, the rules of what causes the ball to be in or out, and finally who is responsible to make that call. The next articles were studies by Collins (Collins, 2008) and gave the history of the system as well as how it operates. Collins Explains that the Hawk-Eye system was first introduced in the game of cricket as an aid to the officials and was later introduced to tennis after the system implementation of high-speed cameras as both an aid to the officials and a training tool for coaches. Other articles done by Yan Baodong (Baodong, 2014) and François Rioult (Rioult, 2017) explains how the system operates and the system’s data analyzing capabilities. Baodong explains that the system utilizes eight to 10 high speed cameras at different points on the court to triangulate the location of the ball and where it will potentially land, which the system then displays on a monitor. François Rioult (Rioult, 2017) adds on to this by giving examples of what kind of calculations the system can perform with an example being when it comes to a player’s winning their first serve, what surface are players most successful on, are men or women more likely with a win on their first serve, and if speed has any effect on the success of the serve. Despite all the impressive capabilities if the system, Dureja Gaurav (Gaurav, 2006) argues that when it comes to these studies, they do not account for all external factors that could affect the system such as hardware malfunction and human error which can corrupt the data presented making it not as accurate as originally presented. Peter Bodo (Bodo, 2013) also supports the claim that the system is not as accurate as originally claimed and how the system takes away from sport as a whole. The articles written by Joseph (Joseph, 2019) and (Productivity Solutions, 2020) look at both the advantages and disadvantages of the Hawk-Eye system. Although they have the same perspective as (Gaurav, 2006) and (Bodo, 2013) in that the system is not as accurate or reliable as originally thought, they also bring arguments against this claim and state that the system has still drastically improved the accuracy of the call made by the officials. Steve Tingor (Tingor, 2020) and Van Sias (Sias, 2017) further support this claim by giving real world examples of how the Hawk-Eye has either proven the accuracy of a call or has helped finalized a challenge given by a player.

Collins and Evans (Collins, 2008) in the Journal of Public Understanding of Science, which is a journal that examines the public’s understanding of multiple different topics and if they are correct or misleading, explain how technology has advanced significantly over the years and how Hawk-Eye is the logical next step moving forward when it comes to sports innovations. The system uses multiple cameras to track the path of the ball and displays where the ball landed as shown on a monitor. In the early years, the Hawk- Eye system used pre-existing broadcast cameras. Today the system has transitioned to high-speed cameras to improve the accuracy of the system. Hawk-Eye was the only tracking system to pass strenuous International Tennis Federation (ITF) testing. ITF testing is a system used by national tennis organizations to test these kinds of systems. Collins and Evans (Collins, 2008) give multiple examples of other sports that utilized the Hawk-Eye system as well as its main purpose of tracking and data analysis. The first sport to use the system was cricket. As part of training, the tool would  give extra feedback as to how the players could improve. It was later introduced in 2008 as a tool for the referees to double check difficult plays. Another sport that utilizes the Hawk-Eye system is tennis. It is mainly used to help train players and finalize a challenge if a player disagrees with a call made by the referee (Collins, 2008).

John Crim (Crim, 2013), from *Tennis Companion,* a website that gives virtual instruction on the basics of tennis, covers information such as the serve, forehand and backhand technique, different tennis terms, and equipment needed for tennis. It also covers the basic rules of the sport, as well as how to treat tennis-specific injuries. Crim’s article (Crim, 2013) explains basic rules of determining whether the ball is in or out and the purpose of the two sets of lines on the outside of the court depending on whether the current game is for singles or doubles. Doubles is where a team of two compete against each other, or a singles match where separate individuals go against each other. Crim explains that in a singles match the line closest to the players is considered in, and in doubles the line farthest away from the player is the boundary. When the ball is hit in their side of the court and they see the ball go past the designated line, it is the responsibility of either the players themselves or the lineman to call whether the ball is in or out stating, “In these circumstances, players are responsible for calling balls in or out on their side of the court. A ball is in if it touches any part of the line ” (Crim, 2013). He also states that the player is allowed to contest the ball under specific circumstances stating, “In professional tennis, players are allowed to challenge up to three line calls per set at any point. However, a player must call a challenge on a point-ending shot or when the player promptly stops playing the point” (Crim, 2013).

Yan Baodong (Baodong, 2014) from Yulin University in China explained the basic operation of the Hawk-Eye system. The system uses eight to 10 high-speed cameras to track the location of the ball and display where it lands on monitors.  “The whole arena decorate 8~10 sets high-speed cameras, at a speed of more than 2000 FPS/s for images, easy to capture the tennis trajectories and placement of the data; Second, to transmit the data to the computer, through the system operation can generate tennis trajectories and placement of the 3 d image; Finally, through the real-time imaging technology, these images clearly displayed on the electronic screen, the entire data collection to late the imaging process of no more than 10 seconds, often used in the process of the television” (Baodong, 2014). He then looks at Hawk-Eye’s effectiveness over both the U.S. Open, and the United States Series. In the United Stated Series, challenges were called 839 times. The Hawk-Eye system disproved line judges 327 times, overturning 39% of calls. Finally, for the U.S. Open, a challenge was called 939 times, the system disproved the official 327 times, overturning 35% of the calls.

François Rioult discusses the Hawk-Eye system in Hal Open Science (Rioult, 2017), a website that talks about the different types of technology such as computers, software, and other devices that are used in the real world. This article (Rioult, 2017) shows the capabilities of the system by looking at the success rate of different payers in different circumstances. The study looks at the Association of Tennis Professionals (ATP), the Women’s Tennis Association (WTA), and the Grand Slam Tournaments between 2003 and 2008. The study (Rioult, e2017) looked at factors such as the gender of the player, the court surface, the speed of the serve, and the location of the player as the serve was taking place. After considering the weight force of the ball, the drag force, and the magnus force, the study found that when playing on clay, players won their first serve 66.28% of the time while losing 33.72% of the time. They won their second serve 52.24% of the time while losing 47.76% of the time. For grass players, they won their first serve 71.19% of the time and lost 28.81% of the time, while winning second serve 54.85% of the time while losing second serve 45.15% of the time. On hard courts the players won their first serve 68.34% of the time while losing 31.66%. They won their second serve 52.68% of the time, while losing 47.32% of the time. Finally, for indoor courts, the player won their first serve 72.01% of the time, while losing 27.99%, and won their second serve 53.03% of the time while losing 46.97% of the time (Rioult, 2017). Gender was also found to have an impact (Rioult, 2017). Rioult and colleagues found women winning their first serve 62.85% of the time while losing 37.15% of the time. The study also found women would win their second serve 49.43% of the time and losing 50.57% of the time. Male athletes were found to win their first serve 71.00% of the time while losing 29.00% of the time.  Male athletes won on their second serve 54.18% of the time while losing 45.82% of the time. The study also found that the speed of the ball greatly increased the success rate of both the first and second serve (Rioult, 2017).

Dureja Gaurav from the Journal of Public’s Understanding of Science (Gaurav, 2006) takes a neutral approach and talks about how sometimes people do not gather enough data and make judgments on incomplete studies. In the case of systems like Hawk-Eye, the public can be misled to think that the system is more accurate compared to a human lineman since the system can predict where the ball will land down to the last millimeter. But the public usually does not take into account all the external forces that could cause errors to both the cameras and the system reading. For example, if the cameras of the system have a malfunction the data cannot be displayed on the monitors. Another example is if during the assembly process the cameras could be out of alignment and not synced together properly which causes the data collected to be inaccurate. It is important to understand that although Hawk-Eye has a significantly smaller error margin compared with the human eye, it is not perfect and can be prone to significant miscalculations. For example, if you calculate the location of 10 total serves, 99% of them will have a 2.6 standard deviation, but have a 5% chance for Hawk-Eye’s predictions to be greater than about 9 mm, and 1% be greater than 11.7 mm (Gaurav, 2006). When people make judgments on a new item or something they are unfamiliar with, it is important for them to make sure all variables are accounted for as well as have enough experiments to cover all real-world situations.

  Several articles (Tingor, 2020; Joseph, 2019; Bodo, 2013; Sias, 2017; Productivity solutions, 2020) explain the public’s response to the system and their reasons why it should either stay or leave. Steve Tingor from Tennis.com (Tingor, 2020), a site that writes essays and journal articles about what is currently happening in the sport, discusses the different reasons as to why the system should be used in professional tennis. Tingor used an example of the 2020 tournament in Greenbrier, West Virginia. Carlos Silva, CEO of World Tennis Team (WTT), reports that a spectator commented after viewing the match, “Imagine if we were using replay there, and one team didn’t have any challenges left? That’s a half-a million-dollar point. The wrong team could have won, and there’s nothing we could have done about it” (Tingor, 2020). With the amount of money or prizes on the line in some of these games there can be a lot of tension in determining who gets the winnings. Another spectator who was also a former player commented, “The speed of the shots has passed a human’s ability to say whether the ball is in or out. Now that just about everyone is serving 120 [m.p.h.] or more, and people are hitting 100-m.p.h. forehands, we should stop pretending that it’s possible to make those calls” (Tingor, 2020).

Peter Bodo (Bodo, 2013) who also works with Tennis.com suggests against the use of the Hawk-Eye system on clay courts because of system has not proven itself very accurate on that surface. He states, “The technology was unproven and—as we came to learn—not quite as accurate as first thought” (Bodo, 2013). Another objection made by Bodo is the tradition of the umpire getting off the stand to personally check the ball mark. “This can be quite a spectacle, especially with a portly umpire. Let’s be honest about this—haven’t you secretly hoped that an official might tumble off his perch in his hurry to get down, or rip the back of his trousers as he dashes over to study the mark left by the ball?” (Bodo, 2013). A third objection made by Bodo is that the system is not required because of these distinct marks left on the court and both the umpire and players being able to distinguish the difference between it and extra material that had been kicked up (Bodo, 2013).

Joseph who is from the web site *Advantages and Disadvantage* (Joseph, 2019), which is a site that writes articles about the pros and cons of different subjects, from sports and medicine to the military and owning a pet, explains in his article both the advantages and the disadvantages of having the Hawk-Eye system implemented in tennis. Some advantages discussed by the article were the system allows the umpires and referees to be more efficient and prevent them making decisions that could turn the game to the favor of a specific player. The system can also allow the officials to make more accurate decisions to finalize calls in way players don’t feel cheated (Joseph, 2019). Some disadvantages the article discusses are even though it is much more accurate compared to the human eye, there is a margin of error with the article , “In tennis, there’s a 3.6 mm error margin. Some would argue that the error margin is too large, and the Hawk-Eye technology should be even more accurate” (Joseph, 2019). Another objection to the system being implemented is that the system is prone to failure if the cameras or software are not taken care of properly which puts more work on the officials, and it takes away from the natural beauty of tennis.

Van Sias from Tennis.com (Sias,2017) explained the importance of implementing the automated system over human lineman by giving several examples of how the system was able to be the deciding factor in very difficult calls that would not be possible for the human eye. One example (Sias, 2017) during the 2012 U.S. Open title match happened when Andy Murray served for his first Grand Slam and won the match by the slightest margin against Novak Djokovic. Another example given was at the 2015 Australian Open, where Venus Williams played against Agnieszka Radwanska with sister Serena in the stands. A questionable call went against Venus which Hawk-Eye could have confirmed if the system was in place at the match (Sias, 2017). A third mention by the article is the 2017 Hopman Cup where world great, Roger Federer, called a serve out on Alexander Zverev. When the officials checked the Hawk-Eye system, it showed the ball was in giving Zverev the point (Sias, 2017).

The next article reviewed (Productivity solutions, 2020) was one written by online Productivity Solutions which is a website that talks about many different types of technology ranging from computers and applications to marketing and improving the cloud of a system. Some advantages of the Hawk-Eye system that the article identified include how it allows the officials to be more effective in going through and finalizing calls that are challenged, the system makes less errors compared to a human lineman watching the ball, and finally the system improves morality of both the players and spectators making them less likely to feel cheated. Some cons of the system that are brought up in the article (Productivity Solutions, 2020) include the system has become extremely expensive to operate and maintain so some smaller courts cannot afford it. The system still has an error margin that is too high. Finally, it was found that the system slows down the game because it takes time for it to process the given data to make a decision.

**Research statement**

This research paper looks at the effectiveness of the Hawk-Eye system, compares its pros and cons, the overall function of the system, the overall reaction of both players and fans to the human lineman to determine which is more accurate, and finally if the Hawk-Eye system should continue to be used or should they stay with human lineman or use another system.

**Population Statement**

The population that will be used in the interview is the Curry College men’s tennis team. This group consisted of 10 individuals between the ages of 18 and 22 and consisted of multiple different personality’s ranging from reserved and kind, to outgoing and sociable. The heights of players ranged from 5’7” to 6’2’’. Each member of the team comes from very different backgrounds with some of the players being from inner cities, others from suburban neighborhoods, and some from rural areas of the country. This helps to give a wider range of perspectives on the electronic system.

The method of collecting the needed data for this study was a survey given out to all 10 individuals of the men’s tennis teams and consisted of seven different questions. The survey first asked the players basic information, then asked if any of the players experienced or witnessed another player make a call they did not agree with or one that was difficult to call. It then asked them if they have heard of the Hawk-Eye system, what they thought about the system being implemented in professional games, and if they feel an electronic system is more effective at finalizing calls compared to a person. The coach of both the Curry College men’s and women’s tennis team was then asked to do an interview which he agreed to and was asked similar questions.

The first step was to contact the coach and get his approval to interview the team, as well as a request for a private interview. I decided to send out an email on either a Sunday or Monday to give a week for them to respond, and either approving the meeting or prepare for other alternatives if needed. Once a response has been received, give another week for either a response on when the meeting will work best for both the interviewer and coach or reach out to another source of information. For this specific interview, the coach approved the meeting and scheduled a meeting time to answer questions. After the coach answered the given questions and approved the questions of the survey, I gave the coach two weeks to both inform the team about the survey and to collect the data from all the active players. For those who had not responded in the first week, a reminder was sent about completing the survey and collecting the data. After the data was collected and the coach was interviewed directly, a week was set aside to analyze the data for any patterns, contradictions, or substantial abnormalities worth sharing in the written report. After the data had been analyzed, a final week was taken to convert the given data into graphs and charts and well as use these charts to write an analysis on what the players know about the Hawk-Eye system and how they feel about it being used in professional matches.

**Research summary**

After reviewing multiple research articles to determine whether the automated tracking system, Hawk-Eye, or a human lineman was better, a survey was carried out to get an understanding of the Curry College men’s tennis team’s perspective of the Hawk-Eye system and determine whether the electronic system was superior to the human linemen. A multiple question survey was sent out to 10 members of the Curry College men’s tennis team. The team consists of players who come from multiple different backgrounds and have a variety of experience when it comes to playing tennis. A face-to-face interview was also conducted with the coach of both the Curry College men’s and women’s tennis team to get a third perspective that most other people may not consider. Out of the 10 players who received the survey, only four individuals actively participated (40% response rate), and all statistics calculated in this research were based on those four individuals.

The survey given to the players consisted of seven different questions in total. The four players that responded each completed all seven questions in the survey. The first question asked if the participants had consented to participate in the survey. Of the four individuals participating in this survey, the results showed 100% of the participants giving consent to complete the survey and continuing to the following six questions. In the second question, the participants were asked their current year of study at Curry College. The results showed that all respondents had been with the team for multiple seasons. 75% of the participants were found to be in their senior year at Curry College, while 25% of participants were in their junior year. None of the players were in their sophomore or freshman year at Curry College.

In the third question of the survey, the participants were asked how long they have been playing tennis on the Curry College tennis team. Of those who participated, the results indicating that the players had a total time span of two to five years of play. 25% of participants reported having been playing tennis for two years, 25% of the participants having been playing tennis for three years, 25% of participants having been playing tennis for four years, and finally 25% of participants having been playing tennis for five years. These results seem to indicate that the number of years a member played tennis before joining the team varied greatly

The fourth question in the survey asked the players if they had witnessed a player challenge a call made by another player or the official. Of those who participated, the results show that multiple players had experienced other players being unhappy with the official’s decision. 75% of them had in fact witnessed a player challenge the call of an official either in the match against them or against another player, while 25% claimed they had not witnessed a player challenge a call made by a referee in a match against them or another player. Although this survey did not allow the participants to elaborate, it would have been interesting to hear examples of what they had witnessed. The fifth question of the survey asked the participants if they have ever heard of the Hawk-Eye system, or other electronic tracking systems, and do they know what the system is used for in tennis. The results of the survey show that 100% of the participants in fact had heard of an electronic system such as Hawk-Eye as well as knew of its function in the sport of tennis. This result indicated that all participants had a variety of knowledge when it came to the Hawk-Eye system from having heard of the name to knowing what the system is and what its purpose is in the sport.

The sixth question in the survey asked the participants if they agree with the use of the Hawk-Eye system being used in professional matches and allowed them to respond with strongly agree, agree, neutral, disagree, strongly disagree. A Likert questionnaire was given to the participants with the results indicating that none of the participants strongly agreed with the used of the system in professional matches. 75% of participants agreed with the electronic system being used in professional matched, none of the participants were neutral on the system being implemented in professional matches, 25% of participants disagreed with the electronic system being used in professional matches. These results further indicate a mixture of responses to the system being utilized with most of the participants in agreement that the electronic system should be used while some disagree with the system being used which follows the repeated pattern that has been witnessed throughout this research,

The final question of the survey asked the participants whether they believed a human lineman is more accurate in finalizing difficult calls or the electronic system would be more accurate at finalizing difficult calls. The results of the survey showed that 75% of participants believed that the electronic system is more accurate of the two at finalizing difficult calls and 25% of participants believed that the human lineman was more accurate than the two system when finalizing difficult calls. Although this question did not allow the participants to elaborate, it would be interesting to view their thought process on how they were able to make that decision.

For the interview conducted with the Curry College men’s and women’s tennis coach, six questions were asked that were almost identical to the player survey but one question was changed and one removed. After consenting to being interviewed, the first question was how long had he been playing tennis. The coached explained he had over 35 years of experience in the sport as an active player, a coach, as well as a referee. The next question in the interview asked how long he had been coaching at Curry College. His response was that he has been a part-time coach for five years but had coached at different schools for a total of 10 years. The third question in the interview asked if he had witnessed any players challenge a call made by other players or officials. His response was he had in fact experienced times where players have challenged calls, both when he actively played and during his time as an official. The fourth question asked was if he had heard of the Hawk-Eye system. His response was yes he had heard of the Hawk-Eye system as well as other electronic systems for tracking the ball. These systems include a pad that lays underneath the court and would detect where the ball landed as well as a laser-guided system that would track the location of the ball and display its location on a monitor. For the fifth question, the coach was asked if he agrees with the Hawk-Eye system being implemented in professional matches, and he agreed with the use of the system being implemented. For the final question of whether he feels the electronic system or a human lineman is more accurate, the coach response was that he felt that the electronic system was more accurate compared to the human lineman.

After reviewing the data collected from the Curry College tennis team, it was revealed that three of the four participants understood what the Hawk-Dye system was, with one player not knowing what the system was or how it was used in the sport. Three of the four participants agreed with the use of the system in a professional setting while one did not. Finally three of the four participants believed that the Hawk-Eye system was more reliable in finalizing difficult calls with one participant believing that the human lineman was more reliable in finalizing difficult calls. For the interview with the coach. The data collected revealed that he had witnessed many players challenge the calls he made, as well as the calls of other players and officials. He understood what the Hawk-Eye system was, and was familiar with other similar systems. He agreed with the system being implemented in professional matches, and believed that the Hawk-Eye system was more reliable compared to the human lineman. From the data collected, both the players and the coach gave further evidence of the opinion that the Hawk-Eye system is more accurate than the human lineman.

**Conclusion**

In tennis, the correct judgement calls by the officials can make all difference when it comes to whether a player has a professional career, or they simply fade into obscurity. Prior to the routine use of computer technology in sports, teams, players, and fans relied on the judgement calls of the officials based on what they saw and heard. Now in the age of technology, we have computerized options like the Hawk-Eye system that help us determine what occurred during play. With the speed of tennis balls in play, this technology can be very valuable on the court. After reviewing 10 different articles on the subject, four articles stood out for their importance and contribution to the subject. These articles review the importance of unbiased perception and judgment of before reaching a conclusion, giving the basics rules of tennis, describing how the Hawk-Eye system functions, and what the Hawk-Eye system is capable of. Overall, there are both some advantages and disadvantages of implementing the Hawk-Eye system in professional tournaments, and the tennis public has opinions about the system. Four Curry College tennis players, along with the Curry College tennis coach have opinions as well. The research conducted shows there is more evidence in favor of the effectiveness of the Hawk-Eye system in the sport of tennis, and proves that the Hawk-Eye system is superior over a human lineman in making accurate and reliable calls to finalize a challenge to the decision.

In the game of tennis, there are two distinct lines found on either side of the court. Depending on whether the match is a single or a doubles match will determine the boundaries of a tennis court. The lines closest to the player is considered in bounds when playing a singles match. In a doubles match, the lines farthest away from the players are considered in bounds, which makes the playing court larger to accommodate two players on each side of the net. Depending on where the player is on the court as they are moving around, their perception of where the ball lands can change. Having a stationary system containing eight to 10 high-speed cameras with multiple different angles feeding all the collected data into a single system allows for a more accurate understanding of where the ball landed. This can happen without having factors such as the speed of the ball, the angle of the return, or the angle of the player themselves interfere with the perception of the ball’s location. The high-speed camera used in the Hawk-Eye system also allows it to accurately detect minor changes in the movement in the ball, which allows it to be very useful when it comes to training new players or gathering statistics on how different courts affect the serves of different players. As demonstrated through the research collected, the Hawk-Eye system can determine the success rate of a player’s serve on different material court materials, like grass, clay, or hardcourts, with the system determining in the end that players have the most success on grass courts as compared to hardcourt or clay. The system was also able to distinguish that the indoor or outdoor location, as well as the gender of the player has a part to play in the success rate of their serve. Data using Hawk-Eye was able to find that players have a greater success rate of winning a serve on an indoor court compared to an outdoor court, and that male players are more likely to win their first serves compared to female players. Despite having a much higher accuracy rate compared to a human lineman, it is important for people to not immediately judge something after a few studies. They need to ensure that they factor in all the possibilities that could affect the results for the data and the conclusion to be accurate. Whether it is internal factors, like how the margin of error factors in to the study as a whole, or external factors such the cameras having a malfunction or one camera not being synced with the others, the data risks being incorrect. It is important that the study includes all possible factors in order for the best results to be achieved.

It was found through the given research that the Hawk-Eye system was first implemented in the game of cricket, as a tool to help confirm the officials calls as far back as 2004. It was also later used as a training tool to help player’s performance improve, and give them a more precise picture of what they needed to do to improve their techniques. Over time and the advancement of technology, the system transitioned from traditional cameras to high-speed devices. The Hawk-Eye system was specifically introduced to tennis in 2006 as a training tool to improve players’ performance in the sport, and eventually became the only automated tracking system to pass the test and stringent requirements given by the International Tennis Federation. After this initial success in the tennis world, the Hawk-Eye system was later used as a tool to improve the ball calls given by the referee, and used to finalize judgement of a challenged call. After the implementation of the system in tennis, there were mixed reactions by both the players and the spectators of the sport alike. Some agreed with the decision of its use, feeling that it was a good step in the evolution of tennis, while others felt the decision to use the system took away key element of the sport. For those who support the use of the Hawk-Eye system, the first point of support is when it comes to notable world tournaments with hundreds of thousands of prize dollars at stake. That one decision can make the difference between the rightful winner walking away with the money or them being unknowingly cheated out of what they earned. Another point in support of the system is that it is impossible for the human eye to keep up with a ball traveling 100 plus miles an hour and accurately tracking where it lands. A third point discussed is that the system allows the officials to make more reliable decisions for the integrity of the game. Preventing inaccurate final calls can prevent players from feeling cheated, as well as prevent the fans from being upset that wrong decisions were made by the officials. Several examples of these instances include the 2012 U.S. Open, when Andy Murray served for his first Grand Slam and Novak Djokovic called the serve out, but was later revealed to be in. Another is the 2017 Hopman Cup where Roger Federer called a serve out on Alexander Zverev but the ball was proven to be in giving Zverve the call.

On the other hand, those who are against the electronic system in tennis claim that the Hawk-Eye system takes away from tradition and history associated with the sport. One example includes the tradition that has been part of the sport for centuries, when the umpire comes down from their chair and checks the marks on the courts, which can be quite a spectacle for the audience. A second point against the implementation of the system is that it is not as accurate as originally predicted. Reports state that the Hawk-Eye system has a 5% chance of the error margin spreading to 9 millimeters, and a 1% chance that the error margin will spread to 11 millimeters. A third point against the system being utilized is that the Hawk-Eye system may not actually be needed for specific surfaces such as clay courts where there are distinguishable marks for the officials and players to analyze. An example of this is the tradition from the French Open, where referees climb down off their chairs and lean down to examine the marks made by the ball. This tradition has been happening for so long that officials have become specialized in distinguishing between spare pieces of clay being loosened by the impact and the location of where the ball landed on the court.

Although there were valid points from both perspectives, there was limited evidence as to the disadvantages of implementing the Hawk-Eye system, as well as limited real-world examples as to why the system should not be implemented. On the contrary, there was a wider range of examples given by the research in support of an automated system being implemented, giving real world examples of the Hawk-Eye system correcting an inaccurate call, as well as helping to finalize calls that were debated between the two players.

Similar results were found with both the interview and the survey conducted with the Curry College men’s tennis team, and with the interview with the Curry College tennis coach. Most of the players understood what the Hawk-Eye system was and how it was used in the sport of tennis. Most of the players had played tennis for enough years both on and off the tennis team, to have witnessed challenged calls by both players and the coach. Most of the Curry College men’s tennis players surveyed agreed with the implementation of the Hawk-Eye system in professional matches because they have witnessed other players challenge similar calls, as well as seen professional players arguing with the official on whether the call was in or not. Finally, although one Curry College men’s tennis player believed that a human lineman was more accurate in finalizing difficult plays, most of them believed that an electronic system like Hawk-Eye was more reliable when finalizing difficult calls or finalizing a challenge made by a player about a specific call.

Similar to the players, the face-to-face interview with the Curry College tennis coach revealed that over his multiple decade career as a player, a referee for multiple high school teams, as well as a coach for multiple college level teams, he has seen multiple different tracking systems and has witnessed many players challenge calls he has made. He has seen different players become confused as to whether the ball was in or out, which then causes conflict between both the fans and the coaches. When the courts had implemented the use of an automatic tracking system that uses lasers or cameras to track the ball, or automated systems that have sensors under the court to determine the location of the ball, these systems helped clarify whether the player’s or referee’s call was accurate. In his perspective as a player, coach, and referee, these systems reduced the likelihood of the call being challenged by either the players or the coach and had a significant reduction in conflicting beliefs between the coaches, players, and spectators of the tournament.

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