BS ISO 18825-1:2016

BSI Standards Publication

Clothing — Digital fittings

Part 1: Vocabulary and terminology used for the virtual human body

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee TCI/66/-/3, Clothing sizing systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Published by BSI Standards Limited 2016

ISBN 978 0 580 79592 3

ICS 61.020

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2016.

Amendments/corrigenda issued since publication

Date	Text affected

BS ISO 18825-1:2016

INTERNATIONAL STANDARD

ISO 18825-1

First edition
2016-07-01

Clothing — Digital fittings —

Part 1: Vocabulary and terminology used for the virtual human body

Habillement — Essayage virtuel —

Partie 1: Vocabulaire et terminologie utilisés pour le corps humain virtuel

Reference number
ISO 18825-1:2016(E)

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Contents

Page

Foreword

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The committee responsible for this document is ISO/TC 133, *Clothing sizing systems — size designation, size measurement methods and digital fittings*.

ISO 18825 consists of the following parts, under the general title *Clothing — Digital fittings*:

— *Part 1: Vocabulary and terminology used for the virtual human body*

— *Part 2: Vocabulary and terminology used for attributes of the virtual human body*

Introduction

The virtual human model exists in various formats in the virtual world and is applied in many different industrial sectors. The virtual human body used in the fashion field reflects the attributes of different areas of the human body based on physical measurements and shape characteristics.

Various types of virtual human body-based IT-fashion convergence technology are being attempted today, according to rapid development of the vast online fashion market, including the internet, mobile market, smart TVs, and virtual fittings at shops and stores. Meanwhile, the increased demand of mass customized and made-to-measure garments these days encourages efforts to innovate the traditional process of planning, production and sales. The use of digital technology in this new ubiquitous environment of the international apparel industry is leading to use of three-dimensional information on consumers and digital human bodies that reflect somatotype characteristics, and consumers can now go online anytime, anywhere, to try on clothes, evaluate the style and fit, and place orders. Despite such advances, there is a lack of an International Standard related to the virtual human body.

Therefore, this part of ISO 18825 is the first in a series of International Standards that deal with the virtual human body, a necessary component of the 3D virtual garment system used in the apparel industry. The main goals of this International Standard are to define a virtual human body to be used to improve online communication and reliability of fashion products sold online and in-store through visual confirmation of size, shape, fit and design. This International Standard will establish a single index and reference for all virtual garment programs that are currenlty using various, confusing terminology.

This part of ISO 18825 specifies vocabulary, terminology and definitions related to digital fitting, such as virtual human body shapes, composition and attributes, and thus supports online and in-store consumers, fashion designers, product developers, technologists, manufacturers and retailers who have an interest in the style and fit of clothes. Developers will be able to use unified vocabulary and terminology when they devise virtual garment systems. Online consumers, fashion designers, manufacturers and sellers using virtual garment systems will be able to make use of the vocabulary and terminology regarding virtual body dimensions. It is therefore expected to improve convenience for consumers, improve efficiency in clothing manufacturing and contribute to a decrease in the return rate of clothes purchased online.

INTERNATIONAL STANDARD ISO 18825-1:2016(E)

Clothing — Digital fittings —

Part 1: Vocabulary and terminology used for the virtual human body

1 Scope

This part of ISO 18825 covers vocabulary and terminology used for the virtual human body in the virtual garment system used as a main tool in various fields of clothing application. This part of ISO 18825 is applicable to all stages of online clothing communication and business, including design, manufacture, order, sales, distribution and customer management.

2 Terms and definitions

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

2.1 General terms

2.1.1
virtual human model
three-dimensional model in digital format

2.1.1.1
parametric human body
virtual human model with changeable parameters such as size and shape, etc.

Note 1 to entry: Parametric human body is created by modifying the parameters of the exemplar model imported from the 3D model library. The exemplar models differ with countries as they are based on a database. Therefore, a parametric human body can be made on the basis of height variations, BMI (body mass index) and so on (see Figure A.1).

Note 2 to entry: The parameters of the parametric human body are presented in the parametric human body software. The parameters of the parametric human body can be added depending on the purpose of users.

Note 3 to entry: See Figure 1.

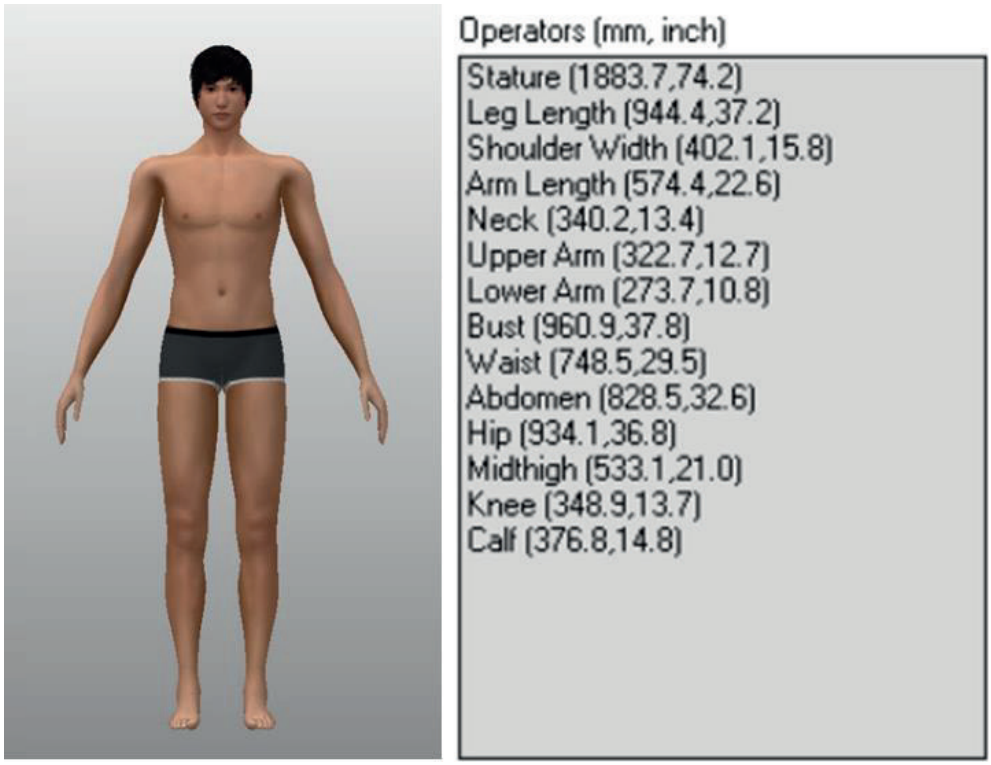


Figure 1 — Examples of parameters of a male adult body

2.1.1.2
virtual human body
virtual human model for digital fitting in the apparel industry, including information such as size, shape, cross section, body texture and skeletal structure

Note 1 to entry: Also called "fashion avatar". In computing, an avatar is the graphical representation of the user or the user's alter ego or character.

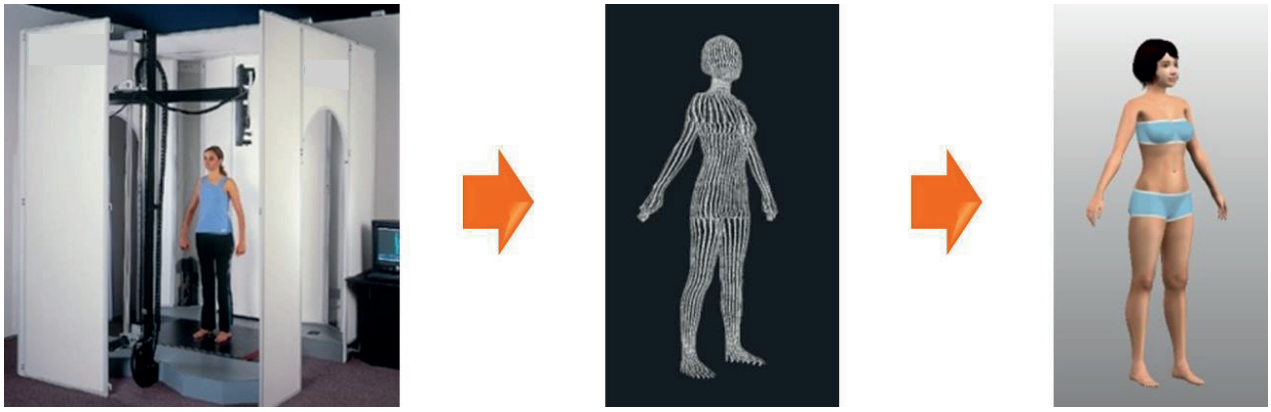
Note 2 to entry: The virtual human body is classified into two key types — virtual clone (virtual shape) and virtual twin (virtual size); see Table B.1.

2.1.1.2.1
virtual clone
virtual shape
virtual human body that is created by forming three-dimensional surface data from a 3D body scanned point cloud (see ISO 20685:2010, 3.21), using surface modeling processes, including noise elimination, hole-filling and mesh generation

Note 1 to entry: It is essential that a user get scanned first to create a virtual clone (virtual shape).

Note 2 to entry: The virtual clone (virtual shape) is identical to the body shape of the user.

Note 3 to entry: See Figure 2.



a) 3D scanning b) 3D scanned point cloud c) Virtual clone

Figure 2 — Process of creating a virtual clone (virtual shape)

2.1.1.2.2
virtual twin
virtual size
morphed virtual human body that is applied body dimensions acquired either through manual or automatic measurements

Note 1 to entry: The virtual twin (virtual size) is a *parametric human body* (2.1.1.1) as it can be altered with parameters.

Note 2 to entry: The virtual twin (virtual size) is not identical to the user; but is a close approximation that can be altered by entering parameters retrieved from a population database.

Note 3 to entry: See Figure 3.

a) Body measurements b) 3D model library c) Virtual twin

NOTE Body measurements are necessary to create a virtual twin. The actual text in a) is not important.

Figure 3 — Process of creating a virtual twin (virtual size)

2.2 Terms relating to basic composition and attributes

2.2.1
virtual body segment
part of the body that depicts the shape of the *virtual human body* (2.1.1.2)

Note 1 to entry: The software is based on at least 10 basic virtual body segments — the virtual head, virtual torso, two virtual arms, two virtual hands, two virtual legs, and two virtual feet.

Note 2 to entry: A virtual body segment consists of virtual body regions. A virtual body region refers to a specific area subdividing the virtual body segment.

Note 3 to entry: The shape and size of virtual body segments can change by entering parameters of the *virtual twin (virtual size)* (2.1.1.2.2).

2.2.2
virtual cross section
closed contour extracted from the plane cutting a *virtual body segment* (2.2.1) perpendicular to its main axis or the three principle axes

Note 1 to entry: See Figure 4.

Note 2 to entry: The main axis is the axis that connects the joints on either side of the virtual body segment.

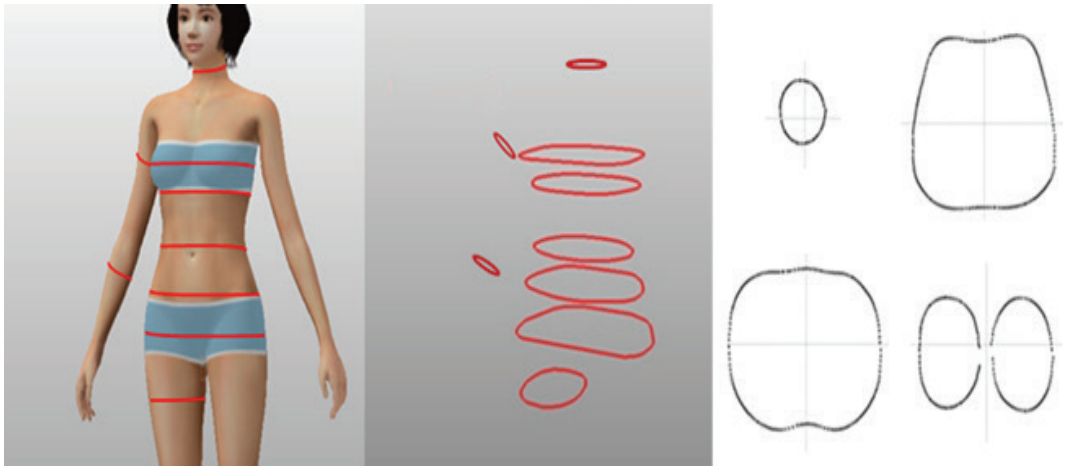


Figure 4 — Examples of virtual cross sections

2.2.3
virtual body dimension
size information on *virtual body segments* (2.2.1) of the *virtual human body* (2.1.1.2) that corresponds to measured anthropometric dimensions of the user in the virtual standing positon

Note 1 to entry: Virtual standing position: the head is in the Frankfurt plane, the long axes of the feet should be parallel to one another and 200 mm apart. The upper arms are abudcted to form a 20° angle with the sides of the torso and the elbows are straight. But the palms face toward the torso. This position shall be used for evaluating the fit of garments.

Note 2 to entry: Virtual body dimensions for the virtual human body can be selected from anthropometric dimensions as defined by ISO 8559.

EXAMPLE Virtual shoulder width, virtual crotch height, virtual neck girth, virtual waist girth, virtual hip girth, virtual knee girth, virtual calf girth, etc.

2.2.4
virtual body landmark
points which define the characteristic of the body shape of the user in the virtual standing positon

EXAMPLE Virtual top head point, virtual side neck-base point, virtual shoulder point, virtual side waist point, virtual hip point, virtual front knee point, etc. (see ISO 18825-2).

Note 1 to entry: For example, points of bony prominence, peak points on a convex or concave surface, or points like the navel can be virtual body landmarks (see Figure 5).

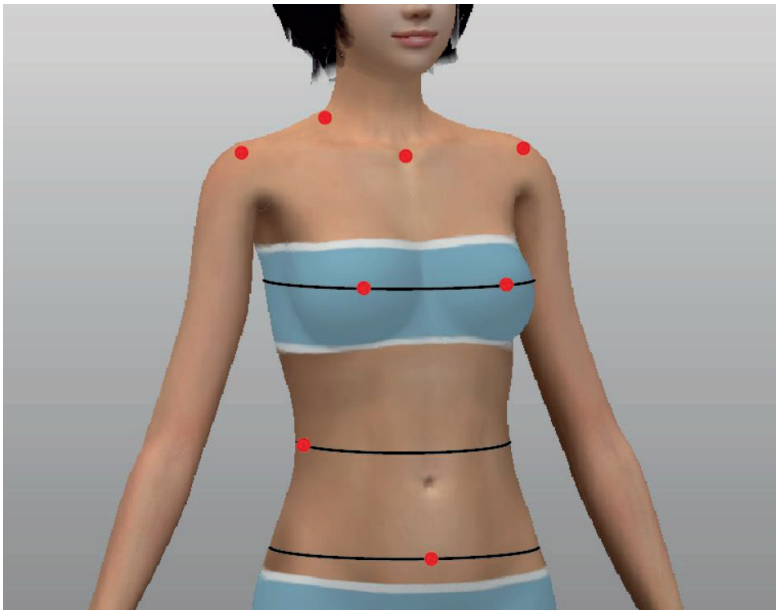


Figure 5 — Examples of virtual body dimensions and virtual body landmarks

2.2.5
virtual skeletal structure
frame of the *virtual human body* (2.1.1.2) representing bones and joints

EXAMPLE 1 Virtual neck bone, virtual collar bone, virtual arm bone, virtual forearm bone, virtual torso bone, virtual pelvic bone, virtual thigh bone and virtual leg bone.

EXAMPLE 2 Virtual neck joint, virtual neck-base joint, virtual shoulder joint, virtual elbow joint, virtual wrist joint, virtual waist joint, virtual hip joint, virtual knee joint and virtual ankle joint.

Note 1 to entry: See Figure 6.

Note 2 to entry: Virtual joints are the part of the virtual human body where two or more virtual bones meet and are able to move together. The virtual skeletal structure enables the virtual human body to express realistic motions and body poses.

Note 3 to entry: The virtual joints and virtual bones of the virtual human body are based on H-Anim (see ISO/IEC 19774) but were simplified as they will be used for virtual garment systems of the clothing industry.

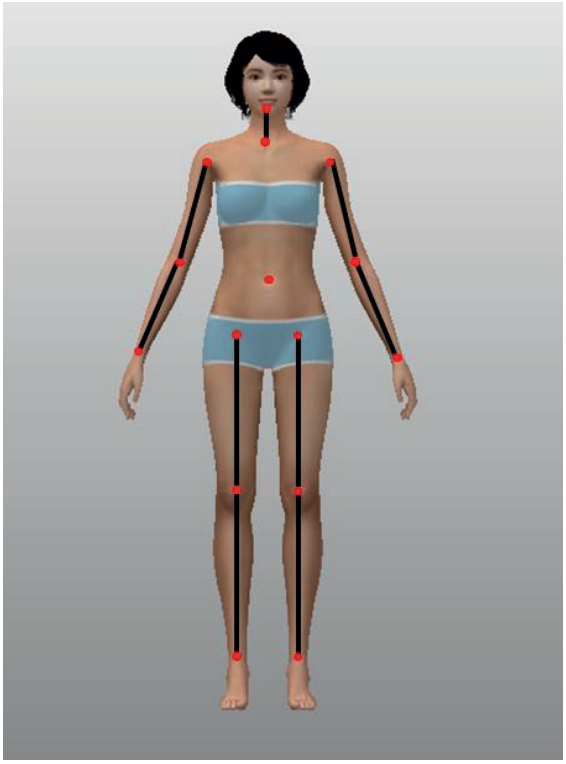


Figure 6 — Examples of virtual bones and virtual joints

2.2.6
virtual body texture
surface appearance of the *virtual human body* (2.1.1.2) surface

Note 1 to entry: See Figure 7.

Note 2 to entry: Virtual body texture is expressed realistically by mapping elements of the image, such as skin and hair, etc.

Note 3 to entry: Colours and tones of virtual body texture can be adjusted.

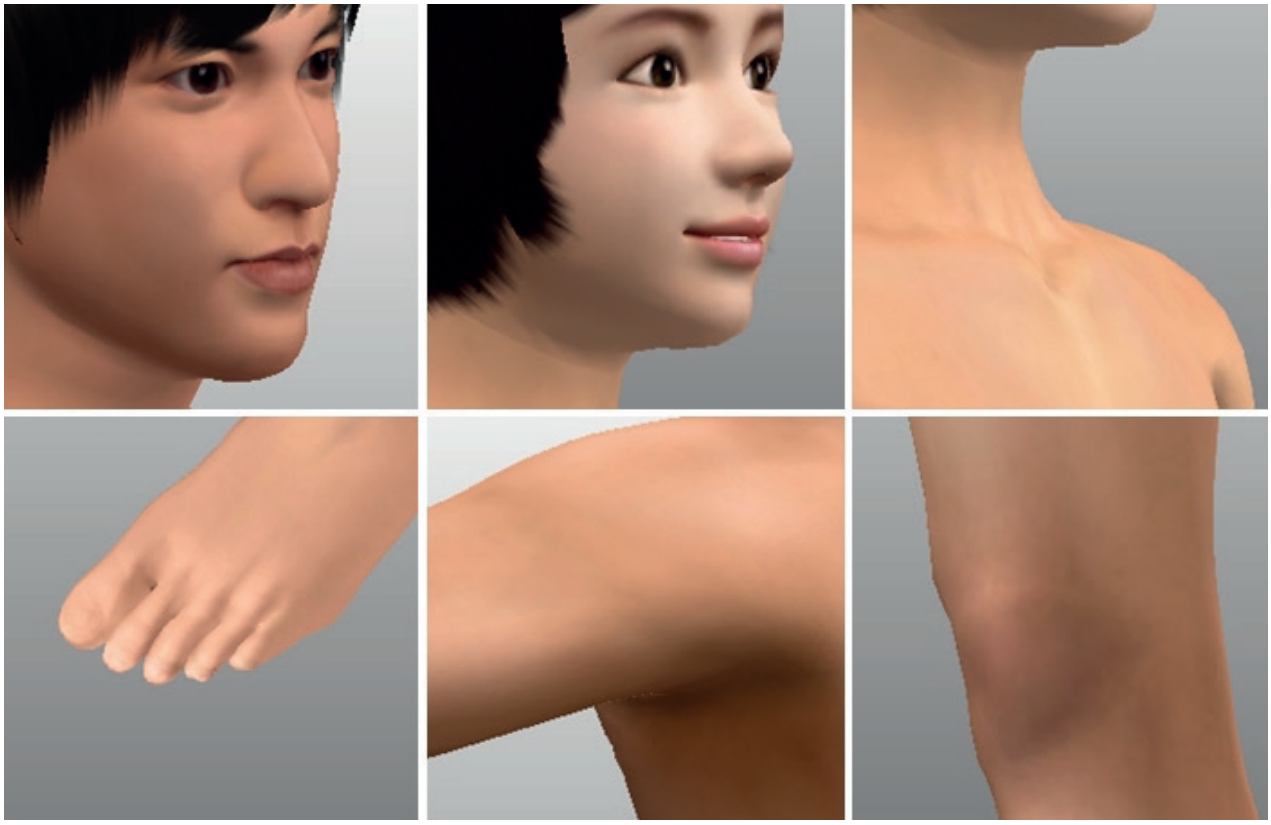


Figure 7 — Examples of virtual body texture

2.3 Terms relating to optional composition and attributes

2.3.1
virtual body pose
static position of the *virtual human body* (2.1.1.2) taken by adjusting the angles between two *virtual body segments* (2.2.1) sharing a joint

Note 1 to entry: See Figure 8.

Note 2 to entry: The virtual human body can be presented in many different virtual body poses, including a standing pose, a walking pose, a knees-bent pose, arms raised with bent elbows pose and shoulder/arms backward and forward pose.

Note 3 to entry: Virtual body poses are necessary to evaluate the fit of virtual garments on a virtual human body in a certain pose.

Note 4 to entry: There are various methods that create virtual poses appropriate to evaluate the fit of virtual garments according to a virtual garment system.

Figure 8 — Examples of virtual body poses

2.3.2
virtual motion
activity or process of continually changing body poses of the *virtual human body* (2.1.1.2)

Note 1 to entry: Virtual motion can be created by rotating virtual joints and interpolating individual *virtual body poses* (2.3.1).

Note 2 to entry: The rotation of virtual joints is a simplification of the rotation of real joints; however, it is possible for virtual human body to run or walk.

Note 3 to entry: Virtual motions are necessary to evaluate the fit of virtual garments on a virtual human body doing certain virtual motions.

Note 4 to entry: There are various methods that control virtual motions appropriate to evaluate the fit of virtual garments according to a virtual garment system.

2.3.3
virtual flesh
representation of muscle and fat of the *virtual human body* (2.1.1.2) used as a modeling element when creating various *virtual body poses* (2.3.1) and *virtual motions* (2.3.2)

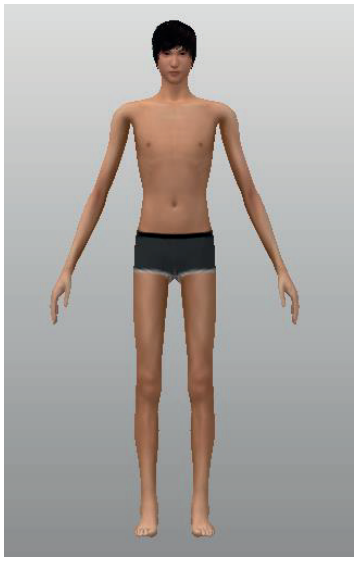
Note 1 to entry: Needs to be considered for mechanical interactions between a garment (see ISO 18163 and ISO 18831) and a virtual human body.

Annex A
(informative)

Examples of parametric human body types

The size and shape of a parametric human body can be expressed visually according to adult/children or male/female body types.

NOTE Parametric human body types can be classified, assigning a certain criterion according to the purpose of users in the parametric human body software.



Operators (mm, inch)

Stature (1871.7,73.7)
Leg Length (944.4,37.2)
Shoulder Width (359.3,14.1)
Arm Length (595.8,23.5)
Neck (308.3,12.1)
Upper Arm (216.9,8.5)
Lower Arm (191.0,7.5)
Bust (829.3,32.6)
Waist (634.8,25.0)
Abdomen (674.6,26.6)
Hip (807.7,31.8)
Midthigh (376.8,14.8)
Knee (300.6,11.8)
Calf (290.2,11.4)

Operators (mm, inch)

Stature (1890.1,74.4)
Leg Length (944.4,37.2)
Shoulder Width (402.1,15.8)
Arm Length (574.4,22.6)
Neck (340.2,13.4)
Upper Arm (322.7,12.7)
Lower Arm (273.7,10.8)
Bust (960.9,37.8)
Waist (748.5,29.5)
Abdomen (828.5,32.6)
Hip (934.1,36.8)
Midthigh (533.1,21.0)
Knee (348.9,13.7)
Calf (376.8,14.8)

Operators (mm, inch)

Stature (1895.7,74.6)
Leg Length (928.5,36.6)
Shoulder Width (407.0,16.0)
Arm Length (572.0,22.5)
Neck (372.0,14.6)
Upper Arm (376.4,14.8)
Lower Arm (278.7,11.0)
Bust (1083.6,42.7)
Waist (1101.1,43.3)
Abdomen (1122.5,44.2)
Hip (1189.2,46.8)
Midthigh (657.7,25.9)
Knee (427.8,16.8)
Calf (434.7,17.1)

Operators (mm, inch)

Stature (1755.7,69.1)
Leg Length (898.7,35.4)
Shoulder Width (329.7,13.0)
Arm Length (526.7,20.7)
Neck (265.2,10.4)
Upper Arm (153.1,6.0)
Lower Arm (137.5,5.4)
Bust (765.4,30.1)
Waist (528.5,20.8)
Abdomen (701.0,27.6)
Hip (801.2,31.5)
Midthigh (373.4,14.7)
Knee (295.5,11.6)
Calf (286.1,11.3)

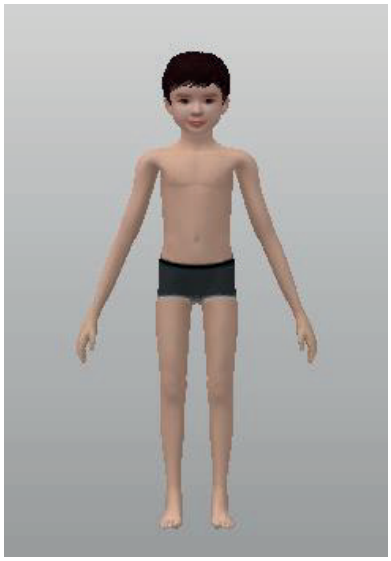
Operators (mm, inch)

Stature (1773.8,69.8)
Leg Length (898.8,35.4)
Shoulder Width (363.5,14.3)
Arm Length (509.8,20.1)
Neck (304.5,12.0)
Upper Arm (211.3,8.3)
Lower Arm (202.0,8.0)
Bust (841.6,33.1)
Waist (639.7,25.2)
Abdomen (839.8,33.1)
Hip (935.6,36.8)
Midthigh (491.3,19.3)
Knee (325.7,12.8)
Calf (342.8,13.5)

Operators (mm, inch)

Stature (1795.7,70.7)
Leg Length (893.7,35.2)
Shoulder Width (379.6,14.9)
Arm Length (501.8,19.8)
Neck (331.4,13.0)
Upper Arm (300.8,11.8)
Lower Arm (227.9,9.0)
Bust (1075.2,42.3)
Waist (941.5,37.1)
Abdomen (1068.4,42.1)
Hip (1148.5,45.2)
Midthigh (657.7,25.9)
Knee (468.3,18.4)
Calf (403.5,15.9)

a) Adult body types



Operators (mm, inch)

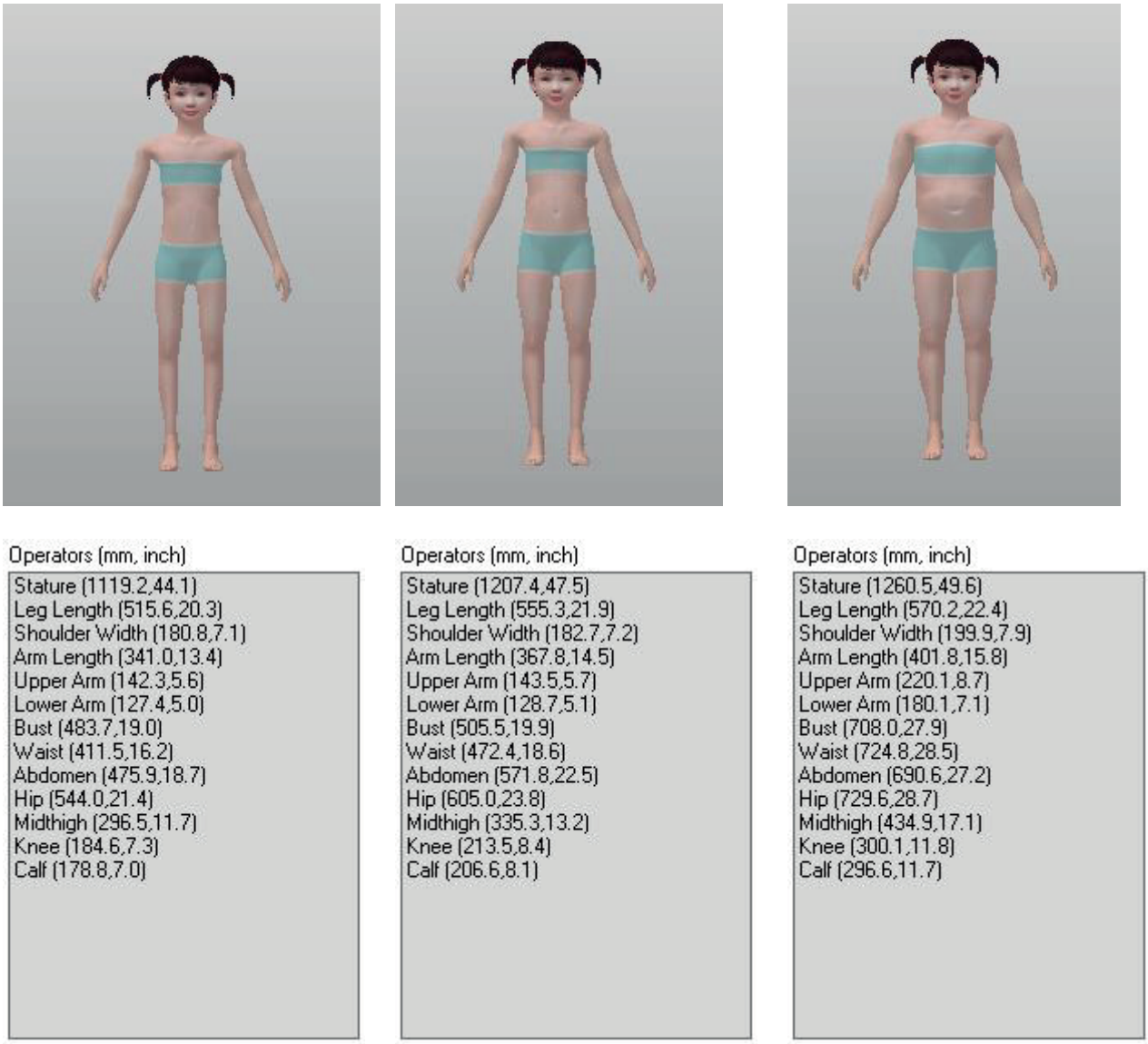
Stature (1175.6,46.3)
Leg Length (566.5,22.3)
Shoulder Width (229.7,9.0)
Arm Length (392.4,15.4)
Upper Arm (168.1,6.6)
Lower Arm (145.8,5.7)
Bust (537.5,21.2)
Waist (425.6,16.8)
Abdomen (473.3,18.6)
Hip (484.0,19.1)
Midthigh (277.1,10.9)
Knee (204.1,8.0)
Calf (176.5,7.0)

Operators (mm, inch)

Stature (1226.5,48.3)
Leg Length (579.5,22.8)
Shoulder Width (230.2,9.1)
Arm Length (381.5,15.0)
Upper Arm (192.8,7.6)
Lower Arm (160.3,6.3)
Bust (625.2,24.6)
Waist (539.1,21.2)
Abdomen (600.4,23.6)
Hip (633.0,24.9)
Midthigh (361.5,14.2)
Knee (241.4,9.5)
Calf (233.7,9.2)

Operators (mm, inch)

Stature (1280.6,50.4)
Leg Length (585.3,23.0)
Shoulder Width (250.0,9.8)
Arm Length (403.1,15.9)
Upper Arm (283.0,11.1)
Lower Arm (190.2,7.5)
Bust (695.2,27.4)
Waist (690.4,27.2)
Abdomen (710.6,28.0)
Hip (663.4,26.1)
Midthigh (426.4,16.8)
Knee (290.8,11.4)
Calf (281.5,11.1)



b) Children's body types

Figure A.1 — Examples of parametric body types

Annex B
(informative)

Examples of notation of virtual human body information

Morphology sources and differentiating characteristics are differentiated according to the virtual human body types. See Table B.1 for morphology sources of virtual human body types and differentiating characteristics.

Virtual human body information is divided into meta information, geometry information, and functional elements. See Table B.2 for an example of an information table.

NOTE The information table may be different according to software used.

Table B.1 — Morphology sources of virtual human body types and differentiating characteristics

Type	Morphology source	Differentiating characteristics
Virtual clone (virtual shape)	3D scanned point cloud	Identical to user
Virtual twin (virtual size)	Body measurements	User lookalike

Table B.2 — Examples of virtual human body information

Class	Items	Contents
Meta information (see ISO 15535:2012, 5.1)	Name/identification	
	Gender	
	Year/month/day of birth	
	Ethnicity	
Geometry information	Virtual body segment	Base body model (torso, arm and leg)
		Replaceable body segment model (head, hand)
	Virtual body texture	Replaceable texture map for skin and/or underwear
	Virtual body landmark	Name and location
	Virtual body dimension	Name and measuring method
Functional elements	Virtual skeletal structure	Name of the virtual bone and virtual joint
	Virtual body pose	Position of the virtual joint and angle of the virtual bone

Bibliography

[1] ISO 8559, *Garment construction and anthropometric surveys — Body dimensions*

[2] ISO 15535:2012, *General requirements for establishing anthropometric databases*

[3] ISO 18163,[1)]*Clothing — Digital fittings — Vocabulary and terminology used for the virtual garment*

[4] ISO 18825-2,[2)]*Clothing — Digital fittings — Part 2: Vocabulary and terminology used for attributes of the virtual human body*

[5] ISO 18831,[3)]*Clothing — Digital fittings — Attributes of virtual garments*

[6] ISO 20685:2010, *3-D scanning methodologies for internationally compatible anthropometric databases*

[7] ISO/IEC 19774, *Information technology — Computer graphics and image processing — Humanoid Animation (H-Anim)*

1) To be published.

2) To be published.

3) To be published.

ICS 61.020
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