Executive summary

Curling is one of the most popular sports in the Winter Olympic Games, often described as ‘chess on ice’ (but with more shouting). It’s easy to see the similarities between the two. Both are turn-based games of skill and strategy. Both see players use offensive and defensive moves to gain territorial advantage on a board, knocking the other players off if needed. And much like chess, the best teams need to think several moves ahead.

The sport has a long history of success for Team GB athletes. It stretches back to the 1924 Winter Olympics in Chamonix, where the men’s team won an historic gold. Great Britain is one of only two nations to have sent curling teams to every Winter Olympics at which the sport has been contested. Famously, curling saw an enormous boost in its popularity after Rhona Martin delivered her ‘stone of destiny’ to dramatically win gold at the 2002 Winter Olympics.

Yet, despite this illustrious past, the role of technology in British Curling has only been a comparatively recent phenomenon. Up until engagement with the Scottish Institute of Sport in 2000, British Curling operated much like many other grassroots UK sporting organisations, with little or no data capture and analysis. Today, with the help of Intel® Core™ Processors and Intel® Xeon® Processors powering the cloud, top-level coaches and athletes have unparalleled access to a wealth of video information and statistical insight.

Performance analysis using data analytics is a crucial feature in many modern sports. It has already changed the way British Curling approaches its national coaching programme. As Kenny More, Performance Analyst at Sportscotland Institute of Sport, explains:

“In the past, if a team won or lost they didn’t really have clarity on ‘why’. Analysis has helped us go to the next level, to look at the statistics, the tactics and the shotmaking metrics below the scoreline. That’s where the understanding comes in. And with that understanding, you can change the way you coach to reproduce the winning habits and reduce the losing habits.”

The evolution of coaching

When Kenny More first got involved in curling in 2000, his experience of curling coaches were willing volunteers that introduced you to curling and helped you start playing the game. After that, he says: “you just carried on playing and got better, and got limited coaching thereafter.” When a team went to major championships, like the World Championships and European Championships, they would typically
take an experienced curler as their coach. But that coaching role tended to be more of a team manager than a trainer or a dedicated strategist.

The setup has changed dramatically since then, with British Curling becoming increasingly data-driven. “Now, our best coaches are thoroughly involved in the whole athlete and team development track,” says More. “They have a very strong understanding of technical and tactical aspects of curling, but they also understand how strength and conditioning, health and wellbeing, and mental readiness is all part of building a curler now.”

In addition, rule changes in curling over the last 10 years have allowed coaches to have a bigger influence on competition play. In the past, they were only allowed to speak to the team before the game and at the fifth ‘end’ interval. Now, coaches are able to do pre-game talks and interact with the team between each end of curling. During a timeout scenario, a coach may also enter the field of play within an end to assist with a critical call or decision-making moment. This increased access means that coaches have regular opportunities to affect performance, strategy and tactics as a game unfolds.

This is where data capture and data analysis comes into play. As Team GB curler Bruce Mouat explains: “Having access to a lot of stats over the past few years has given us the knowledge of when to play specific shots. So, if we’re going for a double in the 6th end to try and score ‘two’ rather than just a ‘one’ or ‘two’, we know we’re going to have an extra 20% likelihood of winning. [With the coach’s help], the data now gives us a lot more information on what shot to play.”

**The pursuit of consistency**

In curling, two teams slide stones along an ice sheet towards a target (known as the ‘house’). The team with the closest stone to the centre wins, and each additional stone within the target area scores another point. Teams play 10 ends in a championship match. For Kenny More and British Curling, the secret to improving a curler’s match performance is improving the consistency of their delivery of a stone down the ice.

“Our pursuit is a consistency in the mechanics in the setup, loading and unloading phases of the delivery,” says More. “Because from that we believe we get accuracy in line of delivery, and accuracy of force production, which equates to weight control. Every stone that gets released – you’re hoping – is on line and at the right weight. Because that way it then behaves predictably, in relation to what that shot is designed to do. The ‘skip’ of the team puts their brush on the ice and says ‘aim here, with this weight, and the shot will work for us.”

**A brief history of curling**

Curling involves two teams sliding stones along an ice sheet towards a target (the ‘house’), the team with the closest stone to the centre wins, and each additional stone within the target area adds another point. It’s widely held that the sport originated in Scotland, and although an exact date is unknown, there is considerable historical weight behind British Curling. The first recorded curling match took place around 1541 near Paisley Abbey, and the first official curling rules were written by the Royal Caledonian Curling Club in 1838.
Then I’ll have my chess piece in the right place’. So, line of delivery and weight of delivery are the two biggest metrics that we track and capture.”

A further complication is added by the ‘sweeping’ phase of each delivery, where each stone can be gently guided after release by brushing the ice in its path. Again, a data driven approach to sweeping has seen significant changes made to the procedure, based on completely new insights. As Kenny More elaborates: “We’ve basically proved in the last three years that the old style of sweeping was often counterproductive. Sweeping used to be about slowing the deceleration of the stone. You melt the ice, you slow the deceleration of the stone, therefore it doesn’t curl as much.

"Now, they’ve realised that if you manipulate sweeping you can sometimes keep it straighter. But at certain points depending on where you sweep it, you can actually get it to curl more. So now you’ll see sweepers literally manipulate the stone all the way up there, depending on how vigorously and where they sweep the ice in relation to the path of the stone. We’ve looked at mechanically how best to sweep, and massively influenced the strength of our athletes and the physiology of our athletes to be able to sweep. Today you’ve got some second and third players who are just magnificent at sweeping, and skips will now say: ‘Gosh, we can do things with stones that we couldn’t do four or five years ago’.

Being consistent in the delivery of a stone, believes More, reduces all the compensations that might need to happen. “For example, compensations in how [players] release the stone, how they add or take away from the speed of the stone, and what the sweepers have to do to accommodate the error that’s happened. We’re trying to produce curlers that can consistently produce line and weight appropriate to the task, without thought to the underlying mechanics. This is where performance analysis comes in.”

The power of video analysis
With their current setup, British Curling’s performance analysis relies on extensive video capture, the majority of which takes place at the National Curling Academy (NCA) in Stirling, Scotland. The NCA’s four sheet ice rink is equipped with 16 IP cameras to provide face/rear/side views of each slide. This video capture system runs continuously from 7am to 9pm each coaching day, providing potential insights when appropriately processed.

The cameras are networked to local NAS, which enables the video data to be accessed and reviewed on any of the coaching laptops situated at the side of each sheet of ice. These laptops have recently been upgraded to models powered by Intel® Core™ i7 processors. Four tablets are also available for immediate shot display and review purposes, although these are primarily used for competitions held at other venues.

Managing the video data alone is a significant challenge, with a single coach potentially capturing about 2GB of data per day. “As an example,” says Kenny More, “one of our Delivery Assessments will have a player deliver 16 stones. This will be recorded from two camera angles and take about 12 minutes, depending upon the athlete. I will conduct this with all four...
The data behind British Curling

16,800
The potential number of data points in a World Championships (15 matches x 160 shots, x 7 attributes per shot).

16
The NCA’s four sheet ice rink is equipped with 16 IP cameras running from 7am to 9pm each coaching day.

2GB
A single coach could potentially capture about 2GB of video data per day during coaching sessions.

750
Coaches will collectively upload data on approximately 750 games during the course of a typical season.

Team GB & British Curling – Sliding to success with Intel® Xeon® Processors
team members in a single session, typically covering four teams in a day. A single athlete will produce 400MB clips from the side-on cameras and 220MB clips from the static dome cameras. For scale, each athlete will do this exercise five times a season and we [currently] have 46 athletes.”

But that’s not the entirety of the data challenge. “In competition,” continues More, “there are about 160 shots in a match. All 160 shots carry about seven attributes of information in relation to the shot. So, a coach going to a World Championships might capture up to 15 matches and come home with 60GB of video. That’ll be 15 matches times 160 shots, times seven attributes per shot... [The data] builds up quite rapidly!”

**Data processing with Intel® Xeon®**

Coaches will collectively upload data on approximately 750 games during the course of a typical season, with 400 of those games having supporting video. All of this data is stored in the British Curling Performance Archive, a database underpinned by Intel® Xeon® Processors powering the cloud. This curling ‘experience bank’ is a rich source of data for Scotland/Team GB competitive play, opposition scouting, and strategic planning, both post-match and in-game.

As Kenny More explains: “The post match analysis is all about saying: ‘what have we acquired that is an effective addition to our experience bank?’ So, when we confront [a specific tactical situation] the next time, we make a better decision or at least know that we’ve had this discussion in the past. In terms of during the game, the coach could be sitting there with the analyst beside them, reviewing the team performance as it’s building in the game. Then, if it’s a between-end or a halftime moment, the coach may bring some of that performance insight to the attention of the team. You might become sensitive to a weakness in the opposition that is developing, for example, and therefore play stones in a particular way. The team might not be sensitive to that weakness yet, but the data is.”

To provide this tactical insight, British Curling has used machine learning on its archive data to produce a predictive model known as ‘game state probabilities’. “What you’re able to do with this data,” says More, “is say: ‘OK, in this current game state, we have a 65% chance of winning. However, if we score one in this end, what does the chance of winning change to be? If we score a ‘two’, what does it change to be? If we blank it, what does it change to be?’ As a coach you’re able to look at the data and say: ‘if we can be really aggressive here and score a ‘two’ or more, we become unassailable.’ That’s worth the gamble.”

British Curling’s access to shotmaking data is used to understand player development and to scout opposition playing profiles. Score line data analysis, meanwhile, delivers tactical understanding, keeping coaches attuned with how well teams are performing with and without Hammer (last stone) advantage. This knowledge shapes the development
priorities for coaching, while the game state probabilities act as an in-game decision making tool that helps guide strategy and tactics.

The whole performance analysis workflow relies on products built with the latest Intel processor technologies. “Intel technology produces the unseen power behind the data acquisition and processing parts of the approach that we have developed on behalf of British Curling,” says Kenny More. “Our tablets and laptops allow us to have an immediate impact after a game. Video is available instantly, the match analysis is already compiled and we’re ready to bring that into the formal debrief. With Intel® Xeon® Processors powering the cloud, data analytics and video is available anywhere we need it. The power of Intel processors allows that to happen.”

**Consistently developing world-class curlers**

As Team GB prepares for the Winter Olympics in 2022, British Curling’s data-driven approach is paying dividends. “If you look at the record of Team GB and Team Scotland over 20 years,” says Kenny More, “we’ve prevailed at the top table pretty significantly in that time period. We don’t have a massive gene pool, so we’ve had to look at making the most of the talented players that we do have.

“This means we’ve got to be more effective and more efficient in our training and I don’t believe there’s another country that adopts such a strong performance analysis influence as we do. Consequently, we’ve had medallists over the years from five or six men’s teams and three or four women’s teams. Our men’s team [Team Mouat] are the form team on tour and both Team Mouat and Team Muirhead go to the Games as European Champions. It’s a validation that the whole programme does produce world class performance, and performance analysis plays a big role within that.”

But British Curling isn’t about to rest on its laurels. The organisation is constantly on the lookout for technology solutions that will help its coaches extract any extra information that will give them a competitive edge. Data analysis and video slow-mo might enable players to improve their technique to achieve a higher level of performance, reach a more consistent level, or get to a level that will ultimately reduce the risk of injury and prolong their careers.

“Data has been crucial for us over the past few years,” says Team GB curler Jen Dodds. “Shotmaking statistics have had one of the biggest impacts on day-to-day training. After competitions, we can look back and see if a certain shot is
"Intel technology produces the unseen power behind the data processing parts of the approach that we have developed on behalf of British Curling."

Kenny More
Performance analyst, sportscotland institute of sport

The future of technology in curling
There is a bright future ahead for British Curling married to data-based analysis and new processor technology. One example is a biomechanical skill acquisition project using 3D motion capture software that could have far-reaching repercussions for athlete performance.

“What the biomechanists are working on now is trying to validate the technical model,” reveals Kenny More. “So, the coaches might say: ‘there's an athlete who slides really well. Let's do a full 3D motion analysis on them’. Then we can ask: ‘what are the forces involved?’ ‘What are the angles involved in producing that type of slide?’ ‘How does it vary for somebody that we currently perceive to have less effective delivery mechanics?’

“[Using this technology], we are getting to the point where we will be able to create a thorough analysis of delivery technique. This will allow us to say that people who perform well in competition slide this way and the data is validated by the biomechanical model. Therefore as we progress along our pathway, we want our athletes to come in and to fully embrace why they need to look at this in order to produce deliveries consistently.”

The power of sporting data and the value of data analysis is of core importance to Team GB and British Curling. The ability to train athletes smarter, improving their weaknesses and building on their strengths, is vital for future success. Intel is increasingly at the heart of this technology revolution and Kenny More is optimistic about where they can improve.

“We've got lots of things that are useful to us, but to be able to harness them effectively, see the connections between them, and produce really powerful outputs for coaches at the key feedback windows, that is the next step. Then, I would be able to sit back and say: ‘we are measuring what is measurable, and we're producing outputs that will have an impact’. If Intel can help smooth and power that, I will retire a happy man.”

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