"Progressive swingweighting means the various clubs are built to be balanced when in motion, so feel the same throughout set."

Cobra CB Forged, Ping S59, and the new Callaway X-Tour.

The iron-fitting system does indeed provide for detailed relative performance comparisons of clubhead forgiveness and trajectory based on the company's formal testing.

However, I agreed with Simon that, within a narrow range of similarly performing head designs, and my fairly repeatable swing, the choice should come down to aesthetics and other subjective thoughts as to how the club sits at address, etc (and, of course, price). After much thought, I decided on the Cleveland CG2 irons for their blend of classic looks and understated technology which I had previously enjoyed testing.

PART C. BUILDING THE CLUBS

As a technician who qualified as a 'Class A' Clubmaker under the aegis of the Professional Clubmakers Society, James Davey's role is to build every set to the exacting specifications appropriate for each client. His first task is to calculate a 'build frequency' according to the components which, of course, also includes the grip.

SST Pure's technology measures and corrects for inconsistencies in shaft symmetry which can seriously affect performance

Precision Golf's expert clubmaker, James Davey, checks Dominic's new clubs on the workshop's loft and lie machine

A) GRIP CHOICE

I was already aware of Golf Pride's useful system for choosing a grip based on personal preferences of 'moisture management' (very dry through to wet conditions), 'responsiveness' (ultimate shock absorption versus maximum feedback) and 'surface texture' (a range of soft/smooth designs through to the firmest, high-traction models).

Preferring a compromise between these features I settled on the Tour Velvet, the popular buffed rubber design, in the standard mens' fitting of 58 Ribbed, weighing 51.5 grammes.

Meanwhile, I was reminded that the thickness of the grip can have a dramatic impact on a player's accuracy and should be chosen according to the size of hand and length of fingers. Grips that are too thick will prevent the wrists from closing (turning over) through impact, thereby pushing shots to the right of target. Too thin, and the wrists will close too much, pulling the ball to the left.

In the past I had piled up extra layers of tape under the right hand to give a chunky 'baseball bat' feel, but will now opt for a conventional tapering (with a uniform two-layers of tape) to help further nurture the draw action I've been at such pains to develop.

B) SWINGWEIGHT – 'FLATLINE' OR 'PROGRESSIVE'?

As well as absolute weight, Precision Golf take considerable care when discussing a player's swingweight preferences, the way weight is distributed between grip, shaft and head, which in turn directly affects how a club feels.

While most golfers will be familiar with 'flat-

line' swingweight (or swingweight 'matching') where every club in the set is built to register the same nominal figure (ie. D2). Precision makes the case for 'progressive' swingweighting which rises incrementally through the set as the clubs get shorter (in my case, from a D0 3-iron to a D5 sand-wedge).

Simon explains the subtle differences in terms of feel:

"With a flatline swingweight, you're only matching the clubs statically. But golf clubs operate in motion, and, dynamically, the various different clubs do not feel the same when swung. The balance point is physically further away from the grip in the long irons than in the short irons, so they will feel heavier when swung at speed.

"Conversely, the rationale of progressive swingweighting is such that the various clubs are balanced when in motion and therefore feel the same throughout the set. You can then put the same dynamic swing on every club without each one feeling different."

Ultimately, it is down to personal preferences and, with most manufacturers building to a matched swingweight, most players (even many pros) still prefer it. But this may be down to habit rather than anything else, and I am intrigued enough to 'go progressive' and see how I get on with it.

C) LOFT AND LIE ANGLES

Correct fitting ensures that the player returns the sole of the club flush to the ground at impact, rather than making contact with the toe (lie too flat), or the heel (club too upright), which can account for sometimes dramatic pushes and pulls, respectively.

As with all careful custom-fitters, Precision confirms that a player's height is often a spurious guide. Players who carry their hands low at address, or have flatter swing planes, usually need clubs with flatter lies, while those with more upright swings need more upright lies.

While I myself have regularly played blue dot (1-degree upright) Ping irons down the years, Simon suggested that the extra 1/2-inch shaft could mitigate against this and, sure enough, a standard lie angle seemed appropriate when I was tested (using both a lie-board and the special 'spray-on paint' routine) when collecting my clubs.

(Note: having moved to a forged head, my loft and lie angles can tweaked far more easily than with a cast construction, with any subsequent necessary adjustment all part of Precision's comprehensive follow-up service. The same goes for bounce angles and other grinding work which Precision offers on any individual basis. For example, while I will be taking the Cleveland sand-iron with a standard bounce, I may well be returning it for James to reduce the bounce. My bunker play has improved recently and would like to use the same club to nip the ball from tight fairway lies – a versatility I particularly require given how I usually forgo gap- and lob-wedges to have more hybrids in the bag.)

D) FREQUENCY MATCHING

Like swingweight, frequency matching and shaft 'puring' are the most invisible of technological developments – yet, some argue, among the most important in the entire club-fitting process. Originally developed by Brunswick Golf, frequency matching ensures shaft flex consistency throughout a set of clubs. The club-fitter chooses shafts, and makes build adjustments, such that the various club frequencies plot on the FM chart to form a straight line. This line is typically set at an angle reflecting the fact that absolute stiffness (as measured by c.p.m.) increases through a set as shafts get shorter but the set as a whole will play according to the level of

improve on your launch conditions to optimise your distance.

Typically it will will rank three premium multilayer balls and three more durable value balls, all based on data gathered on robot testing at 10 mile-per-hour increments from 50-120 mph.

"You'd surprised how the ranking of balls in terms of spin rate and ballspeed varies drastically according to clubhead speed," reveals Helfrich, before discussing how different models of ball are designed to work well within a given speed range.

"Certain premium balls that pros play do not perform well at lower clubhead speeds where the core compression – and resulting ball speed and spin – are too low for an efficient ball flight," he confirms.

His comments directly bear out Titleist's recent decision to opt out of controversial magazine product testing (whether conducted on a single robot set-up or similarly one-dimensional human 'experiments'). And, of course, the reality of different performing ball constructions has had subtle knock-on effects within the industry, with Mizuno even developing its popular low-flying MP-32 irons in response to the rise of the high flying Titleist ProV1 ball on tour.

In my own humble case, Simon Cooper at Precision Golf guided me through the ball-fitting process, elaborating on the system's recommendations that included the Srixon Z-UR (and Z-URS) and Titleist NXT Tour for my particular launch conditions and driver (10.5-degree Yonex Cyberstar Nanospeed).

"With the low weighting in the head and your swing characteristics, the system is confirming that you don't need a high-spinning ball to get the ball up," Simon elaborates, explaining that I naturally generate enough launch angle allowing these lower spinning balls (compared to the premium models to which I was aspiring) to deliver a more 'forward' flight, and hence extra distance.

At last a concept that takes the guesswork out of choosing a golf ball, replacing it with a method that makes perfect sense (even if access is only via a licensed fitter.)

As with the rest of my clubs, I'll be looking for subtle performance changes over the next few months (though already here's one decision that will immediately save me a few bob).

Hot Stix itself started five years ago and now boasts some 45 US licensees with further outlets in Canada as well as Precision Golf in the UK. Adding further credibility to the company's reputation for detailed independent testing is the fact that several leading golf manufacturers, including Fujikura, Adams Golf, Mitsubishi Rayon and Nippon, currently subscribe to the system. This gives them instant access to performance data on their rivals in any market, while allowing them to develop new models according to the competition.

While the nature of big money endorsements means that Hot Stix does not publicise the names of the leading golfers who use their system to perfect their equipment, their clients include leading names from every major professional tour. Not bad for a concept that first started out on a small Excel spreadsheet. For more information, visit **www.hotstixgolf.com** and **www.precisongolf.co.uk**

flex, the precise height of the line reflecting degree of stiffness.

E) SHAFT 'PURING' WITH SST PURE TECHNOLOGY

By contrast, shaft 'puring' is purely about getting the most consistent performance out of any individual shaft by minimising the inevitable random oscillations that occur during the swing. This is due to the inherent difficulty (make that impossibility) of manufacturing a perfectly symmetrical shaft, thereby creating performance inconsistencies ranging from the subtle to the dramatic.

Previously outlawed by the rules, 'puring' has been allowed since 1999 when the USGA finally acknowledged the conundrum of their own rules which, on the one hand, acknowledged that in practice shafts are never truly symmetrical while, on the other, denied golfers the right to restore the very performance symmetry that the rules themselves required!

You won't hear about it on TV, but 'puring' is the secret process favoured by some 200 tour pros, ranging from Jack Nicklaus, Arnold Palmer and Greg Norman, to Colin Montgomerie, Nick Faldo, Paul McGinley and Padraig Harrington. Just like them, I want my equipment to be flawless (so that I need only blame my swing) and therefore I was delighted that Precison Golf is one of the custom-fitters licensed to use the proprietary technology of patent holders, SST Pure.

> "For all the undoubted cutting-edge science, the subtleties of swing analysis and club-building ensure custom fitting remains a high art."

Conclusion

There's no doubt that the level of service provided by James and Simon at Precision Golf has taken my appreciation of custom-fitting to a new level. The process has also raised my awareness of my own game and the interaction between my swing and the equipment I use, which will surely help me with fault-finding in the future.

For anyone serious about their game and looking to give themselves the best chance of performing to their potential, I would thoroughly recommend the experience – while techie golfers intrigued by scientific progress in the industry should take the trip just for the Hot Stix and FlightScope workouts.

PRECISION DRIVER FITTING

While we have focused mainly on irons for the sake of simplicity, the Hot Stix driver fitting programme works in a similar way.

In addition to the tested head data, the system throws up 20-40 shafts, according to your swing characteristics. Interestingly, the better your swing, the more recommendations pop up, reflecting how a good golfer's neutral angle of attack allows for more flight options to be achieved (within the ideal 'window' for spin rate and launch angle) rather than being limited to those shafts that best compensate for a particular action.

Simon recommended that we bring my driver flex slightly down (from the existing 255c.p.m. on my Yonex Cyberstar Powerbrid), more in line with the measured flex on my existing steel-shafted 5-wood, while also lowering the weight from the current 75 grammes.

As with the irons, the intention is to provide me with more 'snap' from the shaft for less effort, while maintaining moderately low torque given my propensity for the occasional duck-hook off the tee when opening the shoulders.

He takes into account that, as far as the driver head is concerned, I will be upgrading to the new Yonex Cyberstar Nanospeed, the high-tech model for 2006. Having enjoyed the Powerbrid for over a year, both in terms of its head shape and performance (and indeed its sound), I am happy to move to the new flagship which I encountered at October's Munich Golf Show. (OK, so I'm also partly influenced by my recent close encounters with Colin Montgomerie – see GI Issue 57 – with whom I had the chance to discuss the club, and the efficiency of nanotechnology construction, while playing a few holes.)

Again Simon narrows down the relevant shaft field quickly and I help him by ruling out certain choices on price grounds (particularly the user-friendly version of Tiger Woods' Diamana shaft, by Mitsubishi Rayon – a cool £300 a throw).

We agree on the popular (and more affordable) UST ProForce V2, a 55 gramme model whose flex profile is consistent with lowering my excessively high spin rate.

Meanwhile, as an aside, the level of detail of the Hot Stix approach is illustrated by its caveats for fitting shafts into 'bore-through' driver head designs, such as many Titleist models that have up to three inches of shaft in the head.

James explained that this feature will make any chosen shaft play a lot stiffer than a typical 1.5-inch shaft protrusion while also effectively firming the torque and changing the kick-point.

Finally, with the Hot Stix databank for hybrids and fairway woods still under construction, I decide to complete my set by continuing with my existing favourite hybrids which include a 17-degree Sonartec MD and a 22-degree Kasco K2K iTility, whose special hybrid-friendly shafts (UST iRod R and Kasco R58) are already deemed appropriate for my swing.

CLEVELAND'S CLASSY STEP-CAVITIES

Dominic's CG2 irons are a shallow, 'step-cavity' design targeted to lower and more consistent mid-handicappers offering the forgiveness of a

The basic process of custom-fitting an iron or driver costs from £60 with, of course, any components and custom club-building being additional, according to requirements.

Finally, for all the science, custom-fitting clearly remains a high art, from the subtle swing analysis to the intricacies of clubmaking; from the somewhat cerebral discussions of swingweight and 'puring' through to the craftsmanship of the finished goods. As shown by the many glowing testimonials of golfers across the handicap spectrum, I am just one of many impressed by Precision's enthusiastic, cutting-edge approach. Not to mention that, when collecting my custom built set of Cleveland CG2 irons fitted with their Nippon 950 shafts, the FlightScope recorded an immediate increase in my average ballspeed and a seven-yard increase in carry for my 6-iron.

Crucially, this was despite clubhead speed similar to my old set, confirming that the new clubs were working more efficiently for my swing by better timing the release of the clubhead for more energy – yup, as shown by a higher 'Smash' factor.

Of course, the ultimate test comes over the next few months as I put the new gear through its paces out on the golf course. I will report back in due course.

For more information, contact Precision Golf on 01784 470 088; www.precisongolf.co.uk.

cavity back with the workability of a blade. The microscopic carbon spheres within the structure of the trademark CMM material reduces the density of steel by some 10 per cent, helping the clubhead to absorb impact vibration and deliver a notably soft feel. See **www.clevelandgolf.com**

NIPPON'S LIGHTWEIGHT FORMULA

Dominic's new shafts are from the Yokohama-based Nippon Shaft Company that has steadily emerged as the leader in lightweight steel shafts, supplying such major manufacturers as Titleist, Ping, Callaway and Mizuno.

While building golf shafts since 1959 (and now also known for its graphite designs), Nippon burst on to the scene a few years ago with the NS Pro 950 iron shaft, named after its 95-gramme weight that compares with traditional 120-gramme steel.

The shaft stormed the pro tours (soon dominating the ladies and seniors circuits) while taking an unprecedented 95% share of the Japanese market. Nippon continues to push the boundaries with the very latest Pro 750 Pro that follows the Pro 850 of 2004 as the world's lightest steel shaft.

While players rave subjectively over the feel of the proprietary 8655 steel material used, clubfitters confirm the consistency of the designs, in terms of the ultra-tight tolerances for both weight and frequency.

For more information, contact CQI Golf: 0121 744 3900; **www.cqigolf.com**

FLIGHTSCOPE LAUNCH MONITORS - FROM THE M.O.D. TO THE PGA

Almost every premium custom-fitting outfit now employs some form of computer-based system to measure a golfer's personal launch conditions – most importantly, the ball speed, launch angle and spin rate at impact that dominates the performance of any shot, including flight pattern, carry and roll.

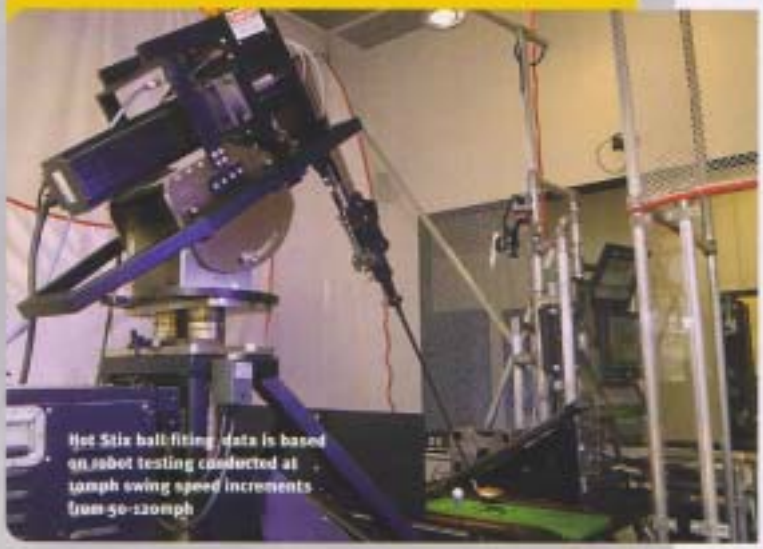
But in the quest for the ultimate modeling system, FlightScope monitors can claim some serious credentials. And not merely because they are the preferred choice for The Belfry's PGA National Custom Fit Centre as well as several leading manufacturers who use it as an integral part of their development programme, most famously Srixon, whose Japanese R&D department is known for its pioneering research into impact conditions which first revealed the nature of the notorious 'trampoline effect' on driver faces.

The same Phased Array Tracking Sensor used for monitoring your humble golf ball in a FlightScope monitor is revealed as the cutting-edge technology at the heart of the latest US military systems for tracking missiles in the battlefield with ultimate accuracy. Any more details and we'd be breaking the Official Secrets Act.

Designed by South African company, EDH Sport, FlightScope accordingly provides a comprehensive array of data and with an exceptionally high degree of accuracy. The club-fitter can also follow the increase of the club velocity just prior to impact relative to the club speed at impact, with the ratio between the two allowing a further parameter for accurate custom fitting.

FlightScope first enjoyed some high-profile publicity at the 2004 Nedbank Million Dollar Challenge, at Sun City, when it provided the official stats on carry distance, ball speed, backspin and clubhead speed for a field that included Tiger Woods, Ernie Els and Phil Mickelson.

The FlightScope comes in three models priced from £4,000 to £10,000, according indoor or outdoor use and features. For further information, contact **www.flightscope.com** or **www.edhsport.com**



Hot Stix ball-fiting data is based on robot testing conducted at 10mph swing speed increments from 50-120mph