

# BETBRIGHT

## THE FUTURE OF ROBOTS IN SPORTS

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## » INTRODUCTION

Robots have developed a lot in the last year or two. Some of the emphasis has been on making humanlike robots, harnessing the many recent AI developments, but perhaps the most spectacular improvements have been in agility, with robots learning how to do movements athletes would be proud of. It's obvious that robots will feature greatly in housework, industry and the military, but what about sports? Let's take a look.

## » HORSE RACING

Many people get great pleasure and excitement from trying to predict which racehorse will be the fastest on this track, today, against these other horses, with this jockey, in these conditions. Human jockeys introduce variability and uncertainty that make it harder to separate the jockey's and the horse's merits. This suggests that there may well be a market for robot jockeys, which could be identical physically and have the same basic technology too so that horses compete on equal terms. Robot jockeys don't have to look like humans so could be any shape and size, maybe streamlined to reduce drag, but humanoid jockey robots seem more likely at first. Since horses have individual personalities, deep learning neural nets could be used to allow the robots to get to know them, working with them over numerous training sessions to learn how to make the most of their abilities, just as a human jockey does. Provided that these learning systems are kept within strict specifications laid down by the sports authorities, every horse would have an equal chance to shine. We should start seeing prototypes soon, and although it might be several years before formal racing adopts robotic jockeys, show races or informal entertainment races might start using them by 2025.

Robot jockeys could be used in other ways too. They don't all have to be equal. We could see the same variability that we see in car racing, with teams of engineers competing fiercely within technology limits to gain the best possible performance via ingenuity. They may be constrained to the same basic technology, but might be free to use that how they wish. Different race teams might therefore develop different strategies for their robots according to the conditions at race-time. Those strategies and techniques could be developed over time across a number of horses, so that skills gained stay with the team instead of going with the jockey. This could also extend to spectators. Some aspects of robot jockey behaviour might be open to input from spectators, such as where and when to drive the horse harder. If they push it too hard too early, it will perform less well later. If they are too lenient for too long, it may not be able to catch up.

Other areas of robot use are more mundane. We already have drones used for photos and video capture. Drones can easily be automated, allowing more interviews, more coverage, more angles, more personalised. So can bookmakers of course, allowing people to place bets and collect winnings with minimal effort. They can do that online of course, but robot bookmakers could add the extra excitement of a physical and charismatic persona. Face recognition technology might mean that punters could be recognised and welcomed by every bookmaker at every race.

Robot surgeons are also becoming common and sometimes exceed human capability. Over the next decade, robot doctors will become commonplace, using high-tech sensors and AI to diagnose problems and automated surgical skills to remedy it. Throughout sports, robot doctors and physios may become commonplace, and in horse racing, we'll also have robotic vets too.

## » FOOTBALL

Football robots would very likely be humanoid. Nobody would watch a game that was just two ball-cannons doubling as goalkeepers, but teams of aliens, zombies, cartoon characters or celebrity lookalikes would work just fine. Unlike today's pulleys and wires, future humanoid robots are likely to use electro-active polymer muscles laid over a metal or plastic skeleton. These muscles in the lab are already 15 times stronger weight for weight than human muscles, so by the time we see them entering routine sports, the real issue may be toning them down to human-like speeds and strength. We could make robots that could run up and down the field at 100mph and kick balls so hard they burst, but that wouldn't be fun to watch. Spectators need play to be slow enough that they can follow it properly. They also want teams that are fairly well matched in terms of ability. If robot footballers are designed with humanlike ability, they could take part in games against each other or against humans. They could even be part of teams. The game authorities would have to regulate acceptable performance of course, but if a player or two on each team could be controlled by fans, that might improve fan engagement enormously with corresponding increases in team loyalty and presumable income. That makes it very likely to happen, and the date could be any time from 2030 onwards. Any robots before then wouldn't be very humanlike, but they could be abundant nonetheless. We might see line-robots, camera-bots grounds-bots, cleaner-bots, boot-maintenance bots, security-bots, robot coaches, trainers, managers, guides and journalists. These don't have to be any particular shape so could arrive any time.

Robotics can also morph to cybernetic enhancement of human players. We already see synthetic limbs used in disabled sports, so why not allow regulated enhancement for any player? Exoskeletons don't have to be metal and hydraulic affairs, but could be as simple as electro-active polymer leggings. By 2025, something only as thick as a tracksuit could double a player's strength, letting them run faster or for longer or be more agile. Adding electronics to the player's skin surface, creating 'active skin', would allow total monitoring of biomedical behaviour, giving precision fitness feedback to trainers during training sessions. By linking direct to a player's nervous system, it would also allow a direct link between AI in training computers and a player's sensations, so that they could quickly learn a new movement or perfect a kick technique, or simply have sensory input to guide them through a manager's game strategy. Robotics and bionics could therefore be involved in training or show-games long before they are authorised for use in real matches.

Apart from being players, more mundane robots might feature soon as linesmen, following play to check if a player is off side or whether a ball just crosses a line. These don't have to be humanoid, and could even be simple drones, appearing by 2020, linking to the referees augmented reality so that when the ref looks at a ball or player, they can immediately see anything the need to be aware of. The referee could also be robotic and again in the shorter term could be a drone before a fully humanoid referee is feasible in 2030. Drones could follow play from the air, so would perhaps be less visually intrusive than a humanoid robot, but seeing everything happening by being electronically linked directly to other sensors and cameras around the field, so would be able to make more accurate calls than a human ref who can only be in one place at a time and looking in one way. Drone referees and linesmen would be technologically feasible by 2020, but might take much longer to be accepted.

## » GOLF

Robotic golf carts and self-driving buggies are so obvious as to barely need listing, but robotic groundkeepers could benefit from high precision sensors that could mean that future greens are precisely flat with every blade of grass the same length, and every divot precision-repaired. Ball-cleaning and score-keeping can easily be incorporated into buggies, and even ball retrieval. Robots could also measure positions of balls or distances to holes more precisely than humans. Training would seem to be their main role though, and that may mean a range of shapes and sizes. Obviously if a robot is teaching a player how to hold a club, it will need humanoid shape, but if it is just helping a player to select the right club, estimate range, or determine the correct angle and strength for the shot in the prevailing weather conditions, it could be any shape at all, or even be built into the cart.

Robot golfers would seem to be a non-starter because they could be made to any arbitrary ability, making holes in one the norm, and that simply wouldn't be fun. Cybernetic enhancement of human players might have a market, especially for older frailer players who don't want to retire from the game they love just because their health is declining. Strength-enhancing leggings or cat-suits could allow people to play long after their body has fallen below par, and we could see such medical devices appearing by 2025. Vision enhancement would also help some people in the next year or two, zooming in on distant greens to help work out a play, illustrating a shot via augmented reality, or just more easily spotting a ball in long grass.

The flight of a golf ball depends critically on the spin and its dimples. Making tiny changes to ball aerodynamics would allow a degree of control that could bring an extra dimension to the game. For example, an opponent might be able to choose particular flight characteristics from a defined set before the ball is struck, forcing players to make allowance for more diverse factors. Or players could steer their ball after strike within very strict allowances. This could become a niche interest sometime after 2025, but is unlikely to become mainstream

## » TENNIS

Tennis was the earliest popular sport to prominently feature technology, with line monitors saying whether a ball is in or out, something humans are not very good at when a ball is travelling at over 100mph. Tennis also gave us data on serve speed, making another category of sports statistics for fans to enthuse about. Many players practice against ball-firing machines and use rackets built from the most advanced materials, so tennis is certainly as technophilic as any sport. It would be no great surprise to see introduction of ball-collecting bots or even robo-umpires appearing in the next few years. Robot players could certainly replace ball-firing machines for training, and if they are humanoid, that would allow players to learn to anticipate the type of serve, with robots exaggerating any mannerisms or facial expressions that might be typical of their next human opponent. However, although non-humanoid robots to train against might arrive by 2025 (they already exist in table tennis), humanoid ones will probably be well after 2030, and we shouldn't expect to see them in matches until 2040. Ground, court and stand maintenance can be automated any time.

Tennis robots could play against one another of course. Even without increasing ball speed too much, there are enough variables to make it highly challenging to make good tennis robots, so technology companies might want to show off their skills in sensors, AI and physical agility.

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## » CRICKET

As a non-cricket fan, I would argue that cricket robots offer opportunities to liven up a game that is much in need of it. While ball-throwing and batting mechanics could easily be automated, a degree of AI competence would be needed for a robotic cricketer to work out how to deal with each incoming ball. Sensors would need to determine spin and speed, and AI needs to calculate optimal responses and that needs to account for likely response and competence of every fielder, whether human or robot. This would create sufficient variability to enable robot cricket teams to compete without always having the same outcome. Robots can entertain too. A variety of different robot types could make up teams, and some could be controlled in part by fans. By 2030 we could have 'transformer' robots that can run or change shape and use wheels, or could jump high and do elaborate somersaults, or even fly. Shape-changing in the 2040s could even involve the 'liquid metal' familiar to sci-fi, so a bat could be quite literally part of the robot's body. Shape changing that allow 10m long arms might make catching a ball too easy though, though it would also allow supersonic balls that could easily kill a human player. Spectators wouldn't be able to follow balls travelling supersonically, though high risk sports do suggest that possibilities of severe injuries to human players might increase viewing figures.

However, the nature of cricket suggests that unlike in tennis, robotics would be unwelcome, apart from in things like ground keeping or catering. It is hard to imagine robots mixing with humans either on the same teams or in competition. Either robots would need to be constrained too much to make them fun to watch, or the sport could become too much a gladiatorial contest where the bats and ball become primarily weapon.

## » FAN EXPERIENCE

Robots can be as networked as desired so fans could easily be incorporated into play, controlling robots or inhabiting them, or seeing through their eyes. Individual robots could attract a fan-base that influences how they behave, and of course that might depend on subscriptions. Degree of robot autonomy is also controllable. Although they might follow default behaviours, or be controlled by managers, behaviour could also be linked directly to fan monitoring. Depending how crowds are responding, determined from apps, social media, video cameras, gesture, face and emotion recognition, marketing AI might determine how to change robot behaviour as games progress to optimise fan engagement and profits.

Inhabiting robots will become possible late in the next decade. Microscopic electronic devices could be printed onto the skin surface or even into skin, it can detect signals travelling through nerves. It will become possible to record sensations and our nervous systems will sometimes be networked by 2030. Recreating the same signals associated with particular recorded sensations will allow those same sensations to be replayed. That technology will allow sensors in a distant robot, or even a human player, to be transmitted and experienced by human spectators. Active contact lenses in 2030 or even augmented reality visors in 2020 would recreate 1st person player vision and sound, so fans could get a full-sensory experience of being that player, whether robot or human. That will greatly increase sense of involvement, team loyalty and of course income potential. When fans number in millions, this will inevitably be one way broadcast, but for small events, individual fans might be able to control a robot as if it were their own body. A group of people could inhabit a team of robots to play against another human group inhabiting the other robot team, and they all may experience having abilities far in excess of their own, performing feats they could otherwise only imagine.

Fan experience thus extends from conventional watching of broadcasts, through full sensory experience via a player's point of view, all the way to being actively involved as a player via linkage to a robot.

## » VIEWING SPORTS

Drones, aerial and body-worn cameras have already made sports viewable from pretty much any point of view, and thanks to development of active skin technologies over the next decade, that will likely become full-sensory as the norm during the 2030s. While some fans will want to watch sports conventionally, others will want to become more involved, associating with particular players or riders and experiencing it through their eyes and ears. We already often watch motor racing through driver helmet cams and this will extend to other sports too, with cameras in bats, balls, on horses' tack, fences and hares running away from greyhounds.

Drones typically give an aerial point of view, and some skiers can already have a drone camera follow them down a run. As costs fall and sophistication increases, we'll soon have small flocks of drones following us, making 3D video from all angles so that we can later recreate an event to watch or incorporate into computer games. Incorporating simulations of real play into computer games is already established and that will increase as time progresses. Robots offer opportunities to exceed some human abilities such as strength or speed so they will often be used to give fans an experience of being superhuman.

“ WE’LL SOON HAVE SMALL FLOCKS OF DRONES FOLLOWING US ”

## » AI IMPACTS: PLAYING, EXPERIENCE

AI already surpasses human ability in many fields from chess to medical diagnosis, so we should expect AI to become prominent in managing, working out optimal strategies for football play, or accurately emulating tennis opponents so that players can practise against them. AI is even excellent at identifying emotions from gestures and facial expressions, and because electronics can easily see things like blood flow, pulse and even oxygen levels, a robot linked to remote sensors and AI as well as what it has on-board would be in a perfect position to know how an opponent is feeling and anticipate their likely next move.

Coupled with the ability to easily make robots faster and stronger than human, the real challenge for using them well in sports will be determining how to tune them to the right performance levels. It will be relatively easy to make robots that could easily beat humans, but that doesn't make good viewing – we don't watch people running against jets or weightlifters competing against cranes. Just as car racing authorities tightly regulate technology use in cars, other sports will need to regulate robot use to maintain both safety and watchability. Some things may be permitted in training but not in competition.

## » MARKET FOR ROBOT-ONLY SPORT

Many people have enjoyed Robot Wars for decades now. One day, probably in the late 2030s or 2040s, those remote controlled machines will have evolved into android gladiators that will have synthesised emotions, and a (simulated) will to live, so that they will give convincing performances in future arenas. Future gladiator fights between androids will be as popular as human gladiators were 2000 years ago, because our human nature hasn't changed much at all. In other sports, robots will only make good viewing if they either are designed to human-like specifications so that people can identify with them and follow play as if they were human, or if they are so spectacular to watch that new variants of sports emerge that only involve robots. Watching 20m high transformers slug it out will undoubtedly be fun, as will scaled-up aerial robotic drone racing, with races with small drones flown by humans already very exciting to watch.

While people often have reservations about violent sport that may cause injuries, robot fights or boxing matches wouldn't carry the same issues. Few people would worry about a machine needing repair or replacement after a match, so robot boxing might greatly increase the sport's following, offering even greater excitement but without the ethical issues. That might change once machines are given consciousness and emotions, but that presumably wouldn't be allowed if it would jeopardise the sport's commercial attractiveness so will only happen to the extent that society supports. Boxing robots would also have a large role in training, offering practice in specific areas where a particular boxer needs improving, as assessed continuously by AI training programs. Every club could thus make the very best training available to every member so people would improve faster and the even top levels of the sport could reach higher proficiency. Robots boxing against each other would be easier to implement than mixing them with humans for training, so we might expect robot-robot boxing around 2030 and their use in training by the mid 2030s.

Cybernetically enhanced humans will likely be another category. People do already fight in Titan-style robots. The problem is of course safety. As Robot Wars proves, robots can totally destroy each other and be fun, but people need to be protected from harm, and that inevitably means toning robots down somewhat. Pure robot sports are likely to be more exciting than hybrid human-robot sport, but only if they are constrained enough that people can still follow what is going on. New types of event that are designed for robots will emerge over coming years, packed with acrobatics, speed, tricks, lights and special effects. With all the technology advancement coming, one thing is likely to remain true: sports will always require that opponents are reasonably matched so that outcomes aren't too obvious in advance. The elements of competition and unpredictability are the foundations of fun and audience engagement.

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## » CLOSING REMARKS

High tech has always been prominent in sports like motor racing, but has been introduced more reluctantly into tennis, and is still inconspicuous in horse-racing, golf, football and cricket. Robots will likely be introduced into sports via training at first and later into competition, but only where they can add far more to entertainment value than they do to costs.

Robot jockeys will change the ways horses perform so add a new dimension for spectators and gamblers. Cybernetic golf trousers will extend involvement well into people's old age. Robot footballers will offer new kinds of players for fun games and more options for stag parties. One day, the return of Roman gladiators and their inevitably enormous popularity will prove that our fancy futuristic technology is just a thin veneer over the same underlying human nature that has driven sport for millennia.

“**CYBERNETIC GOLF TROUSERS  
WILL EXTEND INVOLVEMENT  
WELL INTO PEOPLE'S OLD AGE**”

## » ABOUT THE AUTHOR

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Ian Pearson is a full time futurologist, tracking and predicting developments across a wide range of technology, business, society, politics and the environment. He is a Maths and Physics graduate, a Doctor of Science, and has worked in numerous branches of engineering, from aeronautics to cybernetics, sustainable transport to electronic cosmetics. His 1800+ inventions include text messaging and the active contact lens. He was BT's full-time futurologist from 1991 to 2007 and now runs Futurizon, a small futures institute. He writes, lectures and consults globally on all aspects of the technology-driven future. He has written several books and made over 750 TV and radio appearances. He is a Chartered Fellow of the British Computer Society and a Fellow of the World Academy of Art and Science and the World Innovation Foundation.

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