

# Quality Control of Anthropometric Databases

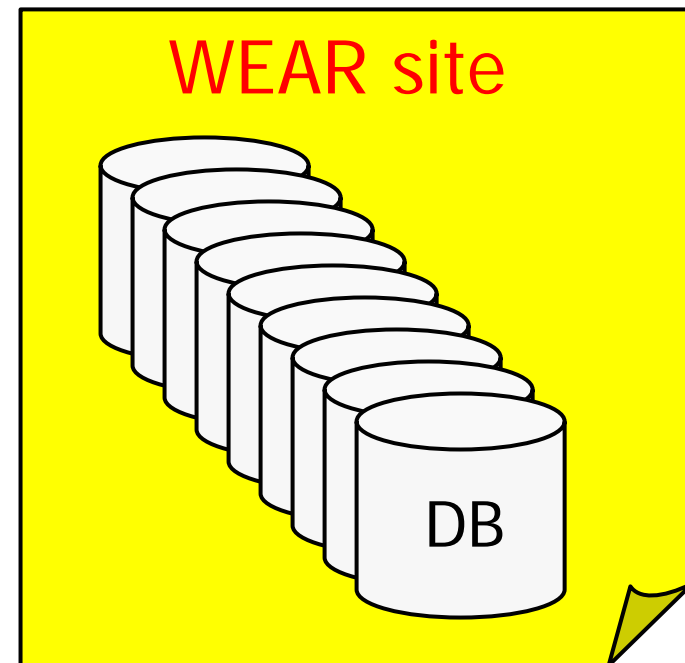
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# Many databases in WEAR site

- There will be many databases in WEAR site
- They are different in various ways
  - Year of measurement
  - N of measurement
  - Type of measurement (1D/3D)
  - Target population (sex, age, ethnicity, etc.)
  - ...
  - Quality
- Any data may be better than no data
- WEAR group will evaluate each database for the quality





# What to evaluate for the quality

- Is the subject population close enough to my target population?

**Validity**

- Is the measurement taken by the same way with other databases?

**Comparability**

- How correct and accurate is this measurement?

**Accuracy**



# Good data

- Subject population --- Valid
- Measurement method --- Comparable
- Measurement quality --- Accurate
  
- We will examine each database
  - By examining the documents related to the DB
  - for the validity, comparability, and accuracy
  - using a checklist



# Who evaluates and how?

## ■ Database provider

- Objective evaluation
  - Provide detailed description of measurement definitions
  - Evaluate the quality by filling the quality-check-list sheet made by WEAR group
- Subjective evaluation
  - Make a self-evaluation of the total quality with comments

## ■ WEAR group

- Objective evaluation
  - Confirm measurement definitions
  - Examine the quality-check-list sheet filled by the provider
- Subjective evaluation
  - Rating the total quality with comments



# Check list items for **Validity**

- We examine if there is enough back ground information to judge the validity
  
- **Sampling**
  - Sampling method
  - Sampling bias examined or not
- **Description of subject population**
  - Location of examination
  - Year of examination
  - Number of subjects by gender and age group
  - Other specification as required
- **Secular change**
  - Rate of secular change in height in last several decades
    - Useful to know how soon the data is outdated



# Assurance of **Comparability**

- **We examine the definition of each measurement before including a database**
  - List up factors to define each measurement
    - Landmark
    - Measurement definition
    - Posture
    - Instrument
    - Clothing
  - Define comparability level for each measurement from coarse to fine
    - Stature (any standing posture, any clothing, any instrument)
    - ...
    - Stature (basic standing posture, barefoot, anthropometer)
  - Develop a measurement searching software based on user-specified comparability level



# What to evaluate for the quality of measurements?

- Many factors affect the quality of measurement

Measurement	Factors influencing the quality of anthropometric data
<b>Traditional: 1D dimension</b>	Measurement Condition (Clothing, posture, etc.)
	Skill of marking operator and measurer
	Accuracy of instrument
	Data editing to eliminate erroneous values
<b>Scan-derived: 1D dimension, Landmark, Surface shape</b>	Measurement condition (Clothing, posture, etc.)
	Skill of marking operator
	Accuracy of scanner system (hard) & performance of scanner system (soft)
	Data editing to eliminate erroneous values





# Checklist items for the **Accuracy**

## ■ Before measurement

- Training of measurers
  - Method and duration of training
- Accuracy of Instruments (especially 3D scanner)
  - Testing methods and test results
  - Comparison of 1D measurements with traditional data

## ■ During measurement

- Repeatability of measurements
  - Evaluate using TEM

## ■ After measurement

- Data editing to eliminate outlying values due to mistakes
  - Y/N if Y, how?

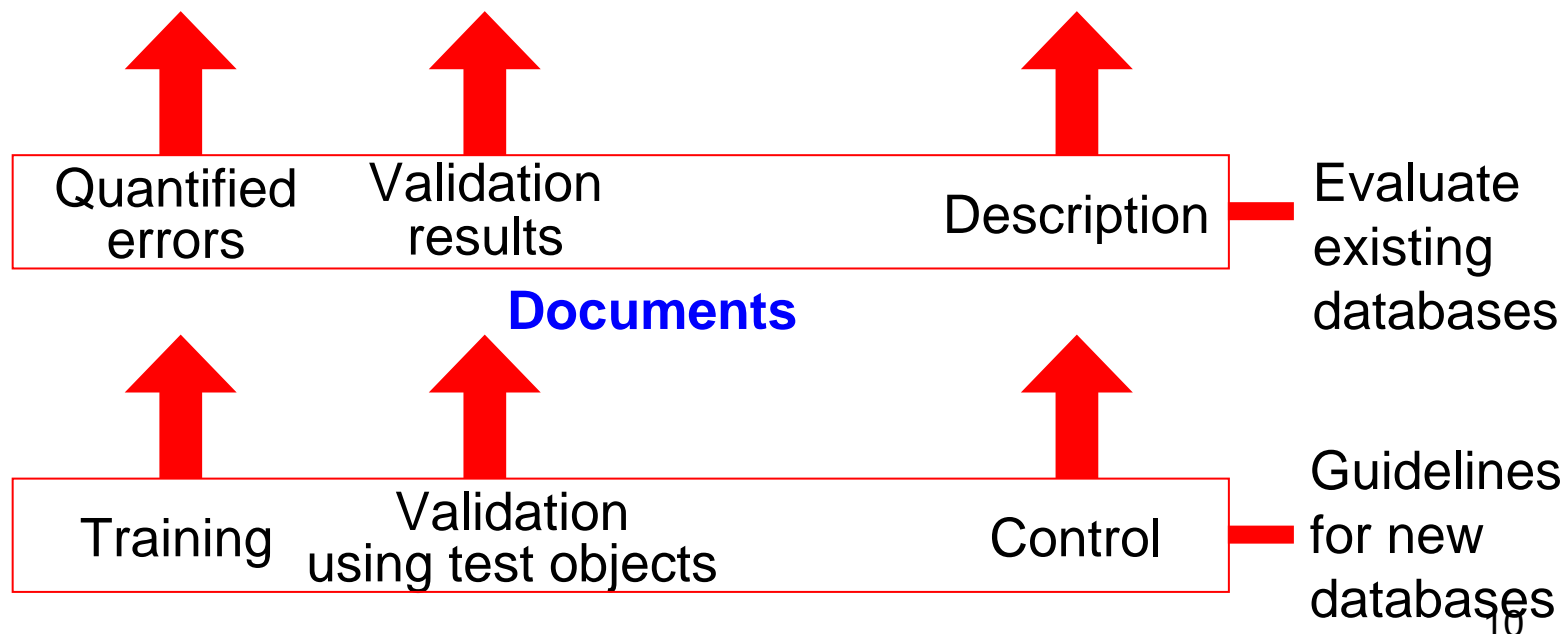


# What to do for Future Databases

## ■ Model of measurement errors

$$e_T^2 = e_M^2 + e_D^2 + e_E^2 + e_P^2 + e_S^2$$

<u>T</u> otal	=	<u>M</u> easurer	+	<u>D</u> evice	+	<u>E</u> nvironment	+	<u>P</u> rotocol	+	<u>S</u> ubject
		Skill		Tape meas. Caliper 3D Scanner		Temperature Humidity		Clothing		Body sway





# Check list items for traditional 1-D measurements

$$e_T^2 = e_M^2 + e_D^2 + e_E^2 + e_P^2 + e_S^2$$

<u>T</u> otal	<u>M</u> easur Skill	<u>D</u> evice Tape meas. Caliper	<u>E</u> nvironment Temperature Humidity	<u>P</u> rotocol Clothing Posture	<u>S</u> ubject Body sway
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## ■ Repeatability of measurement

- quantified using Technical error of measurement

$$TEM = \sqrt{\Sigma d^2 / 2N}$$

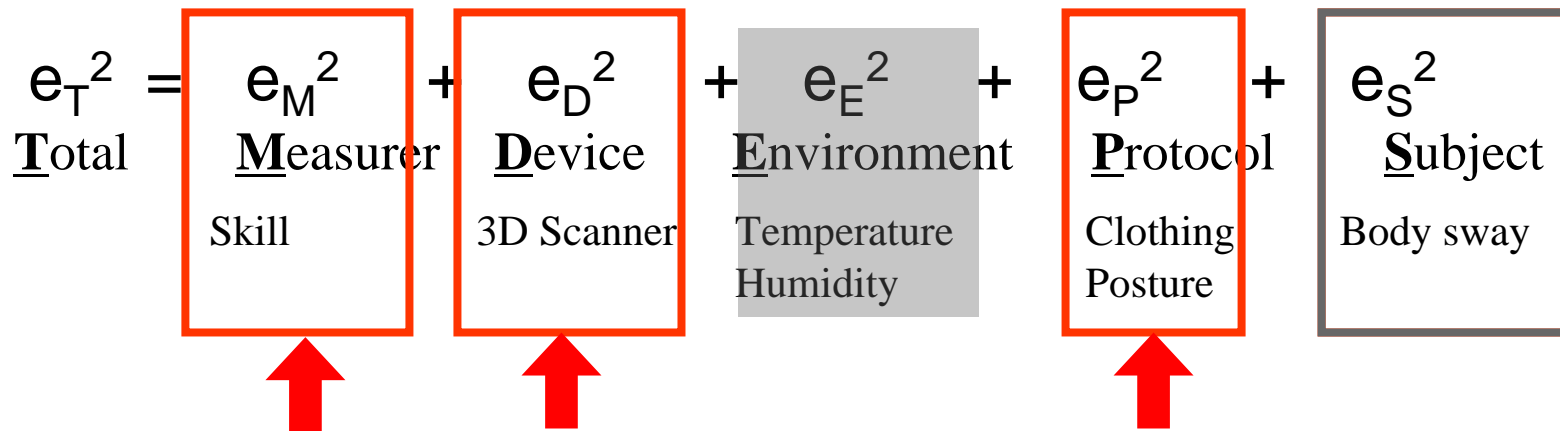
**d**=difference between repeated measurements on  
**N** subjects

**N**=number of subjects measured





# Check list items for scan-derived measurements



## ■ Repeatability of measurements

- Evaluate by comparing repeated measurements

## ■ Accuracy of the scanner

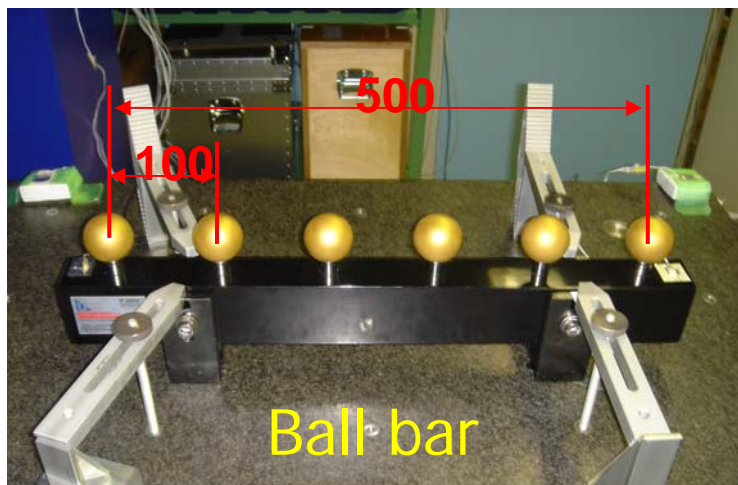
- Evaluate by measuring test objects of known size

## ■ Effects of clothing/posture on body shape

- Description of clothing/posture
- Evaluate by comparing measurements for clothing or posture differences

# Test objects for evaluating scanner accuracy

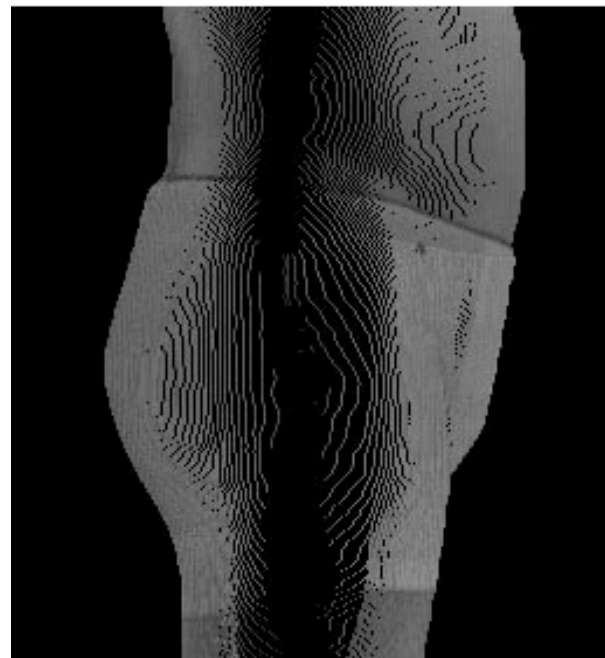
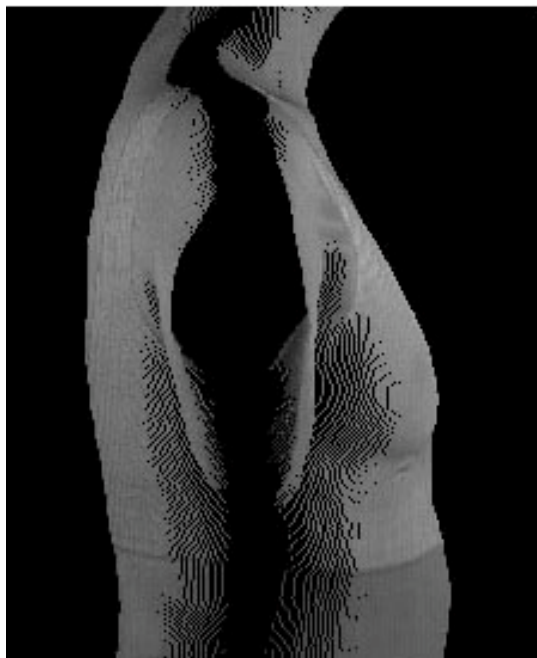
- **Type 1: simple mathematical shape with known dimensions**
  - Accuracy as a measurement system
- **Type 2: anthropomorphic dummy**
  - Repeatability of landmarks locations, measurements, and shape
- **Type 3: actual humans**
  - Evaluation including effects of body sway





# Why use anthropomorphic dummy?

- To evaluate the effects of shape on the repeatability of data
  - no influence of body sway or repeatability of posture
- Repeatability of landmark locations at the side of body is NOT good in scanners that cannot measure the side of the body

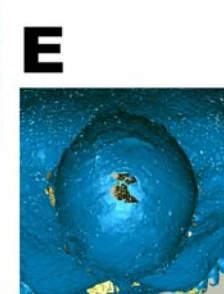
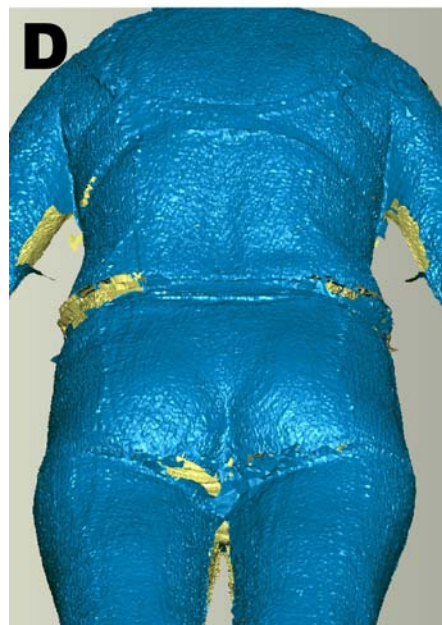
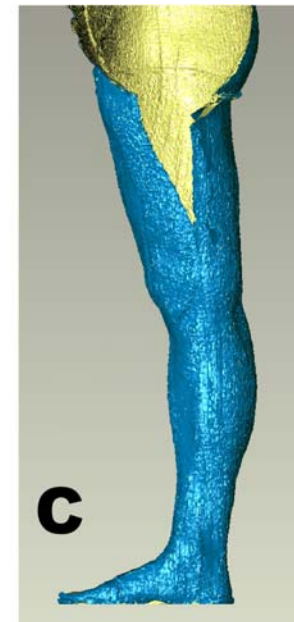
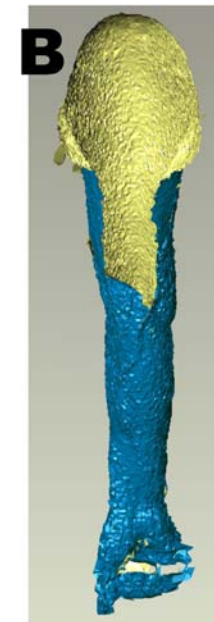
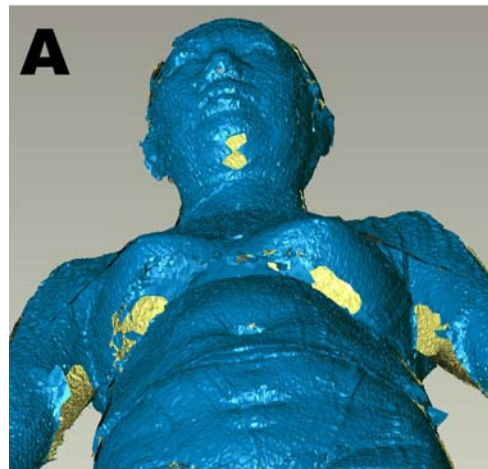




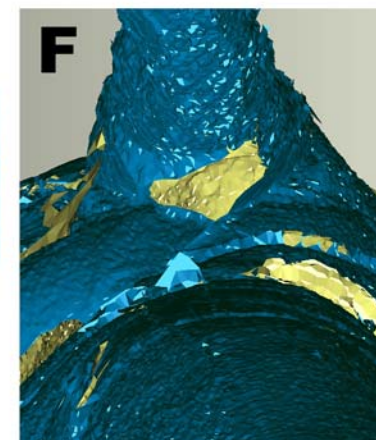


# Why use living humans?

- To evaluate the repeatability of the real data
- Large variation in size and shape
  - Differences in occluded area
- Effects of subject factor (body sway, and repeatability of posture)



↓  
anterior





# END

- How to evaluate the quality of databases
- Checklist items evaluated for the quality

**Thank you for your attention!**