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Health informatics — Categorial structure for representation of 3D human body position system —

Part 2: Body movement

Informatique de santé — Structure catégorielle pour la représentation du système de positionnement du corps humain en 3D —

Partie 2: Mouvement du corps

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Foreword

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This document was prepared by Technical Committee ISO/TC 215, *Health informatics*.

A list of all parts in the ISO 23541 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.

Introduction

In the medical field, body movements are important parts of medical recording. Gait analysis, heart pulsation, blood flow, hemiplegic movement as well as extremity motion are representative body movements which can require medical description. However, conventional text-based terminology does not have the capability to express details of body movement.

With the popularity of virtual reality (VR), augmented reality (AR) and three-dimensional (3D) contents, many medical 3D animations are created without clear terminological concept representation. 3D animation messages can vary depending on the creator, audience or countries. For example, names of body parts in a VR scene are not clearly given by standard medical terminology. Sometimes, 3D animation concepts are described only by narrative text, which is insufficient to deliver precise medical concepts. Additionally, 3D animations without terminological coordination do not allow terminology-based searching capability and interoperability within the VR system.

Patients with movement disorder do not have a visual impression on their disease. The meaning of their symptoms and signs cannot be exactly delivered to their families. They cannot understand long-term trends of their movement. Quantitative assessments of their motions are very difficult to achieve.

This document explains how 3D medical animations are coordinated with standard medical terminology. Categories and relations among 3D models, actions and text terminology are given in Figure 7.

By coordinating 3D body movement to text-based standard terminology, 3D medical contents will allow standardized communication between users and creators. This is also helpful for exchanging medical information in health-related research. The coordination helps to deliver medical concepts of 3D body movement, and it allows search capability with standard medical terminology.

Clinicians are able to describe patient's movement in a more detailed manner. 3D movement models allow objective, independent assessment of patient's symptom and disease. Quantification and long-term assessment are more clearly achievable.

With technological advancement in sensors and optical device, it is possible to log patient's movements quantitatively. These data can be processed and animated in a 3D world. Continuous monitoring of patient's body movement is also feasible with visual impression. Patients are able to understand their disease status in a meaningful way.

ISO/TS 23541-1 is applied to a static model. Categorial structures for static models cannot be applied to 3D medical animations because 3D animations have one additional axis of information, which is the time dimension. Because of this additional dimension, the categorial structure of 3D animation differs in many ways form a static model.

In a static model, concepts are coordinated with the model and the coordination occurs only once between the model and text terminology. However, as movement of 3D model develops over time, text terminology is coordinated with a specific time segment as well as with a specific model. For example, the 3D gait action model of a Parkinson's disease patient can be sub-divided into multiple time segments. Since the action in a time segment can be normal or abnormal, repetitive coordination is required between text terminology, 3D model and time segment. Sometimes opposite concepts such as "normal gait" and "abnormal gait" can be coordinated with a single body part in an action which does not happen in a static human body model.

In static models, a body part is the target of description. Instead, action sequence, movement range, movement trajectory are the main targets of description in dynamic 3D human body model.

In dynamic models, a body part changes shape, location or size continuously. Accordingly, single body parts will have multiple models which are coordinated with the same text terminology, which is not allowed in fixed model. To handle this, two categories are given to the body part model, which are base model and actor.

Health informatics — Categorial structure for representation of 3D human body position system —

Part 2:
Body movement

1 Scope

This document provides terminological concepts for the representation of human body movement and establishes the categories and relationships of text-based terminology and time-dependent body movement in 3D data.

This document does not cover 3D graphic user interface, data structure, implementation and guidelines.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviations

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 General terms

3.1.1
three-dimensional
3D
having the three spatial dimensions of height, width and depth

Note 1 to entry: Computer representation of 3D information is used in healthcare.

3.1.2
3D body movement
representation of the body movement or motion of a human body in the *3D* (3.1.1) space

3.1.3
3D animation
3D (3.1.1) computer graphic that depicts moving objects

3.1.4
anatomical site
location in or on the body

EXAMPLE 1 Stomach (SCTID: 69695003) is anatomical site in Gastrectomy (SCTID: 53442002).

EXAMPLE 2 Leg (SCTID: 61685007) is anatomical site in Leg ulcer (SCTID: 95344007).

Note 1 to entry: It is the object of medical observation, decision, or intervention.

3.1.5
terminology
structured, human and machine-readable representation of *concepts* (3.1.6)

3.1.6
concept
unit of knowledge created by a unique combination of characteristics

[SOURCE: ISO 1087:2019, 3.2.7, modified — Notes were removed.]

3.1.7
timeline
time-sequential set of record components in the *3D body movement* (3.1.2)

3.2 Characterizing categories

3.2.1
3D body part
3D (3.1.1) model or entity that constitutes the structural organization of a human body

EXAMPLE Stomach model in 3D gastrectomy animation.

3.2.2
3D body site
3D (3.1.1) model that represents an *anatomical site* (3.1.4)

Note 1 to entry: Site model is used to represent disorder, tumour and *finding* (3.2.11).

EXAMPLE 1 Brain tumour model in a brain surgery scene.

EXAMPLE 2 Fractured part of humerus in *3D animation* (3.1.3).

3.2.3
3D object
3D (3.1.1) model that represents physical objects that originate from outside the human body

EXAMPLE 1 Surgical knife (SCTID: 102307003).

EXAMPLE 2 Prosthetic valve device (SCTID: 11358008).

3.2.4
3D annotation
3D (3.1.1) model that represents title, mark or note that is added to body movement

EXAMPLE 1 3D text describing laminectomy (Figure 1).

EXAMPLE 2 3D arrow models (Figure 1).

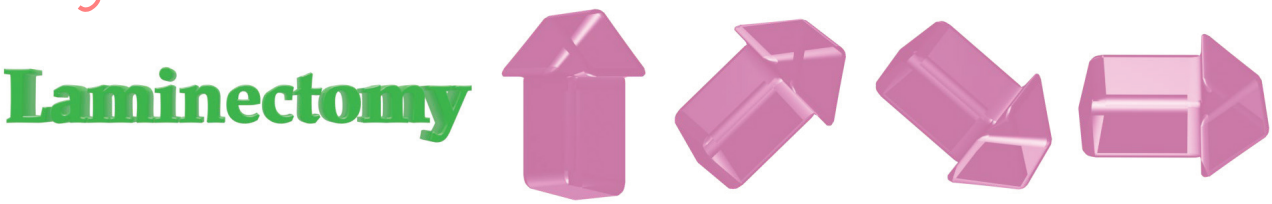

Figure 1 — Examples of 3D annotations

3.2.5
text-based description
conventional text-based *terminology* (3.1.5) which provides description of *3D* (3.1.1) model and *action* (3.2.7)

Note 1 to entry: Text-based description is meant to be coordinated with body movement models.

EXAMPLE SCTID: 363349007 to provide description of stomach cancer operation.

3.2.6
3D actor
3D (3.1.1) model that performs a body movement or *action* (3.2.7) which is a modified model of *3D body part* (3.2.1), *3D body site* (3.2.2), or *3D object* (3.2.3) model

Note 1 to entry: 3D actor is created by deforming 3D body part or 3D site model.

EXAMPLE Heart valve movement actor model which has variant shape of normal heart valve.

3.2.7
action
any movement, gesture, or activity performed by the human body

Note 1 to entry: Actions include simple movements such as walking, running, or waving, and complex actions such as dancing, playing sports, or performing intricate tasks with the hands.

3.2.8
action segment
piece of *action* (3.2.7) that is segmented along the *timeline* (3.1.7)

Note 1 to entry: An action segment is meant to be coordinated with text *terminology* (3.1.5).

EXAMPLE See Figure 2.

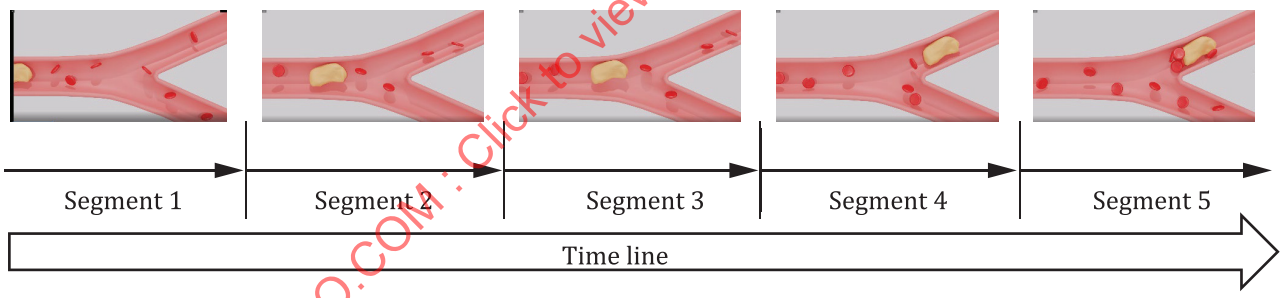

Figure 2 — Example of action segment

3.2.9
intervention
action (3.2.7) taken to maximize the prospect of achieving the patient's or providers' goals of care, including the removal of barriers to success

Note 1 to entry: Connecting tubular body structures, removing unnecessary body parts or cutting are good examples of interventions.

EXAMPLE 1 Gastrectomy (SCTID: 53442002).

EXAMPLE 2 Endovascular insertion of branched stent graft (SCTID: 746046001).

EXAMPLE 3 Oral airway insertion (SCTID: 7443007).

EXAMPLE 4 Lumbar discectomy (SCTID: 239542002).

3.2.10
observation
measurement of a single variable or a single value derived logically and/or algebraically from other measured or derived values

Note 1 to entry: A test is an observation.

EXAMPLE 1 Left atrium systolic volume (SCTID: 399235004).

EXAMPLE 2 Heart rate (SCTID: 364075005).

EXAMPLE 3 Vital capacity (SCTID: 268379003).

3.2.11
finding
concept (3.1.6) that represents the result of a clinical *observation* (3.2.10), assessment or judgement

Note 1 to entry: Finding also contains diagnosis, symptom, nursing diagnosis.

EXAMPLE 1 Leg ulcer (SCTID: 95344007).

EXAMPLE 2 Pineal tumour (SCTID: 127026004).

EXAMPLE 3 Fungating tumour (SCTID: 413281002).

3.3 Abbreviated terms

VR virtual reality

AR augmented reality

SCTID SNOMED CT identifier

4 Categorial structure

4.1 Overview

The representation of the formal concepts pertaining to the 3D human body position system in body movement includes characterizing categories (see 3.2) and semantic links (see 4.2). It is illustrated in Figure 7 as an information model.

4.2 Semantic links

4.2.1 hasDescription

Having description that provides information about action.

It expresses the semantic link between action (see 3.2.7) and text-based description (see 3.2.5).

EXAMPLE 3D action “gait” has description of “abnormal gait”.

4.2.2 hasAnnotation

Having 3d models with additional explanatory notes, comments or labels.

It expresses the semantic link between action segment (see 3.2.8) and 3D annotation (see 3.2.4).

EXAMPLE Action segment “laminectomy (SCTID:387731002)” has 3D annotation model (Figure 3).

Figure 3 — Example of hasAnnotation relationship

4.2.3 hasModel

Having 3D human body model to express medical terminological concepts.

It expresses the semantic link between text-based description (see 3.2.5) and 3D actor (see 3.2.6).

EXAMPLE "ataxic gait (SCTID: 25136009)" has 3D actor model.

4.2.4 hasAction

Having movement, gesture, or activity.

It expresses the semantic links between text-based description (see 3.2.5), 3D actor (see 3.2.6), and action (see 3.2.7).

EXAMPLE 1 "ataxic gait (SCTID: 25136009)" has action (Figure 4).

EXAMPLE 2 Patient actor model has an action of "ataxic gait (SCTID:308909003)".

4.2.5 hasActor

Having 3D model that performs action.

It expresses the semantic links between 3D body part (see 3.2.1), 3D body site (see 3.2.2), 3D object (see 3.2.3), 3D actor (see 3.2.6) and 3D annotation (see 3.2.4).

EXAMPLE Left leg (body part) has 3D actor model (Figure 4).

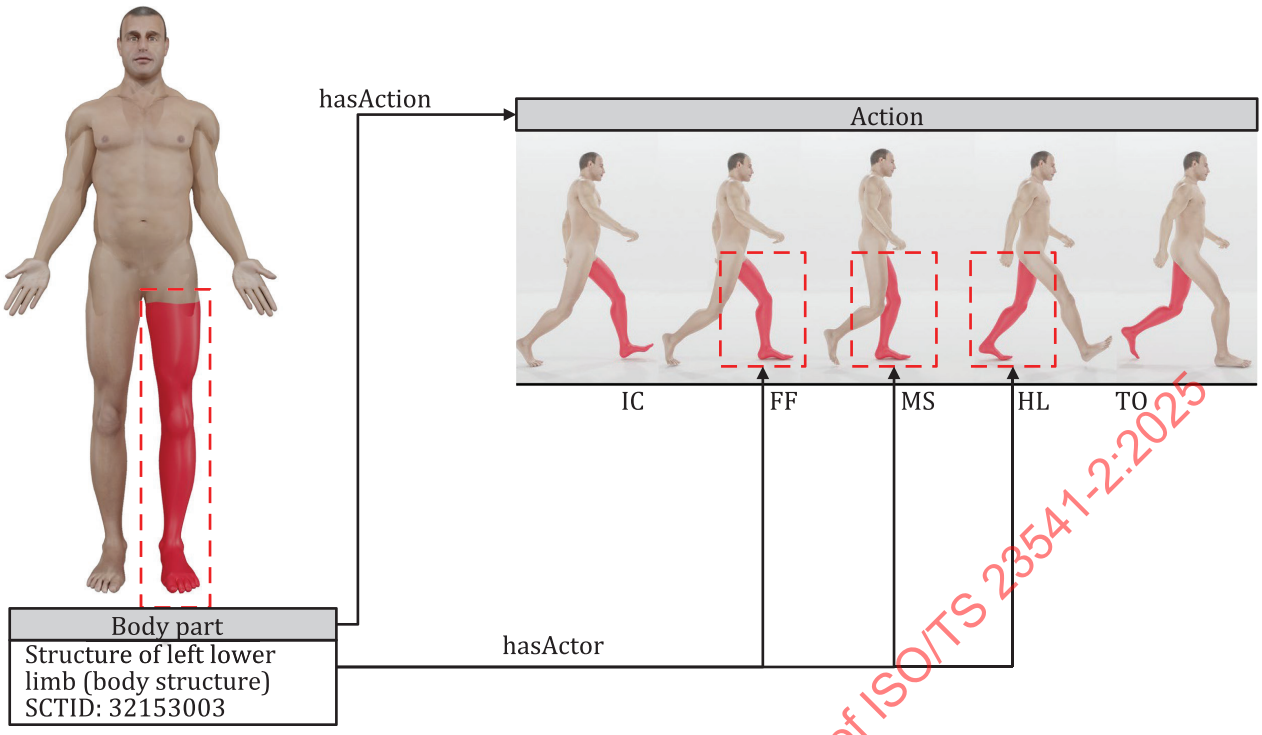

Figure 4 — Relationship of 3D body part and actors

4.2.6 hasObservation

Having measurement of clinical context.

It expresses the semantic link between action segment (see 3.2.8) to observation (see 3.2.10).

EXAMPLE 1 Gait speed is 3 m/sec.

EXAMPLE 2 Right knee joint range of motion is 35°.

4.2.7 hasFinding

Having clinical assessment or judgement.

It expresses the semantic link between action segment (see 3.2.8) to finding (see 3.2.11).

EXAMPLE Patient has parkinsonian tremor (Figure 5).