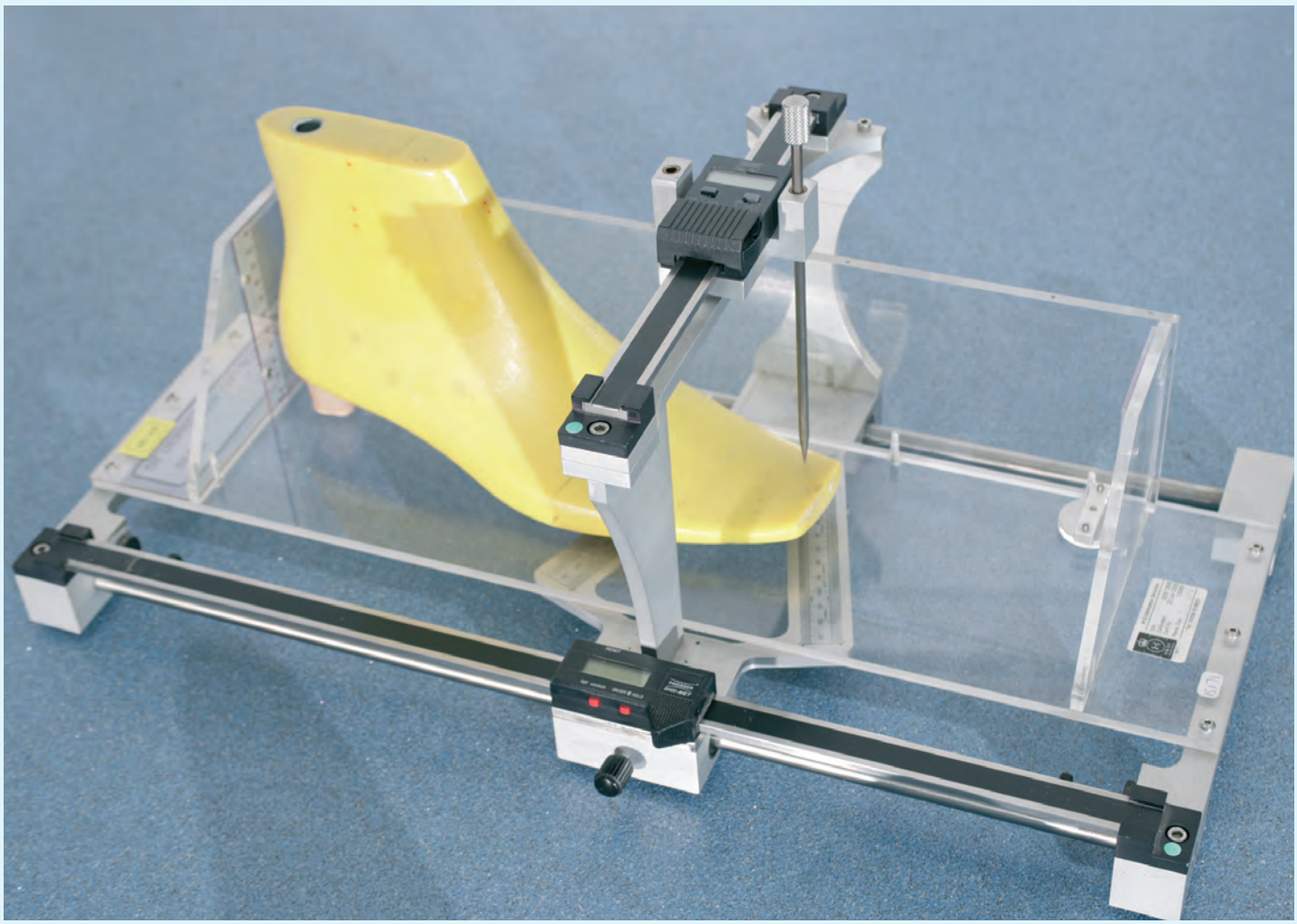
Digitising and automating last measurement

MADISON LAYTON outlines a new automated process for assessing the size of a last.

The 'number one' comfort factor of footwear is fit – which is, in turn, largely determined by the last on which it was made. To assess lasts, SATRA uses well-established test methods that define set procedures for taking key measurements. These measurements can be used to assess a last's fitting qualities against SATRA guidelines.

Traditionally, last assessment has been a time-consuming manual process. However, SATRA has developed a digital last assessment procedure capable of assessing three-dimensional (3D) lasts in computer-aided design (CAD) software. While it has become more common to create a 3D CAD-designed last, technological advancements in 3D scanning devices have also resulted in it being easier to obtain a 3D scan of a last (figure 1) with much more accuracy.

SATRA has developed a set of programs that can assess 3D CAD files of men's, women's or children's lasts to include the following measurements: i) effective length, ii) joint girth (figure 2), iii) 70 degree joint width, iv) ring width, v) corrected big toe depth, vi) corrected little toe depth, vii) instep girth, viii) big toe contact point distance in, ix) big toe tip point distance in, x) little toe width, and xi) little toe tip point distance in.



Last set-up in a last assessment jig

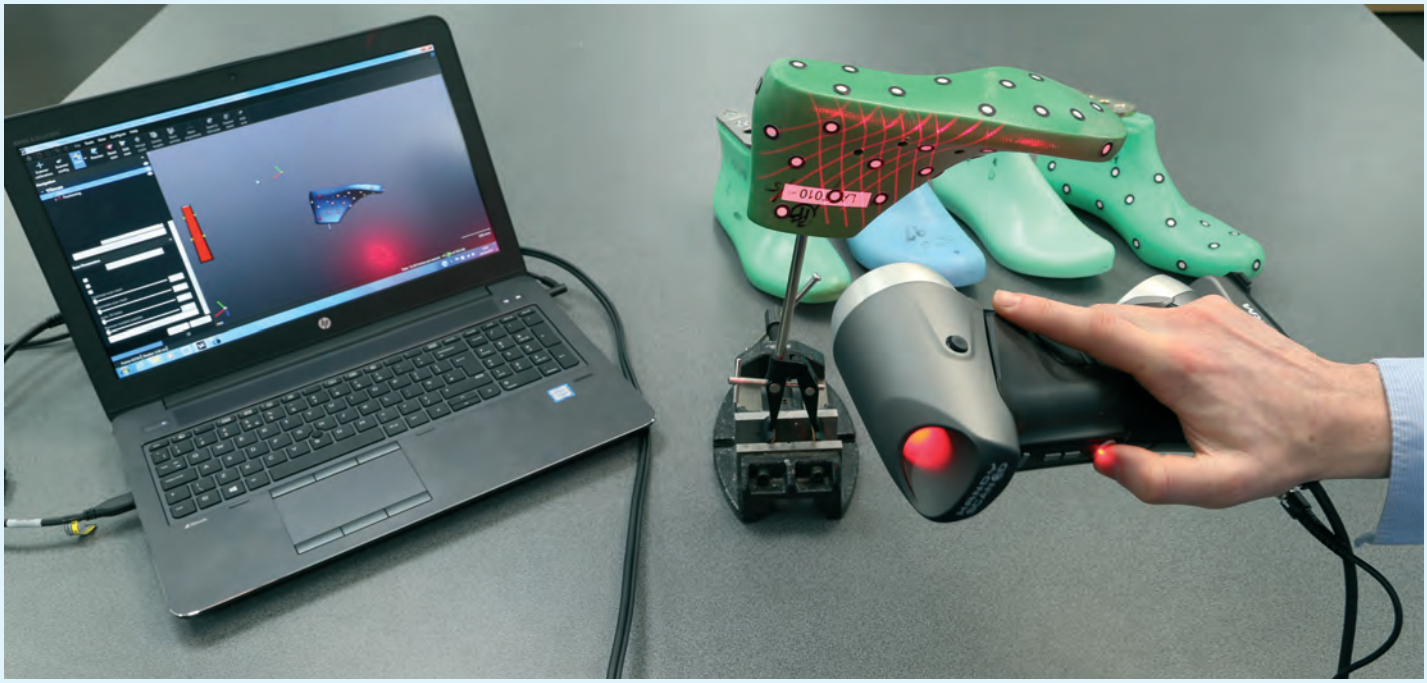


Figure 1: A last being 3D scanned

Advantages

One of the most obvious advantages of a digital assessment procedure is that lasts can be assessed remotely. All that is needed is a 3D scan or the original 3D CAD design for the last as a digital file. With no need to send the actual last to SATRA, results will be received for the assessment much more promptly, usually the next working day.

A digital procedure eliminates the lengthy process of taking measurements with equipment such as tape measures and digital calipers. However, caution should be taken that a digital last assessment procedure is not used as a substitute for acquiring fitting expertise and design assessment of the footwear.

A distinct advantage that will have a considerable impact on development time, cost and, of course, fit and comfort, is the use of digital assessment in the development process of a last. A 3D CAD design can be assessed, adjusted and re-assessed – thus creating a last which has precisely the dimensions desired for a specific item of footwear – before the first real last is produced.

It may appear counterintuitive that taking measurements from a 3D scan of a last could be more accurate than taking measurements from the last itself. However, with some 3D scanners having a resolution as small as a micrometre, it is possible to obtain a very accurate 3D scan of a last. Furthermore, measurements in 3D CAD software often offer a much greater accuracy than measurements taken physically. This is not only due to the resolution of the CAD software, but also because of the ease of taking measurements. A prime example is when taking a circumference measurement. Conventionally, a tape is wrapped around the last and the measurement is recorded. In 3D CAD software, a measurement can be taken of the last flush against the surface, and this circumference can be accurately measured in the same place every time – significantly improving repeatability and reproducibility when compared to the manual method.

The use of CAD software opens up the opportunity to take measurements that may otherwise be a problem to take physically. As an example, it can be difficult to measure a cross-sectional area with a tape, as a method is needed to ensure that the tape lies in the same plane for the entire path around the last. However, this is a straightforward measurement to take in standard CAD software. Other measurements that can be taken include the volume and even the curvature of the back heel curve.

Automated procedures can be used to assess a large volume of CAD files in bulk, with little user input (aside from the writing of the actual script). This could be used to assess the variability in shoemaker's lasts which have been produced to the same standard.

Considerations

While creating a digital last assessment procedure has its benefits, there are also limitations. Some conventional measurements that have historically been used by SATRA for assessing fit are designed to be easy and practical to take by hand. However, these measurements are not always easy to assess digitally. For instance, 'continuous geodesics' are relatively easy to find when using a tape measure. A continuous geodesic is defined as 'a line on a curved surface, which has – at all points on the line – the normal to the line also being the normal to the curved surface, and which on passing right around the surface of an object, returns to its starting point and then continues on the same path as for the first circuit'. In practice, this is found using a tape measure of a specified width, that is wrapped around the last so that the tape lies completely flat against the last at all points and overlaps itself following the same path on its second circuit. This measurement is challenging to obtain using 3D CAD software.

It is important in any assessment to have a clear understanding of the