Anthropometric Databases and Applications

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World Engineering Anthropometry Resource
The WEAR Group
USA- Canada - France - Japan - Korea - The Netherlands
Taiwan - Brazil - South Africa - Australia

Setting up during IEA-2000-HFES San Diego August 2000

Aim

- Gathering the existing methods in Anthropometry and related disciplines - Identifying the databases
- **Defining the structure of the on-line information system - Developing databases, data models and software tools**
- Characterizing populations of 3-D subjects in a manner that can be effectively searched, mined and visualized
- Understanding the cognitive processes of anthropology experts when dealing with such 1-D and 3-D databases - Identifying a means to computationally replicate these processes
A distributed on-line database system

Database 1

Database 2

Database 3

Wear members

Database n

Local Area Networks

End Users

Wear

Database

Web
Anthropometric and Ergonomic Database System

Principle

Additional files

Synthesis sheets

Dictionary of measurements

Demographic data

Quality Evaluation of Anthropometric Data

+ xxx xxxx

Bibliographical Data

Data files

1-D

Individual Data

Aggregated Data

3-D

XX

Sorting Query

Data processing

Digital man-models

Shape analysis

Fit tests

(a) (b) (c) ...
Database components

**MAIN SECTIONS**: 1 to 5

1. **ANTHROPOMETRY**
   - 1-D
   - *links dimensions*

2. **SURFACE ANTHROPOMETRY**
   - 3-D
   - *shapes, volumes, inertia*

3. **ANATOMY**
   - 1-D
   - *skeleton, organs*

4. **ANATOMY**
   - 3-D
   - *shapes*

5. **PHYSIOLOGY AND BIOMECHANICS**
   - *field of view, range of motion, properties of tissues*
Database components

MAIN SECTIONS: 6 to 9

- **6. POSTURES** → angular values
- **7. STRENGTH** → static, dynamic peak values of force, torque, power
- **8. MOTION** → trajectories
  - angular values as a function of
    - time
    - distance to reach
- **9. MOVEMENT BEHAVIOUR FUNCTION**
- **9. DOCUMENTARY SHEETS ON ERGONOMICS** → norms recommendations
general or specific results
Database components

- Information on surveys
- Demographic data: Sex, Age, Educational level...

1-D data

3-D scans

New Data

Criteria for query:
- sex, age,
- morphological criteria,
- Educational level...

1-D Data

3-D Data

Dictionary of measurements

Quality Evaluation of Anthropometric Data

Scanners info

Digital products

Statistical processing

Shape analysis tool set

...
Dictionary of measurements
( example )

Aim
- Give an unambiguous definition for each mesurement
- Help to define necessary measurements for each survey

Contents
- Graphic representations of the human body with locations of anatomical points
- For each measurement, for each point definition method of measurement graphic

Definition
« Distance plan postérieur du massif fessier - face antérieure du genou »

Method
« Sujet assis, jambes fléchies à angle droit, fesses appuyées au mur, distance à partir du mur servant de plan de référence entre la face postérieure des fesses et la face antérieure du genou »
The need to create an Ontology?

• Common set of terminology
• Formal/Testable representation
• Take advantage of advanced tools
  – (why reinvent work when you can steal from others!)
• Integration with new web services and W3C semantic web architecture

Adapted from S. Ressler, 2006
Protégé (Stanford Ontology Tool)

Adapted from S. Ressler, 2006
Enhanced Web Pages (visualizations)

Adapted from S. Ressler, 2006
Semi-Automatically Generated Web Page

Adapted from S. Ressler, 2006
Databases Applications

**Examples of 1-D anthropometric data processing using Databases of WEAR**

**Evolution of the stature. Mean values for two french populations from 1940 to 1991.**

**Prediction up to 2020.**

**Choice of well-adapted measurements**

Choice of typical human body models using bivariate distributions.
Example to create 5th, 50th and 95th percentiles of mannikins.
Databases Applications

Example of the visual interface of CLEOPATRA to navigate and interrogate a 3-D Database of WEAR

Adapted from M. Rioux, 2005
Databases Applications

Examples of 3-D size/shape analysis and fit tests using 3-D Databases of WEAR for the design of equipments

Adapted from K. Robinette, 2002 and R. Mollard, 2003, 2005
Conclusion

==> to develop a Post-Database Creation Ontology

» Enable future integration capabilities
» Check for coverage/completeness
» Formal description of content and methodology for adding semantic hooks
» Improved (semi-automatic) documentation

==> to develop the WEAR on-line database system connected with existing databases