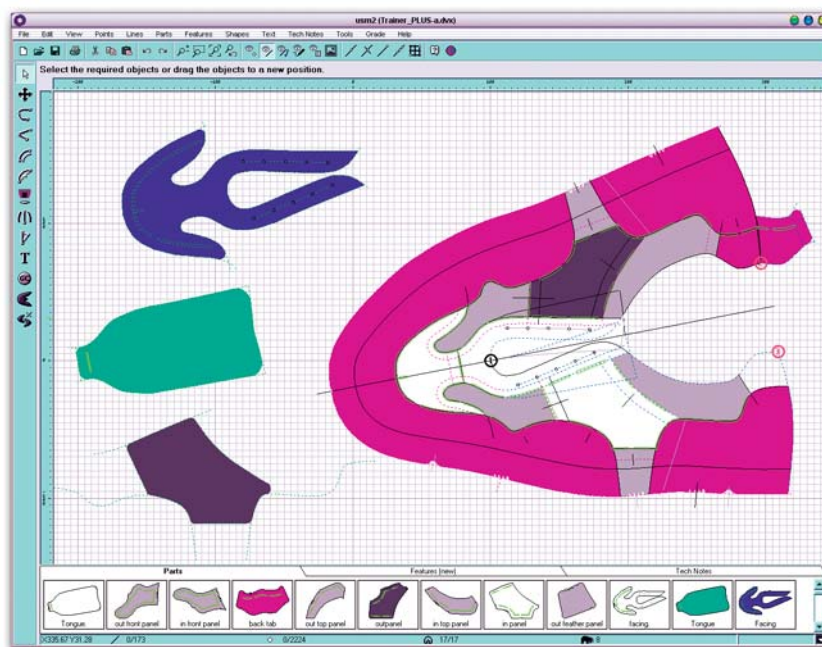


CAD/CAM systems have had a major impact on how pattern cutters work over the last 15-20 years with their convenience of use and transferability of data, speed and accuracy. But, does built-in expertise really enable CAD software to assist the less experienced pattern cutter?



Courtesy of Advent Technologies Ltd

Does CAD make better pattern cutters?

Tony Garley

The first question we must ask is, "What are the essential skills of an experienced pattern cutter?"

SHOE-MAKING

1. An understanding of the relationship between a last and the outline of the formes, the standard subsequently developed from them; and how the shoemaking processes and design, in combination, affect this relationship.
2. How the chosen materials (bearing in mind the lasting processes), the practicality of inserting the foot in the boot or shoe concerned and its retention on the foot during wear, are appropriate to the style.
3. A clear understanding of the upper assembly that allows the sequence of closing to evolve in the pattern cutter's mind as the sectional patterns are developed.

SHAPE AND IMAGINATION

An analytical approach to problem solving is essential. It is vital to be able to imagine how the components of the upper will join together as patterns are being cut, and be very methodical when components do not fit together correctly or the upper does not fit on to the last as well it should.

These skills can only be learnt over a period of time and are influenced by the individual's aptitude. Training time is always short, so can CAD-CAM help by complementing the pattern cutter's skill?

Note: Conventional upper styles and a welted or flat-lasted construction are assumed throughout this article.

FUNCTION-RELATED HELP

There are various examples of how current software can help a novice pattern cutter to work effectively more quickly.

Flattening the last — the functionality to produce an inside and outside forme from a digitised 3D last model is becoming increasingly used as the starting point for (2D) pattern development. Where its use has become established, CAD/CAM's contribution to the expertise is beyond question, given that manual forme flattening is a subjective and skilled process.

Creating a mean forme and outline-standard (shell in USA) — these steps in pattern development are well-suited to a wizard-based process—a method of simple database migration—in which a specific pre-defined procedure in the software is followed. Once the wizard has been specified and, if necessary, tailored to suit a user's preference, a novice pattern cutter is able to produce useful work. This is a very simple example and, at this stage, would only be applicable if a conventional upper is to be conventionally lasted.

Pre-defined elements — there are situations in which pattern making software helps the operator by having some elements of each production process pre-defined. For example, instead of specifying the width of a margin, such as an underlay allowance in millimetres, the operator could select 'underlay-2 row' from a table. In this case the set-up process would have involved pre-specifying a dimension for an underlay allowance (for a lap-seam) with two close rows of stitching.

Tables of underlays –

1. Lifted by feature 2. Lifted by measurement

Margins / Offsets - Mens		Margins / Offsets - Mens	
Feature	mm.	Feature	mm.
Bagged seam	3	Close-seam: medium	1.5
Close-seam: medium	1.5	Close-seam: heavy	2
Close-seam: heavy	2	Gimping	2
Folded edge	5	Bagged seam	3
Gimping	2	U-edge trim	3
Lap-seam U-lay	10	Folded edge	4
ditto: with spaced rows	12.5	Trim-off -- lining U-lay	5
ditto: with 2-and-1 punch	15	Lap-seam U-lay	6
U-edge trim	3	ditto: with spaced rows	8
Trim-off -- lining U-lay	8	ditto: with 2-and-1 punch	10
			12.5
			15

This CAD technique of having dimensions and common line shapes pre-defined is very easy to use and not intrinsically different from a manual pattern cutter having a table of margin dimensions or line-shape templates to hand. CAD has simply adopted an existing manual technique. But, while undoubtedly helpful, is it really an example of CAD software contributing to operator expertise?

Added tasks providing additional benefits — some tasks were not previously part of a pattern cutter's job. Automatic pattern assessment for material usage is an example of expertise that can now be contributed by a CAD system. The actual grading of a pattern requires additional knowledge about grading and a CAD system's grading process contributes expertise by displaying instructions about the pre-grading steps that must be completed before grading can take place or by having a wizard that has specific steps that must be followed. In this respect, CAD has minimised the training and experience required to area-assess a part and to grade a pattern.

Output (cutting paper patterns by hand) — using a computer-controlled cutter/plotter to cut out the paper shapes eliminates the manual skill required to cut paper by hand. However, the skill required to cut pattern shapes by hand is very different to applying the expertise necessary to create the formes and standard, and to define the parts. So, does the elimination of

paper-cutting skills make it easier to learn pattern cutting? Smooth lines are a vital feature of well-cut patterns and separating the judgement of whether a line is the required shape from the ability to hand-cut the line to the required shape in paper must be helpful.

These five examples show that CAD has indeed had some impact on the skill-level needed by a system operator. However, they are all 'function-related' and have the common feature of being easily defined, relevant to most patterns and not, to any significant degree, style-sensitive.

DESIGN-RELATED HELP

A really significant step up in the level of expertise offered by CAD software will be when automatically-generated comment or advice is style- or pattern-related. Can a CAD system ever contribute expertise in this area?

It has traditionally been said that a typewriter cannot contribute to the expertise required to write a letter or an article for a journal. But today word processors cannot only correct the spelling but also suggest improvements to syntax. Correcting the spelling may be compared to ensuring that a curved line on a shoe pattern is a smooth curve. Improvements in written syntax, on the other hand, are comparable to more complex issues such as identifying when an underlay allowance for a lap-seam is too narrow or eyelet holes are too close together.

It is doubtful if any word processor as yet contributes to an author's knowledge about his subject, so we should not expect a footwear CAD system to offer comment or advice about a design or styling in general, but rather about the way the patterns implement the design.

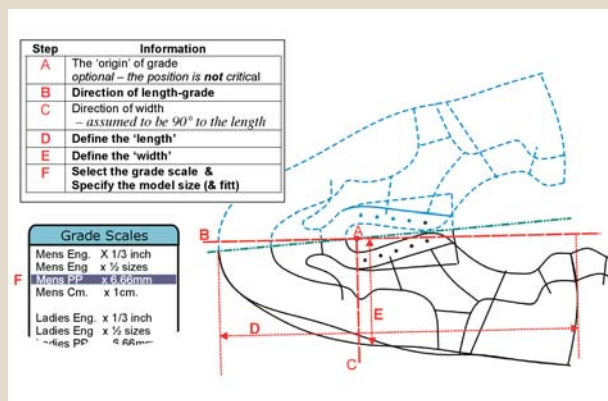
Having reviewed the skills required by a pattern cutter, it is no surprise that creating rules in the software that a computer can usefully apply to the work of the operator is a huge challenge. A major difficulty is that the computer does not know anything about 'toe' and 'seat' or overall length and width. Likewise, the phrase 'forepart centre-line' is very meaningful to a shoemaker, but just one of a number of lines on the screen as far as a computer is concerned. Consequently, if the computer is to offer pattern-related help, some knowledge about the lines of the pattern will need to be defined before any knowledge rules can be applied.

WIZARD OR DEDICATED FUNCTION

The use of a wizard to guide an operator through the steps needed to create a mean forme or grade a pattern has been referred to above, but the technique can be used for other operations too. In practice, a wizard becomes a dedicated combination-function for a specific shoe-pattern operation as opposed to the normal functions that operate on points and lines and shapes.

There are ways of enabling the process to be tailored to avoid a 'one solution fits all' process which would not be acceptable. In most cases, if the use of a wizard or dedicated (shoe-pattern) function is to be extended, then an appropriately tailored process would be needed to accommodate a variety of situations, such as size ranges for various classes of work (children's, girls', ladies', etc). The wizard and its built-in prompts to 'point to this' or 'to select that' gets around the problem of the computer understanding the purpose of each line. ➤

Grading input on a CAD system



PRE-SPECIFIED RULES

When sectional patterns are developed the work is style-sensitive and the processes and procedures for every pattern are different. Let's consider a simple case of the software checking a sectional pattern after it has been created. This checking may be automatic and transparent to the operator, or it may be one element in an overall check-process before the patterns are outputted.

Suppose an underlay allowance on a part goes from the lasting edge to a folded top-line and the system's rules say that the corner of an underlay within the lasting margin should have a radius, while an underlay that ends within a folding margin should have a small specified bevel. One can imagine that the system would give a warning to the operator if the radius or bevel had been omitted but, unfortunately, there is a complication.

We referred earlier to some knowledge about the lines of the pattern needing to be defined. How does the system know that one line is the lasting edge while another line is the top-line? This complication of having to identify the lines and positions on a pattern in shoemaking terms is one reason why achieving style- or pattern-sensitive help represents such a major hurdle.

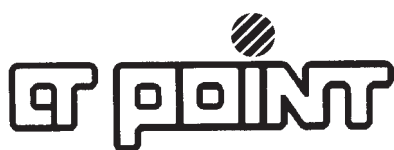
The wizard technique works well for grading because the length and width directions and distances are specified as part of

the wizard process. Pre-specified rules may enable a CAD system to flag up when eyelet holes are too close together, but only if it knows that a row of points or line intersections represent eyelets.

EXPERT SYSTEMS

The phrase 'expert system' often occurs in CAD promotional material today, so clearly CAD developers are exploring this aspect. The phrases artificial intelligence (AI) and knowledge engineering (KE) are also used in this field. An expert system could be the route to achieving a shoemaking solution comparable to a word processor's aim to 'improve the readability and understanding of the meaning'. Perhaps a CAD system could eventually prompt the pattern cutter when an upper assembly would be very difficult to stitch or that an impractical stress will be required to shape the upper to the last, but it will take time.

CAD software has without doubt reduced the level of training required for a few specific tasks but developments that replace or complement a pattern cutter's expertise are very much in their infancy. Finding ways for footwear CAD systems to provide very specialised help will continue as developers seek to give their products a technical edge in the market-place. They still have a long way to go. 

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