

PFI Project Description

3D Grading for Shoe Lasts on the Basis of Real-world 3D Foot Data

Although the decision to purchase a pair of shoes is usually made on the basis of optical criteria, perfect fit is ultimately THE key to customer satisfaction and generates brand loyalty. Yet it remains an open question whether the critical element responsible for the shape of the shoe, viz. the last, is indeed produced according to the latest state of the art. In other words: Does not the possibility of scanning feet in 3D cry out for use of these data in the development and grading of lasts? Numerous companies in the clothing industry actually now see real-world 3D body scans as holding great promise for their future.

Status quo:

In conventional grading, the measurements of lasts for the production of various shoe sizes are calculated with the aid of proportionality factors for length and width (technical ball girth). The entire last is simply enlarged or reduced on the basis of these measurements. This procedure was developed about 70 years ago, at a time when no other technical possibilities were available. However, real feet are different. A wide forefoot often comes in combination with a slender heel or a relatively broad heel with a slender forefoot. The variety of foot shapes and sizes is huge. That is why many people wear shoes representing a compromise, but not an optimum solution, for their foot measurements.

Nowadays, CAD systems are used in the design of shoes and lasts. Although these systems offer so many more possibilities, lasts are still graded according to the old procedure in order to derive the entire assortment of lasts from a pattern last. In fact, these systems allow development, modification, grading, and CNC production of lasts on the basis of digitised data. Yet even here, only two measurements have so far been used in grading: length and girth; inclusion of additional foot or last measurements is not envisaged.

Aim of the project:

The objective is to develop a new method for the development of lasts which allows production of an entire last assortment. Specifically, a new procedure for 3D grading of shoe lasts based on real foot measurements is to be developed and tested. Currently available technical possibilities are to be applied to the production of shoe manufacturing lasts in order to improve the fit of shoes.

The project partners have the task of developing lasts on the basis of foot-specific measurement charts and of deriving the entire last range.

3D-CAD solutions offer sufficient opportunities to consider further parameters in addition to last length and technical ball girth.

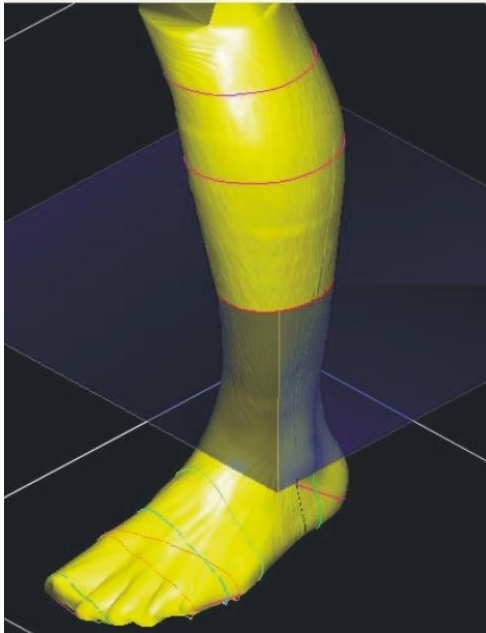
The latest research results from the clothing industry show grading procedures based on real 3D data to be highly efficient and to significantly improve the fit of products.

Approach adopted:

A grading algorithm embracing all relevant information for last design has to be developed for each size to be graded and for the various foot types.

The footwear industry uses different last forms for different shoe types. In the present project, a procedure is being developed which is suitable for all kinds of shoes. In this case, the geometric relationships between foot and last therefore have to be determined independently of the type of shoe.

Last design and 3D grading can then take place on the basis of developed median feet, their measurements, and the spatial distances determined between the foot and the last. This new system is completely different from that used hitherto. Design of the lasts starts from the respective median foot of each particular foot type with the corresponding foot length/size.



The 3D foot data determined for adults in a previous project are used in the present project. More extensive measurements of children's feet (3D full scans) and data analyses are currently being performed for this project.

Project progress in the area of adults' feet:

- For ladies' feet: Median feet of various types have been calculated (basis for grading). The feet of the test persons were measured in standing barefoot.
- The heel pitch is integrated into the foot data.
- Grading on the basis of foot data was tested.
- The median feet had to be stylised.
- An initial version was developed for a grading procedure and is currently undergoing correction.



Project progress in the area of children's feet:

- About 300 children's feet were 3D scanned.
- The foot measurements were determined and evaluated and also compared with existing 2D foot scans.
- Foot types were classified paying due attention to foot growth in children.

Additional work to be undertaken:

- Calculation of median feet for children
- Development of a new procedures for grading of lasts for children
- Evaluation of the graded lasts

Project status:

Ongoing project. Funded by IGF under the funding reference number 19335 BG.

Duration: 1 January 2017 to 31 December 2019

Project partners:

- Technical University Dresden, Institute of Textile Machinery and High-Performance Material Technology
- University Potsdam, Institute for Sports Medicine and Prevention
- University of Applied Sciences Trier, Department of Information Technology, Information Technology and Therapeutic Sciences



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Please address inquiries to:

Dr. Monika Richter
Footwear Development and Research
Tel.: +49 (0)173 3094168
E-Mail: monika.richter@pfi-germany.de