



# Paul Hawkins response to ESPN CricInfo Blog – ‘Why ball-tracking can't be trusted’

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**Blog Author:** Russell Jackson

**Hawk-Eye Response:** Dr Paul Hawkins, Founder of Hawk-Eye

**Russell Jackson:**

I don't trust the data. Don't worry; this isn't another Peter Moores think piece. It's Hawk-Eye or ball-tracker or whatever you want to call it. I don't trust it. I don't trust the readings it gives.

This isn't a flat-earth theory, though flat earth does come into it, I suppose. How can six cameras really predict the movement of a ball (a non-perfect sphere prone to going out of shape at that) off a surface that is neither flat nor stable? A ball that is influenced by constantly changing amounts of torque, grip, flight, speed and spin, not to mention moisture.

**Paul Hawkins:**

Not understanding it is different to it not working. I don't understand how planes fly, but I believe that they do. Variable bounce is one of the biggest misunderstandings, which has been explained many times. Once again - the LBW relevant part of our ball tracking is only from the bounce to where the ball hits the batman, everything pre-bounce is irrelevant. All we do is measure the flight of the ball during this time. Therefore torque (which doesn't make sense), grip, flight, spin (other than any effect it may have on post bounce swing), and moisture are all irrelevant.

**Russell Jackson:**

When Hawk-Eye, a prediction system with a known and well-publicised propensity for minor error (2.2 millimetres is the most recent publicly available figure) shows a fraction less than a half of the ball clipping leg stump after an lbw appeal, can we take that information at face value and make a decision based upon it?

**Paul Hawkins:**

2.2 mm is our tennis error. We have stated 5mm accuracy, and 10mm is some scenarios.

**Russell Jackson:**

During Tuesday's World Cup semi-final, my long-held conspiracy theory bubbled over. How, I wondered, could the ball that Imran Tahir bowled to Martin Guptill in the sixth over - the turned-down lbw shout from which the bowler called for a review - have passed as far above the stumps as the TV ball-tracker indicated? To the naked eye it looked wrong. The predicted bounce on the Hawk-Eye reading looked far too extravagant.

**Paul Hawkins:**

The naked eye is often deceived when looked at from front on. This is largely because you are seeing it from a camera quite high up and foreshortening makes it difficult to judge the distance the ball has travelled from pitching to hitting the batsman. I think we would all agree that the naked eye from a non-ideal TV angle would be a very inaccurate way to make LBW decisions, so why when that method disagrees with Hawk-Eye, should you assume that it is Hawk-Eye which is wrong?

**Russell Jackson:**

Worse, why upon seeing that projection did every single person in the pub I was in "ooh" and "aah" as though what they were seeing was as definitive and irrefutable as a ball sticking in a fielder's hands, or the literal rattle of ball on stumps? Have we just completely stopped questioning the authority of the technology and the data?

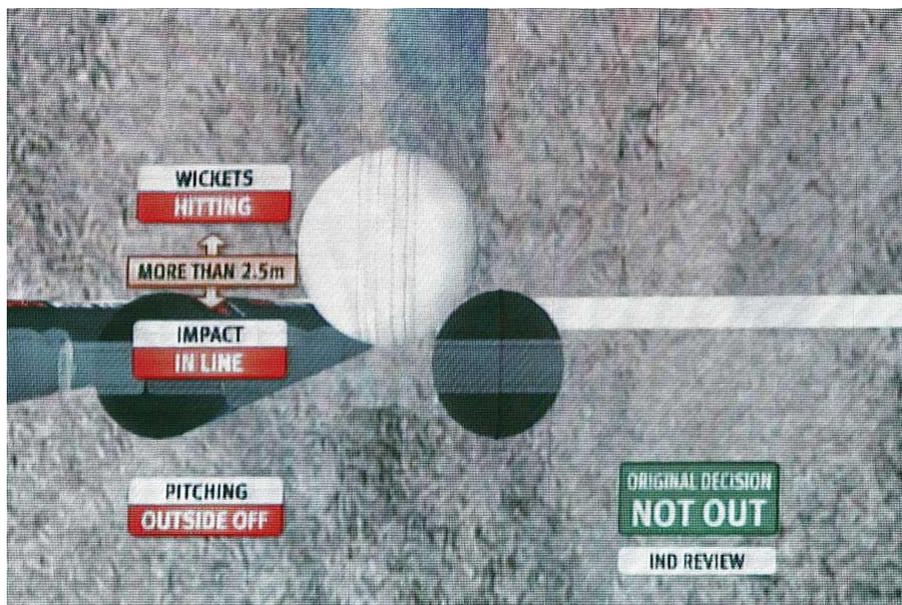
**Paul Hawkins:**

Because Hawk-Eye was right. No harm in questioning things, but keep an open mind until you see some better evidence.

**Russell Jackson:**

Later I checked the ball-by-ball commentary on ESPNcricinfo. Here's what it said:

"This is a flighted leg break; he looks to sweep it, and is beaten. Umpire Rod Tucker thinks it might be turning past the off stump. This has pitched leg, turned past the bat, hit him in front of middle, but is bouncing over, according to the Hawkeye. That has surprised everybody. That height has come into play here. It stays not-out."



It surprised me, but did it surprise everybody? Probably not. More TV viewers seemed to accept the call than question it. When you've watched enough cricket, though, some things just look a little off. To me this one didn't add up. Guptill made another 28 runs, not a trifling matter in the context of the game.

A disclaimer: though I distrust it for lbw decisions, I'm not saying that Hawk-Eye is all bad. It's great for "grouping" maps to show you where certain bowlers are pitching the ball, because tracking where a ball lands is simple. What happens next I'm not so sure on, particularly when the spinners are bowling?

To be fair, Hawk-Eye's inventor Paul Hawkins was a true pioneer and has arguably made a greater contribution to the entertainment of watching cricket on TV than many actual players manage. That's the thing, though: it's entertainment. In 2001, barely two years after Hawkins had developed the idea, it had won a BAFTA for its use in Channel 4's Ashes coverage that year. It wasn't until 2008 - seven years later - that it was added as a component of the Decision Review System. Quite a lag, that.

On its website, admittedly not the place to look for frank and fearless appraisal of the technology, Hawk-Eye (now owned by Sony) claims that the fact TV viewers now expect a reading on every lbw shout is "a testimony to Hawk-Eye's reputation for accuracy and reliability". But it's not, is it? All that really tells us is that we are lemmings who have been conditioned to accept the reading as irrefutable fact upon which an umpiring decision can be made. But it's a prediction.

#### **Paul Hawkins:**

Simply not true – Hawk-Eye has to provide an answer every time there is a LBW appeal, and only very occasionally do we make a mistake. We did make a mistake in December 2014, we knew we had straight away, and we held our hands up. It didn't change the decision made though, and the ball did travel post bounce for less than 40cm which we have made the ICC aware is the most challenging technical scenarios for ball tracking (and umpires). Hawk-Eye transitioned from broadcast enhancement to official aid in tennis in 2005, so we have 10 years of experience in this area, and the "lag" in being used in cricket was nothing to do with the performance of the technology, but the governing bodies debating whether they wanted to use technology to assist the officials.

#### **Russell Jackson:**

Not even Hawk-Eye itself would call it a faultless system. Last December the company admitted it had got a reading completely wrong when Pakistan's Shan Masood was dismissed by Trent Boult during the Dubai Test. In this instance, the use of only four cameras at the ground (Hawk-Eye requires six) resulted in the operator making an input error. Why it was even being used under those conditions is more a question for the ICC, I suppose.

The Masood debacle highlights an interesting issue with regards to the cameras though. Understandably, given the pay cheques at stake and that Hawk-Eye is a valuable component of their coverage, TV commentators rarely question the readings even in cases as puzzling as the Masood verdict. Mike Haysman is one who stuck his neck out in a 2011 Supersport article. Firstly, Haysman echoed my earlier thought: "The entertainment factor was the exact reason they were originally introduced. Precise decision-making was not part

of the initial creative master plan." The technology has doubtless improved since, but the point remains.

**Paul Hawkins:**

The point doesn't remain. We accept that the system was not accurate or reliable enough to be used as an official aid in 2001 when it was first used, but all of that live experience and dealing with the practical problems which different stadiums pose was valuable in us being able to deliver a system which is accurate and reliable. The track record is excellent for all the time the system has been used as an official aid if you measure it against definitive evidence. If you measure it against "what looked right" then clearly there will be more disagreement.

**Russell Jackson:**

More worryingly, though, Haysman shone a light on the issue with the cameras upon which Hawk-Eye depends. At that point an Ashes Test, for instance, might have had bestowed upon it a battalion of deluxe 250 frame-per-second cameras, whereas a so-called lesser fixture might use ones that captured as few as 25 frames-per-second. Remember: the higher the frame rate the more accurate the reading. Put plainly, for the past five years the production budget of the rights holder for any given game, as well as that game's level of perceived importance, has had an impact on the reliability of Hawk-Eye readings. Absurd.

**Paul Hawkins:**

The only thing absurd is the inaccuracy of the reported facts. Hawk-Eye uses six 340 frames per second cameras at all cricket matches which use DRS.

**Russell Jackson:**

As a general rule, the more you research the technology used in DRS calls, the more you worry. In one 2013 interview about his new goal-line technology for football, Paul Hawkins decried the lack of testing the ICC had done to verify the accuracy of DRS technologies. "What cricket hasn't done as much as other sports is test anything," he started. "This [football's Goal Decision System] has been very, very heavily tested whereas cricket's hasn't really undergone any testing." Any? Then this: "It's almost like it has tested it in live conditions so they are inheriting broadcast technology rather than developing officiating technology." Does that fill you with confidence?

**Paul Hawkins:**

Entirely the wrong conclusion. The cricket system has been very thoroughly tested by us in the same way as we have tested our tennis and football systems. The part that hasn't happened yet is for an independent body to come along and also test the system. This helps credibility, but it doesn't help accuracy. Given that Hawk-Eye has never failed an independent test in other sports and Hawk-Eye is pro-actively wanting these independent tests may help people form an opinion for how we are likely to get on in these tests when they happen.

**Russell Jackson:**

Hawkins and science-minded cricket fans might bray at the suggestion that Hawk-Eye can't be taken as law, but in lieu of any explanation of its formulas, machinations and the way it's operated (also known as proprietary information) it's hard for some of us to shake the doubt that what we're seeing with our eyes differs significantly from the reading of a computer.

### Paul Hawkins:

By answering all questions raised and explaining as best as we can, hopefully all doubt will be shaken off. Some people will not be able to understand how it works, and there is not much I can do about that. Those that site examples where they feel it was wrong, we are able to show conclusively that we were right in all instances apart from in 4 occasions over 7 years of DRS where we have held our hands up and said we were wrong (over 99.5%). The Tendulkar World Cup semi-final is not one of those 4.

Continue below for blog comments...

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Posted by  **Paul Hawkins** on (March 27, 2015, 15:36 GMT) - Russell, thanks for your kind words personally. I invite you to "become educated" as we did for Mike Selby: (<http://www.theguardian.com/sport/blog/2014/jul/15/hawk-eye-england-india-drs>). If your opinion is unchanged I will give 1000 pounds to a cricket charity of your choice. If it is changed, I expect you to write accordingly. The things you will learn:

1. The specific LBW you refer to was correct and we can show it to you.
2. We take our contribution to the game very seriously, and the system is accurate and reliable.
3. On the very occasional instance when we have made a mistake we have immediately held our hands up. This should build a trust that if we say it is right, it is.
4. The 2 main reasons for the mis-trust in Hawk-Eye are because broadcast cameras can be deceptive, particularly for height, and poorly informed journalists spreading mis-information.

Cricinfo - I also offer to do a webinar to answer any of your readers' questions live DR PAUL HAWKINS - HAWKEYE FOUNDER.

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Posted by **Nasersid** on (April 1, 2015, 20:12 GMT) - I think overall, DRS is a good system that can help improve some decisions. The technology used is capable of judging any faint snicks better than naked eye and the bat pad decisions for lbw and close catching, generally has been significantly improved. However the ball tracking leaves a lot of unanswered questions. Every ball turns and bounces uniquely and the DRS somewhat generalizes this fact. This is where major improvement is needed.

### Paul Hawkins:

Answered above - we only track post bounce so turn is irrelevant.

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Posted by **Sir\_Francis** on (April 1, 2015, 9:34 GMT) - Many years ago (wish I could recall the game) the Channel 9 commentators were railing against the umpire for not giving an LBW. Hawk-Eye backed the commentators up; however, a slow motion replay showed a quite thick edge that the commentators missed (at normal speed) as did Hawk-Eye. Somehow the Umpire saw it. I've never paid Hawk-Eye much heed since then. Certainly laughed when I read it uses military technology (scud missiles perhaps). It's just another gimmick that we apparently need because the game is "boring".

### Paul Hawkins:

Hawk-Eye only tries to provide 3 bits of information to assist with a LBW decision – where the ball pitches, where it hits the batsman and where it would have hit the stumps. Whether there was an edge is a job for snicko or high speed camera. You are criticising it for it not doing something it doesn't attempt to do.

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Posted by **Indianumerouno** on (April 1, 2015, 9:07 GMT) -

It is indeed farcical that the accuracy of the system depends upon the number and quality of cameras being used. Why do we need this complexity and cost?!

**Paul Hawkins:**

Simply not true as explained earlier.

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Posted by **stuckwithcricket** on (April 1, 2015, 8:39 GMT) -

Till we get something better I am very very happy with use of this technology. Umpires decisions are respected through this as we have Umpires call on all sides/top of wickets. So everyone (players/audience) is a winner.

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Posted by **swarzi** on (April 1, 2015, 6:09 GMT) -

Russell, I'm almost certain, that not only "science-minded cricket fans" who are apprehensive about the accuracy of Hawkeye's ball-tracking technology. I think that every cricket fan with common sense is so inclined. But what is good about it is the fact that none of us knows whether or not it is accurate on the spur of the moment - hence, we all accept its verdicts with significant unanimity, which is what the sport mainly requires. It's left to the operators of the technology only, to subsequently make some sort of honest confession - but when it doesn't really matter anymore - the sting in the excitement already over! On the other hand, when an umpire via his natural instincts makes a mistake, every normally functioning spectator sees and knows! I'm also not too concerned about the actual ball-tracking accuracy (which would improve with time); my main concern has to do with the possibility of the so called operator-on-call being able to instantaneously influence the decision!

**Paul Hawkins:**

An operator cannot influence the decision in the way you imply. It would take too long to explain the complete work flow of the 3 person on site operation. But this was a question that the ICC was concerned by, and with them having seen our operation, they have no further concerns.

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Posted by  **Vijay Senthil** on (March 31, 2015, 5:35 GMT) -

I disagree with Russell. The margin of error and the inherent problems in the predictive technology are well researched and published. Also, Hawk-Eye would give the same decision over and over for the same ball. Can the same be said for the umpires? Everyone knows that many times there are close calls and the decisions could go either way but some decision has to be given. What is important is that it is consistent and Hawk-Eye is currently the best.

Issues with the DRS currently have more to do with the way in which the rules have been made and not with the technology itself. (a)third umpire should intervene when there are clear bloopers (b)increase no. of reviews and marginal calls shouldn't be counted (d)umpires can get two reviews per game (e)third umpires should be enforced to zoom in of the foot near the rope to avoid controversy (f)The ball should be in play till both teams complete their "action". Umpires could wait for the action to complete, e.g. delay LBW till run is over.

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Posted by **Philip\_Gnana** on (March 30, 2015, 13:26 GMT) -

We have seen, heard and read so much about the DRS and another wonderful piece written here. Thank you.

Tracking or prediction via Technology should not be too far away from what the naked eye can see. A replay to show the slow motion is more than sufficient for the third umpire to have a rethink. It is not rocket science.

The slow motion does help us in many ways. It is human error with DRS too and why take that to be totally factual and not use common sense?

We have seen far too many dubious decisions by umpires and this is the very reason that the review system was brought in in the first place.

The viewer is able to see what the umpire is seeing and not a ridiculous robot. Let the decision be made by the umpire where ever prediction is required.

The snicko and the hot spots are not 100% either. At least we are able to see point of contact on the snicko to establish if it relates to a particular contact.

Hot spot in my view is highly subjective too.

Philip Gnana, Surrey.

**Paul Hawkins:**

I have seen video replays of the exact same ball from different angles, everyone made a different decision depending on which angle they looked at – it is hard for us to accept that the naked eye is deceptive, but that is the reality. In the 1st phase of DRS, the ball tracking stopped at the point it hit the pads and the 3rd umpire had to predict the rest. It was a farce as they made a guess and were often wrong. Hawk-Eye can predict far more accurately than the naked eye.

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Posted by **Madhukar09** on (March 30, 2015, 13:00 GMT) –

It is surprising to see people comment that no sport uses predictive technology to reverse umpires' decisions because I can't think of any sport that actually lets the umpire make a decision on his prediction either. The LBW law is such. The umpire HAS to predict based on what he has seen. It is not objective; it is based on assumptions whether or not the ball will go on to hit the stumps. And all those comments about various parameters to be considered such as wind, shape of the ball, moisture..... the list goes on, does the umpire compute all these before making his prediction? I'm guessing no. That being said I don't believe Hawk-eye. And I don't believe it should be used to make decisions based on ball tracking. And I wish that the so called extensive testing be made public for the viewers to better understand the process.

**Paul Hawkins:**

Our hope is that independent testing will happen soon, and I am sure the results will be published. I hope then you will be able to believe Hawk-Eye. I note you didn't site an example where you thought it was wrong. Those people that have, we are able to show in all instances, Hawk-Eye was actually right.

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Posted by  **Khastor Troy** on (March 30, 2015, 9:44 GMT) -

Brilliant article, totally agree, we have been having this predictive element debate since the CWC 2011 and the LBW OUT decision of Tendulkar from Saeed Ajmal. You can watch it a million times and it is plum Lbw and the umpire gave out immediately. Subsequent events showed that the only reason Tendulkar reviewed was because they knew Hawk Eye would show it missing. That decision was an engineered result and Pak were never going to be allowed to play the final in Mumbai. Anyone who has ever played or watched cricket with any kind of understanding, the predictive turn to show the ball missing leg stump was complete fabrication. HE should be used for the pitching of the ball, the height and should be frozen on-screen at point of impact with pad and then the 3rd umpire makes a decision based on distance and height. If he has any doubt then stay with umpires call. If Howler, then reverse decision.

**Paul Hawkins:**

The Tendulkar decision was definitely right – detailed analysis in separate document. Available as a download from our [website](#).

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Posted by  **Natarajan Ramamurthy** on (March 30, 2015, 5:36 GMT) -

While I have my doubts about HawkEye, the bigger problem is around the protocol design of DRS in itself:

1. What is the objective of DRS? if it is to prevent howlers how come only restricted number of referrals and that to with the players
2. What is the definition of benefit of doubt? and how do you implement this in the context of a so called precise system called HawkEye

Around Hawk Eye itself, I would like to know

1. The test cases used to test the system? Are they available in public domain
2. How were the test cases simulated?
3. Where are the test results? Again are they available in the public domain?
4. Has this testing been done in laboratory conditions or real conditions or both?
5. What are the variables that impact the accuracy of HawkEye? Is this available?

The issue is more around the confused approach of the ICC. The lack of transparency around the whole thing?

#### **Paul Hawkins:**

Internally, we check the system almost every ball which doesn't get hit by comparing where we tracked the ball passing the stumps to where we would have predicted, if we stop the tracking data earlier.

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Posted by  **Paul Hawkins** on (March 28, 2015, 18:34 GMT) -

JaysKrish and others - the system has been thoroughly tested internally. We welcome independent testing as it adds credibility and prevents this type of debate. There are plans in motion for this to happen. Thedreamer - Hawk-Eye have said it needs 40cm of travel post bounce to make an accurate prediction, and this is built in to the protocol. If they are hit full it is easy as the laws say you should predict straight on. It rarely happens as even I can hit a half volley! If there is more than 40cm travel, the error changes very little as the distance the ball has to be predicted increases Sultan Zafar - needless to say that ball has been thoroughly scrutinised by many people including the ICC, there is no question - Hawk-Eye was right. I agree that broadcast pictures made it look deceptive. Stevo\_ - This has never happened. Do you believe that Neil Armstrong went to the moon!? Sigismund - that is what happened in the 1st phase of DRS, it was a nightmare.

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Posted by **outback\_storm** on (March 28, 2015, 13:58 GMT) -

No one including Russell is saying that Hawkeye does not improve things.

The point is that there are two parts to hawkeye: one is direct evidence - did the ball pitch outside leg, did the ball hit outside the line off offstump, did the ball brush the bat? this is what u need hawkeye to check. this will avoid all the umpiring howlers which was the goal of drs in the first place. The second is predictive technology - what happened after the ball pitched is predictive; I am familiar with this technology and I can tell u that if u tweak a few parameters u will get a different result. There are so many unknowns such as wind, bounce, height of the bowler. You do not need to use hawkeye to overturn these decisions.

#### **Paul Hawkins:**

You are clearly not familiar with the specific Hawk-Eye technology as what you say is simply not true. Height of bowler etc. irrelevant for reasons explained earlier.

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Posted by **outback\_storm** on (March 28, 2015, 13:52 GMT) -

I agree with Russell; No sport uses predictive technology to overturn an umpire's decision - it's just strange and contradicts the notion of irrefutable evidence to overturn an umpire's decision. You could use Hawkeye to check if the ball hit outside the line of off stump, whether it pitched outside leg stump; whether the bat hit the ball - these are direct evidence. By checking these you avoid howlers, which is

the goal of technology. However, what happens after the ball pitched is predictive - one cannot be sure. There are too many uncertainties, the pitch, the bounce, the wind. Under different input parameters, you will get an entirely different result. Under these circumstances you got to live with the umpire's decision.

If you need another hawk-eye howler, just check Ind vs Pak semi-final in world cup 2011 where I believe Sachin got a reprieve against Ajmal. I cannot imagine how Hawk-eye can predict extra turn!!

**Paul Hawkins:**

Answered earlier – the Tendulkar decision definitely correct.

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Posted by **The\_other\_side** on (March 28, 2015, 12:43 GMT) -  
Mr Jackson,

The height of the ball may have been misjudged by the normal eye as there is a parallax error associated with camera being higher placed than the umpire view of the ball. I agree with most of your discussion, but, in my opinion, that decision of Guptill may have been right!!

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Posted by  **Prasenjit Dewan** on (March 28, 2015, 11:16 GMT) -

I remember when England were playing India in India...the year was 2005. Anil Kumble was bowling in a rain affected pitch. I don't remember the batsmen but I remember he was bowled of a Kumble delivery which struck the top of his off stump. When hawk eye predicted the line of the ball it was showing that the ball was going over the stumps rather than hitting it. Many would argue that the technology has much improved since then but it is unclear to us viewers what technology they use?

Do they just track the motion of the ball?? Or do they also consider the surrounding physical environment...like wind and momentum of the ball and bounce of the ball.....

If they only track the line which the ball traverses then the hawk eye technology will be absolutely rubbish while "guessing" the ball which hits the batsman on the full.

**Paul Hawkins:**

I can't remember the specific incident, but I can guarantee what you describe did not happen. Is it possible that the batsman was not clean bowled, but instead played on to his stumps. There have been many examples of this – where we show it missing because we predict a path assuming the batsman had not hit the ball. This was also 10 years ago, when I wouldn't defend our technology quite as strongly as I do now, but nonetheless I am sure this didn't happen.

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Posted by **Gurudumu** on (March 28, 2015, 6:50 GMT) -

At the very least, it puts to bed allegations of biased umpiring. It may not be perfect currently, but it will improve over time and be closer to objective calls as opposed to subjective umpire decisions.

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Posted by  **Mark Davis** on (March 28, 2015, 3:14 GMT) –

Great article, Russell. I found it curious that when HawkEye makes a controversial decision, the host network never show us (or the 3rd umpire, presumably), the angle which might have blown it out of the water. Star Sports, in this case, failed to show the square leg / point ground level view. From that angle, you don't need a microchip inside your head to see if a ball is clearly bouncing over the stumps. Then again, Star's coverage of the CWC has been so abysmal; maybe they didn't have the angle.

The problem is in the regimented implementation of the DRS. Let's not throw the baby out with the bath water, but let the umpires USE ball tracking, rather than be told what to do BY it. Let them have a consultation over the radio, and reach a fair and sporting decision, not a prediction.

**Paul Hawkins:**

3rd umpire can see all angles. The broadcaster would not try to "protect" Hawk-Eye. It would be a

good story for them if they could show us to be wrong. The side on replay for the one Russell refers to doesn't look that good from a TV perspective because you have the back of the umpire largely obscuring the view.

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Posted by **Simon Leon John Enoch** on (March 28, 2015, 1:31 GMT) -

Simple question:

Is Hawk Eye more or less accurate than the human eye?

If you asked a cricket umpire and Hawk Eye to make 1000 LBW decisions, which would get more correct?

The answer is obvious therefore there should be no debate. Hawk Eye may not be perfect but if it improves the decision making process then it is a force for good in the game.

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Posted by **unknown** on (March 27, 2015, 23:11 GMT) -

I think a big thing is that the technology is likely to be more consistent, even if it's wrong. At least the same opposition facing the same ball should get the same decision.

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Posted by **Johnny\_129** on (March 27, 2015, 22:07 GMT) -

I, for one, would trust technology over an old man standing 22 yards away from the impact! Hell, I would trust technology over an old man standing 5 yards away. In fact, I would trust technology over an old man, period!! Also, the batsman accept their fate too rather than make excuses over the umpiring decision - Remember the bad old days when there were so many complaints and excuses over umpiring decisions. In saying that, I think the system can be improved upon if not perfect - Right now the ball tracker looks at a few aspects before declaring that one or two of the aspects are to be decided on the 'umpires call' - Why not get the umpire to state the aspect or aspects they are questioning and only go with the umpires call on that aspect e.g. If half of the ball is hitting the stump but the umpire gives it not out because he suspects the ball is the batsman outside the line - so in such cases the umpire should state what their doubt is and if the ball is found to be hitting in line...

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Posted by **Sigismund** on (March 27, 2015, 19:39 GMT) -

Aye, it really is very annoying. It has led to a general misunderstanding of the LBW rule. But the solution is simple: don't use the predictive part. Umpires' experience and judgment is a much fairer way to decide if the batsman was beaten and would have been bowled, but for his body getting in the way. Howlers mostly came from errors in judging the line of the pitch or impact, or whether he hit it. All these can be challenged fairly on review, and knowing this will allow the umpires to focus more intensely on the prediction part.

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Posted by  **Yashpal Nagaraj Sharma** on (March 27, 2015, 19:21 GMT) -

Cricket, as they say, is a game of uncertainties. This is one of them! Agree with the article in more ways than not. The Hawk-Eye technology had to be credited for clearly reducing the human error, particularly on trivial decisions. However, when the ball has got to travel a fair distance, as is the case with the Guptill example, the tendency for the technology to go wrong just goes up. Very well documented there Mr. Jackson!

**Paul Hawkins:**

Scientific evidence suggests otherwise, and that is easy to test by changing the prediction distance for the same ball and seeing how it changes the results.

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Posted by **reb1** on (March 27, 2015, 17:22 GMT)

People talk about "simple laws of physics" and "technical expertise". On a cricket pitch, laws of physics are not simply applied. Therefore, there is some "Training" on the computing algorithm. The human brain will beat this training EVERY TIME on EVERY PITCH. The predictive part of the technology is not required, the slowing down of the motion is.

**Paul Hawkins:**

There is no "training" on the computer algorithm as the pitch conditions are irrelevant (explained earlier).

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Posted by  **Julian Erasmus** on (March 27, 2015, 14:05 GMT) -

So Russell Jackson is saying that Hawkeye is just for entertainment and shouldn't be used to assist decision making as it isn't perfect. He fails to acknowledge that it is more effective than what we had before in the sense that we have fewer bad decisions and far fewer howlers.

Yes of course there are going to be mistakes sometimes. That's just life. But overall it is an improvement. Just because an improvement isn't perfect doesn't mean it's not worth actually applying it.

This is called progress Russell, yes there will be some bumps in the road but if you are afraid of those to the point that you halt progress things will never get any better.

I remember those horrible calls Daryl Hair and a few others made that used to be commonplace and ruined games and series. Things like that hardly ever happen anymore and I think most supporters and players are grateful for that.

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Posted by **John-Price** on (March 27, 2015, 11:47 GMT) -

You are suspicious of ball tracking technology?

How do you think umpires make their decisions? The answer is they try to do the same thing in their heads. Given the amount of variable involved, they stand no chance of getting it right every time and, as anyone who has played cricket at any level knows, dodgy lbw decisions are the cause of more acrimony in the game than any other factor.

The equivalent in tennis was line calls - since Hawkeye was introduced, players accept calls and get on with the game. I suspect it is not always right, but everyone thinks it is better than the human eye and player discontent has disappeared. The lessons are clear to all.

All except the Indians and Russell Jackson. He appears to imply that the ball tracking kit device built into the human brain is better than anything technology has come up with. I think he needs to re-consider.

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Posted by  **Jeremy Bradshaw** on (March 27, 2015, 10:48 GMT) -

@SeanB, my thoughts exactly. We need to see this analysis of prediction vs. actual to give credence to the predictions offered by hawkeye. In particular the shorter the distance between the ball pitching and hitting the pad, the smaller the sample data, and so the greater margin of error. This variable margin of error is never accounted for currently. Rather than estimating the flight of the ball I'd rather see the prediction of a "box" of feasible paths where this margin of error is taken into account. The smaller the sample data, the bigger the box.

**Paul Hawkins:**

It is difficult enough getting cricket viewers to understand that the pitch conditions make no difference. Uncertainty zones would be too confusing, and the reality is that they would be very small, and hence you wouldn't even see them.

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Posted by  **Nick Potter** on (March 27, 2015, 9:15 GMT) -

I fully agree with the article and what bothers me most is the way commentators use the hawk eye

prediction to comment on umpire's decisions. In Sydney in the recent Aus. v India series the umpire gave an Indian batsman out and Ian Healy's response after seeing Hawkeye showing the ball missing knowingly said "well the umpire has got that one wrong" The umpire is in the perfect spot and has watched that bowler bowl all day.

**Paul Hawkins:**

Umpires do get LBWs wrong.

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Posted by **mohanakrishnannaresh** on (March 27, 2015, 7:52 GMT) –

I agree with this that the ICC has not tested the technology which is used for drs it's causing the terrible wrong decision in drs.

**Paul Hawkins:**

The ICC constantly monitors our evidence. Every decision where there is some doubt we share with them all of the evidence. In every instance (apart from in December – where we immediately said we made a mistake), examining the evidence has proved that we are correct.

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Posted by  **Brent\_Oneill** on (March 27, 2015, 07:09 GMT) -

Perfect or not, Hawk-Eye is still more reliable than the naked eye of a guy standing 30 yards away (especially when the ball is travelling up to 150km/hr). End of discussion.

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Posted by  **Ian Finlayson** on (March 27, 2015, 6:56 GMT) -

@anoopbal Perhaps 100 balls is too few but the idea is right. Greater number of trials under different conditions might provide a more accurate error estimate. More than likely it will be less than 2mm. Allowance for error is already built in with the half ball / umpire's call practice and I am happy enough with that. More an issue in my mind is the team reviewing losing their review on the basis of an umpire's call strike down. So on umpire's call the decision stands but there is no loss of right of review. IMO all decisions given out should be reviewed so the batting team needs no reviews, only the fielding team under the conditions above would be able to review even if it means reducing the number to one per innings.

**Paul Hawkins:**

I agree re teams losing a challenge. The size of the umpire's call area has nothing to do with the accuracy of the system. The umpire's call area came from what the ICC deemed to be a "howler".

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Posted by **bobmartin** on (March 27, 2015, 6:49 GMT) –

There seems to be a lot of emphasis being placed on the fact that the DRS is a prediction... Isn't an umpire's decision a prediction? At least with technology one can be as near 100% confident as makes no difference that the result in any given circumstance will always be the same... which is more than can be said of a human decision in the same circumstances.

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Posted by **rnsmith** on (March 27, 2015, 5:27 GMT) -

If the task is to locate an object in 3D space accurately from a set of 2D images, you'd be much better off having 6 high-res cameras from very different positions than rely on 2 human eyes separated only 15cm apart in which the stereo effect is largely lost a distance of 20 metres. It wouldn't surprise me if DRS can locate the ball to within 2mm of its true position by taking the intersection of 6 rays that are far from co-linear.

The remaining task is to fit an appropriate mathematical curve to describe the ball's position and velocity based on a set of points over time. The physics model needs to consider ability to swing, viscosity of air, and effect of gravity. At 250Hz you probably have many more sampled points than

free parameters, and can use the excess as a consistency check on the degree of fit of the curve. Computers are really good at that. Maybe technophobes would be happier if error bounds for the predicted path based on worst-case assumptions were also displayed.

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Posted by **Usmaan Tahir Khan**[812485390](#) on (March 27, 2015, 4:25 GMT) – Pak vs. Ind in WC 2011. Saeed Ajmal lbw Tendulkar. Hawk eye shows the ball turning dramatically. Ajmal said later in an interview that he had bowled a straighter one; the company itself confessed, later, there was an error made by the operator. But too late. Tendulkar went on to win the match for India. The rest is history.

**Paul Hawkins:**

Yes – Hawk-Eye got it right.

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Posted by **jfgvjksnkka** on (March 27, 2015, 3:55 GMT) -

@anoopbal you are obviously a very wise person. I have been preaching the exact same argument for years almost word for word. Only issue is once the "Russell Jacksons" of this world find out it is only 99.9999% accurate they will start complaining about the 0.0001% 'ers.

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Posted by **SeanB** on (March 27, 2015, 3:45 GMT) -

"How can cameras predict ball movement?" Well, it takes a simple experiment to find out. Run all gizmos with a bowler bowling at the stumps (no batsman) and gather data for 100s or 1000s of deliveries. Feed partial data (till imaginary impact point) to the cameras and see if the prediction is the same as the result. This is something the makers would have done, but may not always reveal all results (who does). Also, with the amount of money invested in this tech and the money they make from each game, they may not be 100% transparent. But, ICC can and should do a public test in major grounds and different conditions - high and low bounce, swing, spin, reverse swing - everything possible and convince the viewer that this tech is right. Till then, there is no place for prediction in sport.

**Paul Hawkins:**

This is essentially what we do all the time in actual matches for balls which the batsman leaves.

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Posted by **MoonasMagicMix** on (March 27, 2015, 2:55 GMT) -

Couldn't agree more with Ruchira Liyanagama. They are not predicting the path from the moment it left the bowlers hand as things like the pitch cannot be predicted. They are predicting the path AFTER it has left the pitch. So if it deviates from a crack that is taken into account. TBH, Russell and subsequent comments about what happens if it hits a crack or if the previous ball is hit to the boundary just show ignorance to basics physics and the technology. Haha as they say: It is better to remain silent at the risk of being thought a fool, than to talk and remove all doubt of it!

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Posted by **RanKan** on (March 27, 2015, 2:15 GMT) -

I did a few back of the envelope calculations, if a ball was travelling at 120kmph it would take 30 milliseconds to travel from pitching a metre in front of the batsman to the pad. At 250 frames/second that is 7 frames. The ball is a pixelated object in each one of those frames. A centre of the shape needs to be computed for each frame (not too accurate since the ball is a pixelated oval and not a circle). So you have about 7 points that are not accurately located from which to trace a 3D trajectory. Reduce the number of frames and you may have two frames to trace a trajectory. Lots of inherent inaccuracy.

You must test these things and publish test results as the writer and reader @anoopbal has commented. Stevo\_ gives an example where the ball missed the stumps 6 times but Hawkeye had it hitting once. Test Hawkeye and publish the data - then there is motivation and competition to introduce better products.

**Paul Hawkins:**

Now do the same back of an envelope calculation with the correct numbers: 340 frame per second cameras. Ball is circa 10 pixels, and we find the centre to circa 1/3 pixel. Also factor in the extra accuracy through triangulation from 6 different angles. You will find that it becomes under 40 cm where error can increase, which is what we have said.

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Posted by **landl47** on (March 27, 2015, 2:07 GMT) -

What this shows is not that Hawk-Eye can't be trusted, but that your eyes can't. I have seen time after time situations where at normal speed an appeal looks out or not out, but when it is replayed with slow-motion and freezes and Hawk-Eye, it's clear that it was an optical illusion. I have seen one or two cases where the Hawk-Eye prediction still looked wrong, but they are very small in number compared to those where it was clearly right.

Expecting perfection is unreasonable. It's like those foolish people who choose not to have their children vaccinated, even though the rate of death from vaccination is only 2% of the rate from catching the disease. Accept there will be an occasional glitch, but take the far higher accuracy of Hawk-Eye over human fallibility and you'll be right almost every time.

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Posted by **anoopbal** on (March 27, 2015, 1:27 GMT) -

Seriously, someone needs to do a simple research study.

Bowl 100 balls, measure the height of the bounce and the deviation. Now, cut the area where the batsman is supposed to stand. And have the Hawkeye predict the height and the deviation.

Now analyze the difference between the predicted and the actual trajectory. How close is it?

It is as simple as this. No need use words like "opinion" and 'trust'.

**Paul Hawkins:**

Answered above.

Posted by  **Ruchira Liyanagama** on (March 27, 2015, 1:03 GMT) -

Written by someone who doesn't know much about physics... It is obvious as soon as he mentioned a possible link between the drs's accuracy and the surface of the pitch. DRS doesn't need to know about the nature of the surface the ball bounced on. It doesn't matter the ground is flat or not. All that is important is the journey the ball took from the ground to the batsman's body. That path is being tracked by multiple cameras and speed guns to give DRS plenty of data such as horizontal/vertical velocity of the ball at each given frame. With this information at hand, it is not that difficult for the drs system to continue and predict the rest of the path from impact point on the batsman to the wicket.

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Posted by **rattusprat** on (March 27, 2015, 0:15 GMT) -

Russell Jackson has got this backwards - technology has challenged one of his preconceptions about LBWs - so he rejects the technology.

Go back 40 years - a number of assumptions made by umpires were accepted without question, for example:

1. if the ball hits the outside half of the front pad it's going down leg - every time
2. if the batsman is back and hit somewhere on the pad (not above the pad) don't worry about the height
3. if he's well forward just give it not out. Improved TV coverage resolution challenged those. Adding the "strike zone" to the pitch and showing the stumps obscured by the batsman made quite a leap wrt no 3.

Now, Russell has a long held preconception about LBW's: if a batsman is sweeping a spinner height is not of concern. No one will question an umpire assuming this in untelevised cricket - it is usually right. But the technology has shown Russell that "usually" might not mean "all the time" in this case. So the technology must be wrong?

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Posted by **\_myk** on (March 27, 2015, 0:02 GMT) -

I continue to think Erasmus and Dharmasena are trying to take DRS down from the inside with some of their use (or misuse) of the technology. Hawk-Eye's about the only thing they can't mess up.

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Posted by **jfgvjksnkka** on (March 26, 2015, 23:58 GMT) -

Russell,

"How on earth can six cameras really predict the movement of a ball"? Just because you don't understand Hawke-Eye doesn't mean it is flawed. You seem to be missing the entire point of this technology. It gives a SIGNIFICANTLY more accurate prediction than the human eye at full speed. Dwell on that for as long as you need.

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Posted by **inthebag** on (March 26, 2015, 22:34 GMT) -

Anyone remember the bad old days before DRS? How many bad decisions swung test matches? No one wants to go back there. It may not be perfect but it's sure better than we had before. And the standard of umpiring has improved.

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Posted by **richcricketguru** on (March 26, 2015, 22:20 GMT) -

Ball tracking as it currently exists is the most consistent and accurate method we have of determining the outcome - it does pick up almost all LBW bloopers and the ball must be clearly hitting the stumps for the umpires decision to be overturned. Can it be improved? Yes. Is the prediction better than the various umpire's error rates (both outs and not outs) day in day out from 11am to 6pm? Absolutely yes! Do the players know what will be the likely predictions? Yes. Is it perfect? No. Will it get even better? Yes. The article just goes to show how incredibly difficult it is for an umpire to compute all of the inputs and make an informed "judgement" - their judgement is subjective, and the level of concentration and emotional state of the umpire will always have a major impact. DRS puts an objective layer on top of the process. It makes it better and improves the accuracy of the outcomes.

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Posted by **FieryFerg** on (March 26, 2015, 21:20 GMT) -

Excellent response mngc1. If Russell actually contacted Paul Hawkins instead of giving us his non-scientific opinions he would happily be provided with a comprehensive description of the algorithms used. I've done it and got them (within the limits of commercial confidentiality). As a physicist and life-long cricket player and watcher I'd happily go with fully automated officiating as a better, more reliable proposition. Especially after some of the officiating in this World Cup.

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Posted by **Justin Watson** on (March 26, 2015, 21:13 GMT) -

Yet people who don't trust hawkeye are happy for batsmen to be given out when clearly they were not out. The issue with the system is teams use it to try and get a 50-50 decision overturned.

Some of the examples as to where hawkeye might fail are very extreme cases and I'm not sure even an umpire could or would take into account a batsmen standing on a crack and negate the possibility of what the ball could have done. If it's a concern, a simple change to say hawkeye can't be used if it hits a batsmen on the full.

Despite what Russell thinks there is no way the human eye can be more accurate than hawkeye when predicting height, especially from front on.

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Posted by **Vanman7** on (March 26, 2015, 21:03 GMT) –

So you're saying that we should trust the call of some half blind and deaf old man 20m away from where the action is happening? When they also have to deal with light issues, crowd noises, bowlers obstructing their view etc? When they have one chance at 0.4 seconds to get the full picture of exactly how the ball was flighted and bounced - and this after they've been looking down to check a no ball? I'll never understand why some people are afraid of technology...

@thedreamer - the rule in that situation is that the umpire should consider the ball to continue on it's trajectory. So as to avoid the (potential) complication you describe.

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Posted by **CricketingStargazer** on (March 26, 2015, 20:41 GMT) -

This mistrust of technology is one of the most bewildering aspects of the game. TV viewers get a foreshortened view from above pitch level that completely distorts the flight of the ball. Yet they are quite prepared to use that view to cast doubt on a system that is far more accurate than the human eye and certainly more accurate than any human umpire. "It has a known error": of course it does! No system can ever be made perfect - the laws of physics do not allow perfection, human or machine. Somehow it seems better to have human error than any machine error, however small. The error is taken into account both in umpire's call and in the distance of impact because the smaller the distance after bounce the less accurate the tracking. If you demand perfection, you will always fail to get it, but if you demand a system that is 100% honest and unbiased, without human frailties, you already have it now.

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Posted by **inswing** on (March 26, 2015, 20:22 GMT) -

It is noticeable how people without much technical education have a hard time believing Hawkeye projections. Only when there is a decision going against them. You can only know what has happened so far, you can never know what would have happened, they say. You cannot project. This is silly. It turns out that you can project pretty accurately, because of this thing called physics. Balls do not behave randomly, they follow some laws. There is always some level of measurement error. But that error can also be measured and quantified. It is not a guessing game. If the error is around 2 mm, or 3 mm, that is pretty accurate. The question is not whether Hawkeye is perfect, it is whether it is better than the umpire. To say that an umpire's guess is more accurate than a system with 3 mm error is ridiculous. And that's why they stick with the umpire's call in close decisions. So the system is never worse than umpire alone.

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Posted by **f Nikko Chunn** on (March 26, 2015, 19:59 GMT) -

Oh no, I tuned out after the opening paragraphs.... Why? It is more black magic fretting like the Indians did and do; more of that philosophizing on why it cannot be 100% correct when that is not the point. The umpire sees the event at full speed, once, effectively with two cameras, side by side, in his skull. The DRS gets to see it with (ironically a point of complaint for the scribe) six 'eyes' that can pinpoint constant movement and slow time for repeat viewings. Not an exact science? And a human being's vision is!? The DRS is there for the howler. there for the edge on an lbw or the not given catch when it was edged and so forth.... after all, it is used in CONJUNCTION with 'snicko' and so forth. And this is adjudicated by the eyes of the umpire, which by your complaint, you prefer. Does that make sense? I mean you either don't want that or you do, so make your mind up! 8-) DRS is an art form in terms of when it is utilized. NZ in the CWC have gone for it 7 times and got 4 right.

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Posted by **yorkshire-86** on (March 26, 2015, 19:47 GMT) -

Hawkeye has error, true - but the accuracy of Hawkeye is FAR greater than the accuracy of a human eye that only gets one look. Also Hawkeye has 6 cameras, all in optimal positions, and all whose job is solely recording the ball's position - the umpire has only 1 set of eyes in an AWFUL position for

judging especially length and height, and has other things on his mind apart from lbw. As for some comments on here: thedreamer - if a ball hits the batsmen on the full the LAW says you ALWAYS assume it will carry straight on upon pitching, even if it's on a 45' slope or the bowler is turning every ball square - thats the LAW, it dosnt matter if it's a human umpire or hawkeye. StraightPull - if half the ball was hitting (umpires call) then the umpire has made a close call (right or wrong), not a complete glaring error. Use DRS for anything other than a complete glaring error = lose review. Thats how it should be.

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Posted by **goabnb94** on (March 26, 2015, 17:49 GMT) -

The ball is tracked with multiple cameras and multiple frames. By the time a ball that has bounced has hit the batsmen, there is not a lot more it can do to move. Certainly not enough to affect the results in any way. When the ball tracked well over, it was clearly going well over. You can't say it would be hitting with that much of a margin. That is why most of the ball must hit the stumps for that result to mean anything; because that means that the ball would almost certainly hit the stumps.

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Posted by **Ravichandran Jagadisan** on (March 26, 2015, 17:16 GMT) -

Great post by mgnc1.a fitting answer to all doubters.it is far better than the naked eye.

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Posted by **Tony Parrish** on (March 26, 2015, 16:52 GMT) -

Quote: "How on earth can six cameras really predict the movement of a ball?" Well you seem to think eyes can do it better (effectively 2 cameras) - that makes no sense. How can the naked eye "predict the movement of a ball (a non-perfect sphere prone to going out of shape at that) on a surface that is neither flat nor stable? A ball that's imparted with constantly changing amounts of torque, grip, flight, speed and spin, not to mention moisture." When was the last time you were able to accurately measure moisture and torque with your naked eye?

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Posted by **jw76** on (March 26, 2015, 16:50 GMT) -

Not infallible, but still less likely to make real shockers than human umpires sometimes do?

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Posted by **mgnc1** on (March 26, 2015, 16:47 GMT) -

Once the ball has bounced the laws of Physics/Maths can predict the path of the ball much better than the human eye/brain which only takes 10 frames per sec compared to the cameras that operate at 200 or more per sec. Height projection should be quite accurate as swing/ball shape after bounce would need horizontal travel to make a difference. A lot of viewers are fooled as the front-on TV does not show how far the batsman is down the wicket. I thought Gayle was clearly out but side on he was at least 4 metres down so the bounce over was right. They should remove on field decisions and make all not out or all out. Hawk-eye's weak point is the ball yorking the batsman where there is insufficient data to predict the path but it is still better than the human eye.

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Posted by **Sultan Zafar** on (March 26, 2015, 16:35 GMT) -

I can recall famous "Not out" of Tendulkar in 2011 World Cup semi-final, when umpire given him out. but on review, Hawk-eye predicted that spinner's ball "could be pitched on ground, keep the line to

middle and then magically change direction just before hitting the stumps to miss the leg stump." Since that day, I do not believe in this Hawk-eye. That day Hawk-eye cost the Pakistan, elimination.

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Posted by **Manso** on (March 26, 2015, 16:04 GMT) -

Yes, 1} if the Ball is NOT HITTING the stumps enough, 2} hitting pads minutely marginally outside off, or outside leg the review shd remain.

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Posted by **ODI\_BestFormOfCricket** on (March 26, 2015, 16:01 GMT) -

at least some one raises this, really i was surprised with that decision? not only that many calls. I think we deliberately using flawed technology

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Posted by **picket23** on (March 26, 2015, 15:37 GMT)

Not much evidence to presented to suggest that the hawkeye system doesn't work consistently and accurately enough to be used.

The error that was admitted to by the hawkeye people in UAE seems to have an explanation.

The recent decision (NZ vs SA) that to the naked eye apparently "looked wrong" didn't seem that unreasonable to me. Considering the replays that were shown, and my experience with legspinners bowling with new balls it seemed quite likely actually. Maybe it pitched a tad shorter than the author could tell from the angle of the tv camera. Maybe he just doesn't appreciate how much bounce can be attained by a legspinner. Maybe the pitch conditions were different than the Author realised. Maybe he had been at the pub too long. Maybe... maybe lots of things.

I know that the umpire didn't think it was out.

Having said all that, I too question the flight path shown by hawkeye sometimes. However, unlike the author I don't just assume that I am right and hawkeye is wrong.

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Posted by **dhanyalraja** on (March 26, 2015, 15:07 GMT) -

Well, nothing can be ideal, that means 100%. The trajectory of ball can well be analysed after the bowler bowled. The only difference is made when it hits the ground, now the trajectory can't be analysed easily because of the speed loss(momentum loss). The spin factor is also in account. The parabolic path of the ball must be calibrated after it hits the ground. It surely isn't calibrated at all, they just follow the cameras around, confuses me a lot. If they can measure the speed right out of the hands of the bowler, it can be measured after hitting on pitch(bounce). Then the parabolic trajectory along with speed and angle of projection can also be measured. Maths has every solution available. I don't know with all resources they have, they can call upon few mathematicians and the equations regarding parabolic projection can surely solve the issue. Some will say not parabolic rather a curved path? How will they define exactly a curve? I'm a maths student so corrections are welcomed.

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Posted by **picket23** on (March 26, 2015, 15:03 GMT) -

@thedreamer - That is not what is being conveyed in this article, because the situation you describe is exactly how Hawkeye should operate. The laws of the game say something along the lines of; if a batsman is hit on the full by the ball, any turn or deviation off the pitch should not be taken into account. So what you have described is how an umpire would judge the decision and also how hawkeye should.

You don't think umpires are meant to guess if the delivery was a googly or a leggy, or how far a crack would have made the ball deviate or in which direction it would have deviated, do you?

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Posted by **thedreamer** on (March 26, 2015, 14:34 GMT) -

Sample this: 5th day of a Test match, an off spinner bowling to a right handed batsman on a typical 5th day, worn down pitch, flights the ball, batsman pushes forward with his front foot and is hit flush

on his left foot. Bowler appeals, but umpire says not out. Goes for review. Replays show that if the ball had not hit the batsman on the full, every possibility it might have pitched right on the rough/crack where the batsman's left foot is, since its a 5th day pitch. Every likelihood that the ball would have missed the stumps by some margin. But the Hawk-Eye won't factor these into consideration and it will show that the ball won't spin, but would rather go on to hit the stumps. This is exactly what Russell tries to convey in this article. The Hawk-Eye won't factor the external conditions to decide the path of the delivery.

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Posted by **StraightPull** on (March 26, 2015, 14:08 GMT) -  
Good point, if less than half the ball was hitting you should not lose your review.

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Posted by **JaysKrish** on (March 26, 2015, 13:13 GMT) –  
Without sufficient testing even the error margin cannot be accurately predicted. When error margin itself is an assumed entity, umpires call just means that the ambiguity of the decision still stands. So, why not give the team that reviews another opportunity to review as the technology was unable to make a decision. Basically in this case the team has appealed over an umpires decision and still the same decision stands as technology could not predict the right outcome. Are we not back to square one.

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Posted by **ADienst** on (March 26, 2015, 12:54 GMT) -  
ModernUmpiresPlz has it spot on, but he just missed out one point about the umpires call. The purpose of the DRS is to correct grossly unfair out/not out decisions, so if a ball is just clipping the stumps, it is not grossly unfair to leave the decision unchanged. In order to ensure consistency, the ICC has decreed that "just clipping" half a ball or less.

The fact that you lose a review if its umpires call does rankle a bit, but, again, the point is that, whichever way the umpire went, it wasn't a grossly unfair call.

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Posted by **Tsaeb** on (March 26, 2015, 12:29 GMT) -  
Isn't the whole point of the 'Umpire's Call' outcome to account for that error? If the decision is sufficiently marginal (i.e. within the known error margin for the system), the on field umpire's call can't be overruled because the technology isn't precise enough to do so confidently. In cases where the decision is clearly wrong (i.e. beyond the known error margin for the system), the call gets overturned. I feel like the criticism from this article would be valid if Umpire's Call wasn't part of the system and the review was simply based on whether the ball tracking showed the ball hitting the stumps or not but, as the system stands, error in Hawk Eye is already accounted for.

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Posted by **ModernUmpiresPlz** on (March 26, 2015, 12:06 GMT) -  
Hawk-eye isn't doing wild things like predicting how the ball will move off the pitch. It is predicting it's continued flight AFTER it has landed, or a continued path if it hits on the full as though the pitch were entirely flat (which is how the umpires interpret it as per the rules of cricket). It makes these predictions by placing the ball using the multiple camera angles to construct the ball's position at multiple stages and then continues that path with a little known piece of science called "physics". Of course, these predictions will never be 100% accurate because we've all seen a cricket ball swerve late or do other random things, but this is not for hawk-eye to account. If an umpire wouldn't account for it why should the technology? You can't predict things perfectly if they haven't happened yet. It is, however, pretty close. Bounce is the one thing that surprises the most often, and that's because it's the hardest to judge on the front on, high camera angle on television.

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Posted by **StraightPull** on (March 26, 2015, 12:05 GMT) -  
The Batsman gets the benefit of the doubt. The reason more than half the ball has to be hitting the stumps is because of the inaccuracy of the system. If the system has an accuracy of 5mm then all

you need is 5mm of the ball hitting the stumps and you're sure the ball would have hit the stumps. To make it easier for umpires they say half, doesn't have to be exactly half. As you say they publish 2.2mm. The ball is obviously more than 5mm diameter, so anything close to half the ball hitting the stump means contact. We've seen balls hitting the stump and the bails not coming off. So when an umpire gives you out LBW how does he know the bails would have come off?

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Posted by **Deuce03** on (March 26, 2015, 11:19 GMT) -

I seem to remember an article on here a few weeks back which mentioned that the visual display on Hawkeye is deceptive: the display doesn't model the precise path of the ball but provides a visual representation of the probability of the ball's hitting the stumps. So a ball shown clipping the stumps would probably have missed altogether, but with a small chance it would have hit - rather than the software predicting a clip per se. Likewise I imagine a ball shown sailing high over the stumps might actually only have missed it narrowly, but the software is confident it would miss altogether, I guess.

When considered in those terms, the way the laws deal with it seem to make more sense, I think, and it's the ignorance of commentators and viewers that introduce confusion, but I have no idea whether it's actually true; it's just what I've heard.

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Posted by **jordan\_nofx** on (March 26, 2015, 10:12 GMT) -

An interesting article but I personally believe hawk-eye is a must, despite not being 100%. As long as it is giving more correct decisions than the umpires alone are, it's beneficial. If umpires get 90% of decisions right and hawk-eye get 92% of decisions right, then cricket is better off. We may never get 100% but through continued use, evolution and improvement we will get closer to it over time. I know that DRS and hawk-eye can't be lumped together when criticising but I don't like watching cricket now as much when India are playing and there's no ability of a team to challenge a poor decision. All sports are heading this way. Regarding the Guptill decision, it was given not out and stayed not out upon review, so DRS did not change anything other than the reason that lbw wasn't out. One thing that needs to be changed is when a team reviews a not out lbw decision, it's hitting the stumps but not enough so it stays umpire's call, you shouldn't lose your review