

# The integration of anthropometry into computer aided design to manufacture and evaluate protective handwear

---

Gavin Williams, Simon Hodder, George Torrens, & Tony Hodgson  
Department of Design and Technology  
Loughborough University  
Loughborough, UK

## Abstract

It is important for high performance clothing and body worn products to contain enhanced fit for the wearer. This is to ensure that they provide protection while maintaining comfort, mobility and good interaction with the surrounding environment and task. This paper describes how anthropometry and computer aided design have been used to manufacture clothing that accurately fits the human body. This is demonstrated by the design of a mould tool for the manufacture of handwear, created using data taken during an anthropometric survey of undergraduate students at Loughborough University. Hand data from this survey have been processed into a series of glove sizes with CAD models of each size generated to represent the data in a 3D format. The mould tool used for the handwear manufacture is a physical manikin of one size of CAD model, created using various techniques of computer aided manufacture and rapid prototyping. Gloves produced using the mould tool have been evaluated to determine the accuracy of their fit by conducting user trials testing finger dexterity and tactile perception using subjects with appropriate sized hands.

## Background

For all types of clothing and body worn products it is important to consider how they fit and integrate with the natural form of the human body. This is especially critical for high performance body worn products that attempt to protect the wearer, while simultaneously maintaining good mobility and interaction within the surrounding environment. To ensure that these products contain the high degree of fit that they require, it is necessary to use the size and shape of the end user at the beginning of the design and manufacturing process. This paper demonstrates the benefits of studying anthropometry and incorporating the data gathered into these products. It is necessary, however, to determine what anthropometric data is appropriate to use, how best to collect it and the most effective way to apply it. Consideration of how the anthropometric data might be used prior to and during its collection will greatly effect the process used to design and manufacture the desired end product. Computer Aided Design (CAD) and Computer Aided Manufacture (CAM) can also be

In D. de Waard, K.A. Brookhuis, R. van Egmond, and Th. Boersema (Eds.) (2005), *Human Factors in Design, Safety, and Management* (pp. 275 - 289). Maastricht, the Netherlands: Shaker Publishing.