Landmarking for 3D Body Scanning, Moving Manual Practices into a Digital Realm

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Abstract

Landmarking has traditionally been a manual practice where the positions for measurement are marked onto a physical body by marking anthropometric points onto body. It is rooted in defining common points to allow, for instance, replicable measurements across a population. Such common points are heavily linked to skeletal and surface body features. With improvements in body scanning and contactless measurements methods, including automation, there is a need to better correlate virtual & physical practice. This further capitalises on the known accuracy of booth scanning applications and considers acceptable degrees of error from mobile apps This paper reports on research seeking to determine the differences in manual, manual virtual and virtual automatic landmark definitions and how they might be defined and applied. It is possible to establish categories of landmark and to classify different landmarks according to key features and to identify critical base points of reference that can be used for product-driven landmarks. This paper considers how “landmark and measurement” (LM) practice could evolve suitably for both virtual and physical environments while remaining relevant through posture change and across disciplines.

Consideration is given to advantages of body scanning and the necessary adjustments in terms of practice and approach which will benefit virtual measurement. Changes in practice between the physical and virtual include defining the origin plane to be the plantar plane, specifying the handedness of the coordinate systems, identifying coordinate transformation matrices for converting between CAD applications, and the order of listing the landmarks. We generalise the notion of landmarks to encompass anatomical folds such as the inframammary and gluteal folds. The virtual environment allows the user of scan data to understand the relationship of the locations of the landmarks. By having the landmarks in a coordinate system, it is possible to determine the body shape and translate the relationship into clothing patterns that promise advances in current practice. The data moves beyond the 1D and 2D to truly the 3D. Landmark tables have three methods for obtaining landmarks: manual, manual virtual and automated virtual. Automated virtual methods are defined by utilising algorithms to automatically find the landmarks and measurements on a body scan based on ISO or other international standard definitions. The manual virtual method is defined by the user manually identifying the most likely location for the landmark and the pose of the body in the scan, requiring transitional steps defining which provide suitable guidance. Landmarks can be determined using sectional planes, analysing the characteristics (e.g., convex hull) of the scan surface or analysis of sectional curves’ shapes and proportions used to identify transitions. The manual virtual example utilized Rhino7 / Grasshopper software.

Keywords: Landmarking, 3D Body Scanning, Anthropometry, Digitization, Anatomical References, body measurements.

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