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Ergonomics — 3-D scanning methodologies for internationally compatible anthropometric databases —

Part 2: Evaluation protocol of surface shape and repeatability of relative landmark positions

Ergonomie — Méthodologies d'exploration tridimensionnelles pour les bases de données anthropométriques compatibles au plan international —

Partie 2: Protocole d'évaluation de la forme extérieure et de la répétabilité des positions relatives de repères

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 3, *Anthropometry and biomechanics*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 122, *Ergonomics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 20685-2:2015), which has been technically revised.

The main changes are as follows:

— landmark names in Table 1 and Table B.2 and subclause numbers in Table 1 harmonized with those in ISO 7250-1:2017;

— standard deviation of radial distances deleted from Clause 3;

— calculation of quality parameter for the repeatability of landmark positions, Annex B and Annex D revised.

A list of all parts in the ISO 20685 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Anthropometric measures are key to many International Standards. These measures can be gathered using a variety of instruments. An instrument with relatively new application to anthropometry is a three-dimensional (3-D) scanner. 3-D scanners generate a 3-D point cloud of the outside of the human body that can be used in a number of situations, including clothing and automotive design, engineering and medical applications. Recently, digital human models have been created from a 3-D point cloud and used for various applications related to technological design process. Quality control of scan-extracted anthropometric data is important since required quality can differ according to applications.

There are a number of different fundamental technologies that underlie commercially available systems. These include stereophotogrammetry, ultrasound and light (laser light, white light and infrared). Furthermore, the software that is available to process data from the scan varies in its methods. Additionally, methods to extract landmark positions differ between commercially available systems. In some systems, anthropometrists decide landmark locations and paste marker stickers, and scanner systems calculate locations of marker stickers and identify their names. In other systems, landmark positions are automatically calculated from the surface shape data. The quality of landmark locations has a significant effect on the quality of scan-extracted 1-D measurements, as well as digital human models created based on these landmarks.

As a result of differences in fundamental technology, hardware and software, the quality of body surface shape and landmark locations from several different systems can be different for the same individual. Since 3-D scanning can be used to gather these data, it was important to develop an International Standard that allows users of such systems, as well as users of scan-extracted measurements, to judge whether the 3-D system is adequate for these needs.

The intent of this document is to ensure the quality control process of body scanners, especially that of surface shape and locations of landmarks as specified by ISO 7250-1.

This document is not intended to be used for an acceptance test.

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Ergonomics — 3-D scanning methodologies for internationally compatible anthropometric databases —

Part 2: Evaluation protocol of surface shape and repeatability of relative landmark positions

1 Scope

This document establishes protocols for testing of 3-D surface-scanning systems in the acquisition of human body shape data and measurements. It does not apply to instruments that measure the motion of individual landmarks.

While mainly concerned with whole-body scanners, this document is also applicable to body-segment scanners (head scanners, hand scanners, foot scanners). It applies to body scanners that measure the human body in a single view. When a hand-held scanner is evaluated, the human operator can contribute to the overall error. When systems are evaluated in which the participant is rotated, movement artefacts can be introduced; these can also contribute to the overall error. This document applies to the landmark positions determined by an anthropometrist. It does not apply to landmark positions automatically calculated by software from the point cloud.

The quality of surface shape of the human body and landmark positions is influenced by the performance of scanner systems and humans, including measurers and participants. This document addresses the performance of scanner systems by using artefacts rather than human participants as test objects.

Traditional instruments are required to be accurate to the millimetre. Their accuracy can be verified by comparing the instrument with a scale calibrated according to an international standard of length. To verify or specify the accuracy of body scanners, a calibrated test object with known form and size is used.

The intended audience is those who use 3-D body scanners to create 3-D anthropometric databases, the users of these data, and body scanner designers and manufacturers. This document intends to provide the basis for agreement on the performance of body scanners between scanner users and scanner providers as well as between 3-D anthropometric database providers and data users.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7250-1:2017, *Basic human body measurements for technological design — Part 1: Body measurement definitions and landmarks*

ISO 20685-1:2018, *3-D scanning methodologies for internationally compatible anthropometric databases — Part 1: Evaluation protocol for body dimensions extracted from 3-D body scans*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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