

# Hawk-Eye, where science meets sports

## Out of the Box

Tony Chan Fan-cheong is president of the Hong Kong University of Science and Technology. He has spent his life pursuing his dreams relating to teaching and research, and has unique views on education, scientific and technological development, and nurturing the young.



AS AN AVID tennis fan, I have completed my personal Grand Slam as a spectator – that is, watched the Australian Open, French Open, Wimbledon and US Open at least once. When I was teaching at Yale in the early 1980s, traveling to New York to watch the US Open was my annual escape.

Every year around this time, the US Open is on TV. For anybody watching the game, they should be familiar with the Hawk-Eye system of using cameras to track the ball and determine whether it is in or out of the service box or the court. It has been called one of the 20 biggest tech advancements in sports history, as well as the “Uber of sports umpiring.”

Hawk-Eye is based on using a set of high-speed high-resolution video cameras mounted at different locations around the court. Each camera tracks the ball across its “plane of view” but each alone cannot determine the 3D position of the ball.

But by merging the information from several

cameras, the ball can be tracked. Using more cameras also achieves higher resolution, and tolerates obstructions by players/shadows, and camera malfunction. Once the position of the ball is known, the system can use a pre-calibrated model of the boundaries of the lines on the court to determine whether a ball is in or out.

Systems such as Hawk-Eye are possible now because of the availability of reasonably priced high-speed high-resolution cameras, innovative image processing algorithms (my own research area) and software systems which allow tracking in real time, and to be retrieved for use by umpires with minimal delay.

First used for cricket broadcasting, Hawk-Eye was created in 2001 by British engineer Paul Hawkins, a PhD in artificial intelligence (“Hawk-Eye” surely was chosen

to reflect both his name and also the accuracy of a hawk’s vision).

It is now used widely in cricket, badminton, football, baseball and ice hockey. Sometimes I wonder why I did not invent the system myself, as I knew the need, the technology and I had seriously thought about technological solutions. But that’s what separates a scientist from an entrepreneur – the latter reads the market needs and takes the risk to invest the money and time to make and market the product. Hawkins’ company is now owned by Sony.

Before Hawk-Eye, line-call controversies were always part of tennis lore (the most famous ones were probably John McEnroe’s tirades).

In the early 1980s, a system called Cyclops was deployed at Wimbledon to make calls on whether a

serve was in or out (only), but it had its flaws and never reached Hawk-Eye’s success. In the early days of its adoption in tennis, many pros were quite skeptical of Hawk-Eye, but slowly most have come along.

This is the story with most disruptive technologies. We are now in the fourth industrial revolution and each of the first three experienced such a phenomenon of rejection and slow adoption.

The French Open remains the lone opposition to adopting the system; the claim is that the ball leaves a clear mark on clay, which can be inspected by the umpire. But I suspect the real reason is a bit of French chauvinism, in making the French Open different.

Some would also argue that sports are human games and the vagaries of umpiring should be part of whole experience, with all the imperfection included.

As a tennis player myself and a scientist, I take a different view. I like watching tennis mainly because of the beauty of the game and skill of the players, and the mental game. Line-call controversies are distractions.

Hawk-Eye does not only provide the accuracy needed; it also rids the game of any biases toward any player. It is not infallible, but if we are not prepared to be wrong, there cannot be any originality or progress.

There is no absolute right or wrong in choosing to adopt tech in sports or everyday life. In the case of tennis, it is a choice between tradition, fairness, objectivity, truth and an appreciation of the human spirit and fallibility. I wish other applications of technology were this benign and humanistic!

