3D measurement of children and implications for industry

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Shape GB is the first phase of a major national research project to measure children, seven years since the last DTI funded National Sizing Survey measured men and women as part of Size UK. A key element of the research approach is the use of 3D body scanning technology to successfully capture the data in place of more traditional methods. It is the first large scale survey for the retail clothing industry on children since 1978.

This phase of the research is funded by major clothing retailers including Next, Monsoon, George at ASDA, Shop Direct, and is supported by the University of Hertfordshire, Manchester Metropolitan University, the University of Hull, Aston University and Loughborough University. The research was coordinated and managed by Select Research, specialists in this type of large scale data collection.

The second phase of the research, to commence later in 2011, will aim to repeat the first phase but with a focus on the measurement of babies and toddlers and funded by additional retailers committed to the Shape GB project. The third phase in 2012 will concentrate on ensuring that national representation on ethnicity is achieved in line with current census data.

For phase one, over an 18 month period from March 2009 to August 2010, more than 2500 children aged 4 to 17 were scanned at twelve locations across England, Scotland and Wales, to obtain a representative sample of UK children. NX12 3D body scanners were used to collect 3D scans of the children together with a small number of supplementary manual measurements.

The data collected provide a robust 3D data set, the first set ever available on children. At present the data contain nearly 200 individual measurements encompassing lengths, girths and circumferences that provide not only the familiar measures of body size, but a much greater understanding of body shape.

The use of scanning technology for this form of data collection has a number of significant benefits. As the primary data collected gives a 3D surface representation of the body, measurements can be extracted from this body model at any time. Thus, the initial 200 measurements may be supplemented at any time for different purposes with additional measures to meet user needs. These additional measures can be extracted from the body models with the fundamental benefit of not having to re-measure participants.

The capture of a 3D body model also allows an understanding of body form or shape that is much greater than that afforded by most existing data sources, which predominantly contain a series of discrete 2D measurements. 2D measures can still be obtained from the scans where desired, however the scans can also be used to create 3D surface mannequins, either individually, or as some form of boundary mannequin. These can be created to provide useful multivariate representations of body size and shape and support a wide variety of applications.

The process of conducting the survey was a challenging task. Ethical procedures were established and approved by each institution. Recruitment of children with parental consent was undertaken via the project website (www.shapegb.org) which provided information about the project and allowed parents to book their children in to be scanned at the nearest scanning location. Care was taken to provide clear information to both parents and children about the process, and what the children and parents could expect. The children who took part were amongst the first children in the world to be measured on this scale using a 3D body scanner, so the initial interest was high.

Issues of privacy and confidentiality were clearly a critical part of the data collection process. Children were scanned in their underwear so parental supervision was essential, together with careful management at the scanning location to ensure privacy. As the body scanners work on contrast, the child's underwear had to be a similar colour to their skin colour, so uniform underwear was provided to the project by Next. George at ASDA supplied all dressing gowns.

The 3D body scanner itself is very similar to a photo booth and has a changing room attached. This arrangement allows the child to get undressed, be scanned, and get dressed again all without having to leave the scanner. The scanning process itself takes approximately six seconds and uses white light that appears as a series of white striped projections to the child being scanned. Children were shown the scanner in operation before being scanned, which gave them an opportunity to opt out of the process if they wished.

All the data captured is stored anonymously and in addition, even though the body model is a detailed 3D representation of the child's body, the scan is not recognisable. The final version may or may not include a 'generic' head attached which will make the image seem more 'real', but avoids any chance of the individual being recognised. However, there are some shortcomings of using this form of 3D body scanner. The scanner does not fully capture extremities, so manual measures need to be taken to supplement the scanned data.

After a child was scanned, a trained male or female researcher with CRB clearance collected stature, weight, head circumference and a series of hand measurements using manual methods.

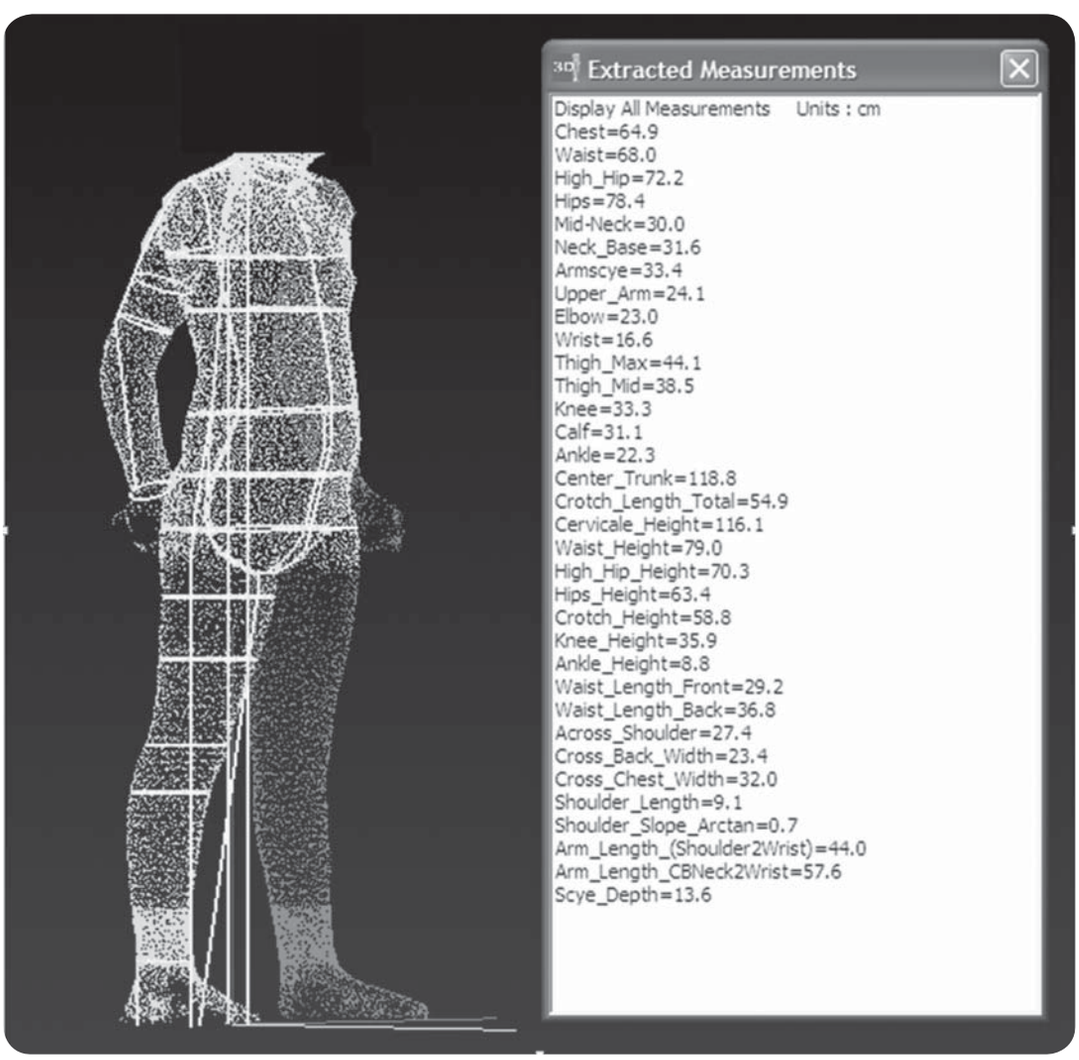
Even with the efforts of the research team, understandably there was some anxiety amongst parents, especially in view of the fact that children were to be scanned in their underwear. Below are a number of issues that were pre-empted and how some of their questions were addressed:

Can I go into the scanner with my child?

You will be able to go into the scanner initially to familiarise your child with the surroundings, but while the scan is taking place a curtain will be drawn and your child will be alone in the booth. You will be able to stand outside the curtain to re-assure your child.

Are there any disadvantages or risks of taking part?

There are no side effects to using the 3D body scanner. Clothing manufacturers have scanned thousands of adults in the past. However during



the scanning there are several brief bursts of flashing lights which can affect people who experience seizures. If your child has had seizures or is on treatment for seizures you must let us know.

What happens when the survey ends?

Once the survey is complete, we will collate all the scans we have collected and the information will be used when designing, specifying and manufacturing clothing. Given the national representation of the sample, in the long-term the anonymous data will also be used for other purposes such as seat design, healthcare statistics and to analyse height variation between children of the same age.

Will my child's taking part in the survey be kept confidential?

Yes. We will follow the Market Research Society Code of Conduct, the Data Protection Act and legal practice. All information about your child will be handled in confidence.

The process resulted in an almost universally positive experience for those involved. Children genuinely seemed to enjoy the experience, and all participants were engaged with the notion of being able to improve the understanding of body size. From discussion with parents during the data collection, it was clear that parents were well aware of the implications of clothing retailers working with out-of-date data and rarely did parents report that they could actually buy clothes in the appropriate size (age) range for their child.

The data gathered provides a more sophisticated means of quantifying and analysing the size and shape of children of different ages. Whilst this was primarily driven by the needs of the retail clothing sector, it has clear implications and applications in other industries where out-dated data for children is currently being used to assess and deliver applications.

The benefit of the data for other practitioners, following initial analysis, is now starting to become apparent. For example, the results from Shape GB show that the average right thigh girth in boys and girls is always bigger than the left; an assumption hitherto not proven. Across all yearly age groups for both boys and girls, the average right thigh for boys is 0.45cm bigger in circumference than the left and the average right thigh for girls is also 0.42cm bigger than the left.

Analysing data from the 2500 3D scans, this is the first time that differences between the limbs for children have been scientifically and independently measured. This provides an indication of the potential for future measurement of muscle development in children, which has implications for fields such as sports science in the future and illustrates how comprehensive 3D data can provide new insights.

The data also show differences between the right arm and left arm, with the average right bicep measurement again being bigger than the left in both boys and girls. Biceps in girls are 3.1% bigger than boys in the early years (4-7) but when boy's biceps start to get bigger as their muscles develop, in teenage years (13-17) the trend is reversed and girl's biceps are then 3.3% smaller than boys, a swing of over 6%. In some ways obvious, given that a majority of children are right handed or footed, but never measured properly before.

3D data can provide insights into children's body shape, not possible with existing data sources. Product, environment and workplace design relies on accurate and usable data, particularly for areas such as custom fit products and products aimed at improved task or sports performance. This new data provides alternative options for measuring and understanding how children change as they grow older, their changing needs for products but also the effect of different activities and sports on a child's physique.

Data from Shape GB is currently being analysed for future measurement of childhood obesity using the new obesity measurement, the Body Volume Index and key findings for garment design and labelling were presented at a clothing industry conference in May 2011.

Industry standards, such as BS EN 1729 for classroom furniture in all UK schools, are just one indication of how manufacturers are having to adapt their production and design processes to account for the fact that children have become larger. However, the implications and the use of this 3D data for ergonomics modelling and research have yet to be realised, so Select are currently exploring the options for use of the Shape GB data for ergonomics with their collaborators.

It is hoped that the availability of this new 3D data on UK children offers opportunities to look at the growing bodies of our children in new ways which can help improve existing and new products and applications. ❖