



European Standardization Organizations

Webinar 'Towards a New European Anthropometric Database for User-Driven and Inclusive Standards'



Your webinar moderator



Els Somers

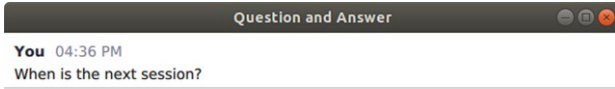
Project Manager

Public Relations

esomers@cencenelec.eu

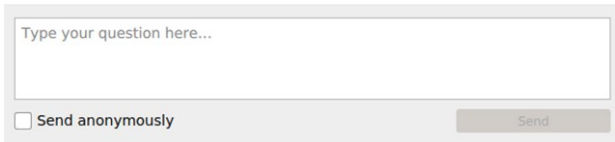
Get the most out of the webinar today

- ▶ Use the Q&A panel to submit your questions



Question and Answer

You 04:36 PM
When is the next session?



Type your question here...

☐ Send anonymously Send

- ▶ Talk about us on LinkedIn, Bluesky or Instagram
[#training4standards](#) [@Standards4EU](#)

Your speakers today



Christiane SCHEFFLER

Professor for Human Biology at University of Potsdam;

Expert in anthropometry;

Expert of CEN/TC 122/WG 1 and project leader of WP on anthropometric data needs for machinery/PPE



Enda FALLON

Associate Professor in Industrial Engineering at the University of Galway, Ireland

Convenor of CEN/TC 122/WG 1 "Anthropometry"

Your speakers today



Sandra ALEMANY

Head of the Anthropometry Research Group at the Instituto de Biomecánica de Valencia (IBV), Spain

Expert of CEN/TC 122/WG 1 and project leader of technical report on statistical summaries (CEN/TR 18296-1)

Sandra.Alemany@ibv.org



Gerd KÜCHMEISTER

Lecturer in Ergonomics at Kiel University of Applied Sciences

Expert of CEN/TC 122/WG 1 and project leader of guidelines on the correct use of anthropometric data in ergonomics (CEN/TS 18296-2)

gerd.kuechmeister@haw-kiel.de

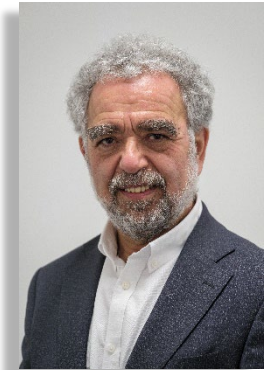
Levent CAGLAR

Chief Ergonomist at FIRA International Ltd, UK

Expert of CEN/TC 122/WG 1

Convenor of CEN/TC 207/WG 6
"Furniture for educational institutions"

levent.caglar@fira.co.uk

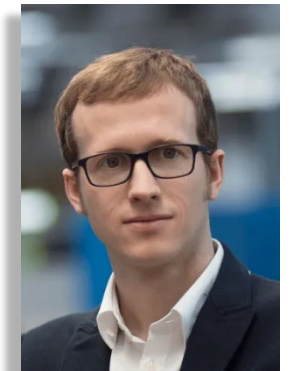


Toon Huysmans

Associate Professor in Digital Human Modeling, Delft University of Technology

Expert of CEN/TC 122/WG 1 and project manager of the survey in NL.

t.huysmans@tudelft.nl



- ▶ Project background.
- ▶ Research on the needs for and availability of anthropometric data of adults in the context of inclusive and gender-responsive standards.
- ▶ Typological approach and future methods.
- ▶ Upcoming project focused on PPE/machinery.
- ▶ Relevance for standardization community and standards users.
- ▶ Q&A



European Standardization Organizations

Background

Enda Fallon

Associate Professor in Industrial Engineering at the University of Galway, Ireland

- ▶ Previous Work - *Anthropometry and Strength Data of Children*
- ▶ Motivation for Current Work
- ▶ Scope of Current Work
- ▶ Future?

Previous Work



PHASE 1

Research on the demand and availability of anthropometric data of children



Objectives:

- Existence/availability of anthropometric data.
- Demands on anthropometric data.
- Gap Analysis.



Result:

CEN/TR 17698 Ergonomics - Demands and Availability of anthropometric and strength data of children in Europe

PHASE2

Anthropometric and strength study of children in Europe

Guidelines for the application of anthropometry and strength data in Europe



Objectives:

- Acquisition of available data.
- Development of the measurement programme (2 EU countries).
- Processing, integration and analysis of databases.



Objectives:

- Guidelines on how to correctly apply anthropometric and strength data of children.



Results:

- **CEN/TR 18296-1:2026.** Ergonomics - Anthropometric and strength data of children in Europe — Part 1: Statistical summaries of the data
- **CEN/TS 18296-2:2026.** Ergonomics — Anthropometric and strength data of children in Europe — Part 2: Guidelines for the correct application of anthropometric and strength data

- ▶ Lack of, or unavailability of European Anthropometric Data for Standardisation
- ▶ Current Data out of date, and not necessarily representative of all of 'Europe' - EN 547-3 (*Safety of machinery - Human body measurements - Part 3: Anthropometric data*) –'1996'
- ▶ Significant Databases available but not accessible for use in standardisation or necessarily amenable to use.
 - ▶ *permission to use personal data, ethical approval*
 - ▶ *definitions of anthropometric dimensions*
 - ▶ *survey methodology,*
 - ▶ *mathematical / statistical estimation of data*

- ▶ The Requirement for Inclusive and Gender Responsive Standards
 - ▶ Explicit consideration of sex and gender differences
 - ▶ All genders equally benefit
 - ▶ Representative database
 - ▶ Inclusive language

- ▶ EC study highlighted 72 high priority standards in need of revision
 - ▶ Selected CEN/TC122-EN 894 series, 'Ergonomics requirements for the design of displays and control actuators – Harmonised re the Machinery Regulation, for Priority Revision
 - ▶ **Requires Inclusive and Gender Responsive Anthropometric Data!**

- ▶ Existence/availability of adult anthropometric data
- ▶ What exists
 - ▶ Is it amenable / suitable for standardisation
 - ▶ Costs associated with the data
- ▶ Demands on anthropometric data – stakeholders needs e.g.
 - ▶ Machinery and workplace ergonomics
 - ▶ Consumer products
 - ▶ Sports and leisure
- ▶ Gap Analysis. – What do we need to do to bridge that gap and ensure Inclusiveness and Gender Responsiveness?

- ▶ Similar to the Children's Anthropometric Project – Completed Gap Analysis and Proposed Scenario(s) for Anthropometric Survey
- ▶ Difference: Incorporated the Topological Approach into our Proposals
 - ▶ Body Shapes, Correlations, Multivariate Statistics
 - ▶ Targeting lead measures which can be used in tandem with existing, for example, epidemiological data, or security data
 - ▶ Clear recognition that there will in future be new sources of anthropometric and strength data

SCENARIOS - Traditional combined with Typological Approach



- ▶ Main considerations:
 - ▶ No of Dimensions
 - ▶ Accuracy
 - ▶ Sample Size
 - ▶ Centres (Countries, Regions)
- ▶ Scenario 1: 2 Centres, Limited Sample, Reduced Accuracy, Reduced Costs
- ▶ Scenario 4: Comprehensive, 6 Countries (regions), Significant sample, high accuracy, significant costs

- ▶ **Project 'Anthropometric considerations for machinery/PPE'**
to define the protocols for scenarios with 2 Cases
 - ▶ Machinery
 - ▶ Face Masks

- ▶ EU Data Hub for Anthropometric Data – Current Call for Tender

- ▶ <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/tender-details/8552d3a2-4a8a-4be6-93d2-3c598f31e982-CN#anchorDocuments>



European Standardization Organizations

Research on the needs for and availability of anthropometric data of adults in the context of inclusive and gender-responsive standards.

Dr. Sandra Alemany

Head of the Anthropometry Research Team
Instituto de Biomecánica de Valencia

CONTENTS

- ▶ WP1. Needs of Anthropometric Data
- ▶ WP2. Availability of Anthropometric Data
- ▶ WP3. Gap analysis
- ▶ WP4. Planning the European Anthropometric Survey

► Sectors and products

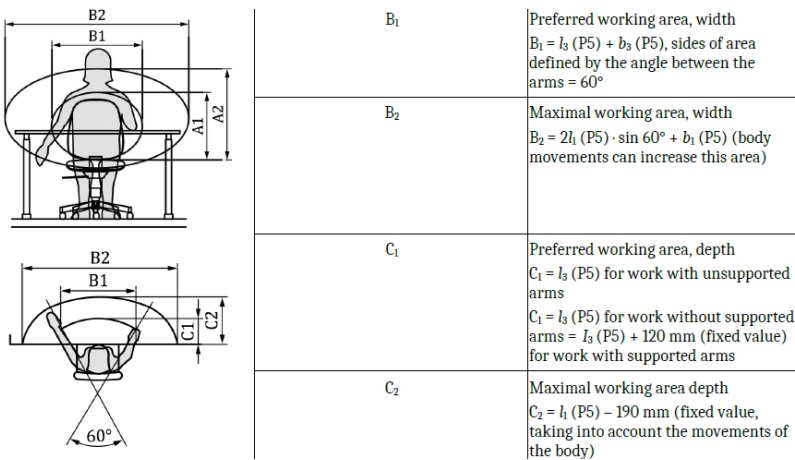
Sector	Subgroups / Products
Industry and Manufacturing (Workstation & PPEs)	Hand tools, Industrial Vehicles, Machines, Helmets, Eye Protection, Mouth and Face, Safety Shoes and Boots, Other Safety Equipment, Protective Clothing, Workstations... <i>*Some protective clothes or equipment affects to specific job position</i>
Furniture	Bathroom, Home, Kitchen, Office, Storage...
Sports and leisure	Sport Spaces, Sports Equipment, Other specific products, Clothing, Footwear, Cycles, Leisure Spaces, Musical Instruments, Recreative Machines...
Fashion and Apparel	Clothing, Footwear...
Technology and Electronics	Devices, Electronical devices, Household appliances, Wearables...
Construction and Architecture	Public furniture, Machines and tools, Public spaces, Elevators and evacuation systems... <i>*A specific study related with a... Spaces, accessible equipment... 11 - Accessibility in the built environment</i>
Health (Sanitary environment & Medical Devices or equipment)	Hospital Beds, Prosthetics, Wheelchairs...
Transport	Public Transport Seats, Restraint Seats, Train Cabins, Transport Buildings...

8 Sectors
 > 600 standards reviewed!!!
 > 200 considered for the
 draft list of anthropometric
 needs.

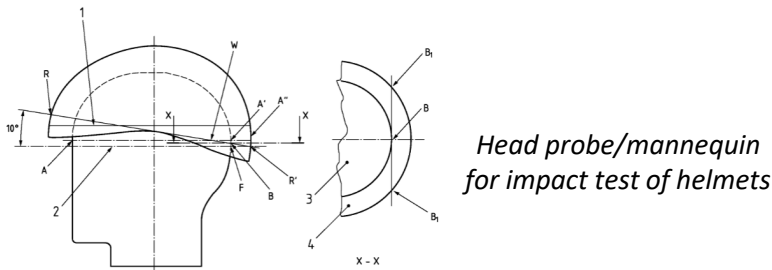
Needs of anthropometric data

Review of standards & Scientific publications

EN ISO 14738. Safety of machinery — Anthropometric requirements for the design of workstations for industries and services.



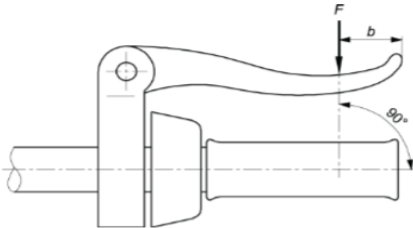
UNE-EN 1078:2012+A1:2012 Helmets for pedal cyclists and for users of skateboards and roller skates.



EN 17860-3:2024 - Carrier Cycles - Part 3: Lightweight multi track carrier cycles - Mechanical aspects

6.2.4 Brake-lever – Position of applied force

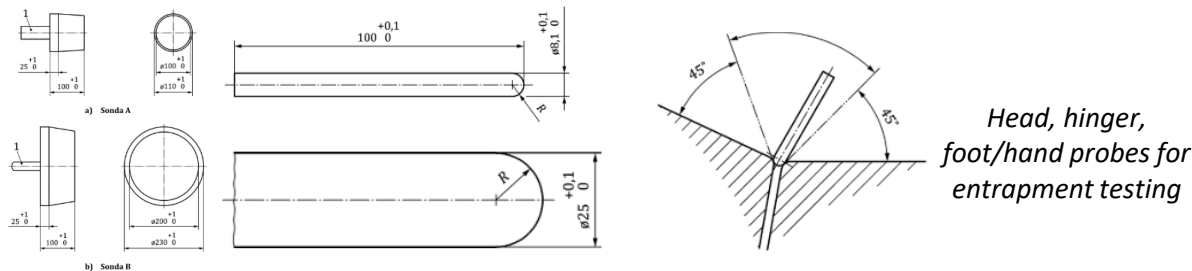
For the purposes of braking tests in this standard, for brake-levers similar to Type A, the test force shall be applied at a distance, b , which is equal to either dimension a as determined in EN 17860-2:2024, 6.2.2.2.2 or 25 mm from the free end of the brake-lever, whichever is the greater (see Figure 4).



Key
F applied force
b 25 mm or dimensions a , whichever is greater

Figure 4 — Position of applied force on the brake-lever type A

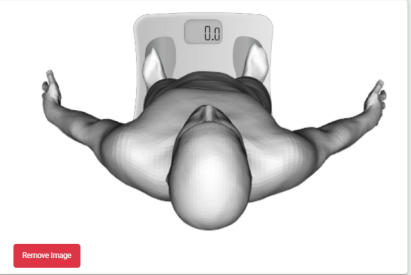
EN 13451-1:2020+A1:2024 - Swimming pool equipment - Part 1: General safety requirements and test methods for equipment installed in pools for public use



Needs of anthropometric data

► Review of standards

WHOLE BODY - BODY MASS (WEIGHT)



☒ Default

Name *

BODY MASS (WEIGHT)

Source

ISO 7250 / ISO 8559 / Adultdata

Body Area **BODY**

Adultdata

1

Digitape Code

mvolume

Description

Total mass (weight) of the body. Subject stands on a weighing scale.

STANDARD SOURCES

STANDARD SOURCES

Filter

Rows per page 200 1 - 17 of 17

ID	Register Source Type	Standard code	Standard Name	ERG	ANT	STR	INC	Type	Technical Committee	Sector	Subgroup / Product	Reviewed	Strength measurements included	Directives in Annex Z
☐ 1	NORMATIVE	UNE-EN ISO 7250-1:2017	Basic human body measurements for technological design	☐	☐	☒	☐	EN	CEN/TC 122 - Ergonomics	Fashion and Apparel	WG 1 - Anthropometry	☒	☒	
☐ 6	NORMATIVE	EN ISO 8559-1:2020	Size designation of clothes	☐	☒	☐	☐	ISO	CEN/TC 248 - Textiles and textile products	Fashion and Apparel	WG 10 - Size system of clothing	☐	☐	
☐ 19	NORMATIVE	ISO 16976-2:2022	Respiratory protective devices – Human factors. Part 2: Anthropometrics	☐	☒	☐	☐	ISO	ISO/TC 94/SC 15 - Respiratory protective devices	Industry and Manufacturing	WG 5 - Human factors	☐	☐	
☐ 30	NORMATIVE	UNE-EN 813:2024	Personal fall protection equipment - Sit harnesses	☒	☐	☐	☐	ISO	CEN/TC 160 - Protection against falls from height including working heights	Industry and Manufacturing	WG 3 - Personal equipment for work positioning	☐	☐	2016/425

MEASUREMENTS											Filter	Rows per page 200	1 - 200 of 416	<	>	>>
☐	ID	Default	Type	Measurement	Description	Source	Adultdata	Digitape Code	Body Area	Data sources	Standard sources					
☐	1	☒	WHOLE BODY	BODY MASS (WEIGHT)	Total mass (weight) of the body. Subject stands on a weighing scale.	ISO 7250 / ISO 8559 / Adultdata	1	mvolume	BODY	4	17					
☐	308	☐	WHOLE BODY	CRAWLING HEIGHT	Measured vertically from the floor to the top of the back of the head. The person is on all fours; arms extended, palms flat on the floor, looking at the floor, close to the hands.	Adultdata	9		FUNCTIONAL	0	0					
☐	307	☐	WHOLE BODY	CRAWLING LENGTH	Measured horizontally from the tip of the toes to the foremost part of the head. The person is on all fours; arms extended, palms flat on the floor, looking at the floor, close to the hands.	Adultdata	8		FUNCTIONAL	0	0					
☐	5	☒	WHOLE BODY	INDIRECT, BACK NECK POINT TO KNEE	Distance from back neck point following the contour of the spinal column to the hip level and vertical level of the center of knee-cap. Calculation: Back neck point to ground length (contoured) (ISO 8559:2017, 5.4.23) minus knee height (ISO 8559-1:2017, 5.1.6).	ISO 8559		m0050_I	BODY	0	1					

Extended set of anthropometric and strength measurements

© CEN-CENELEC 2026

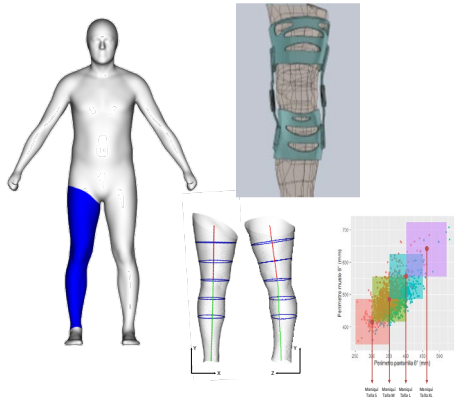
Webinar 'Towards a New European Anthropometric Database for User-Driven and Inclusive Standards' use in standardization'

20

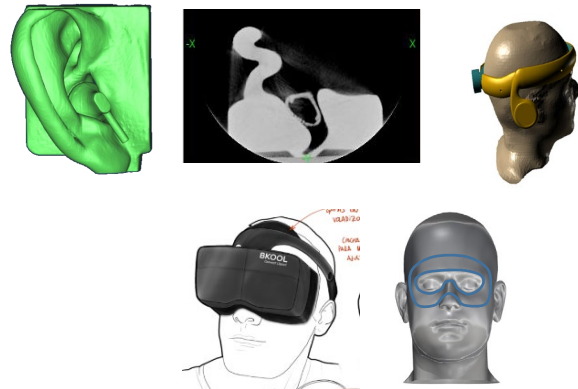
Needs of anthropometric data

WEARABLES

Health Technology



Headwear (PPE, Electronics)

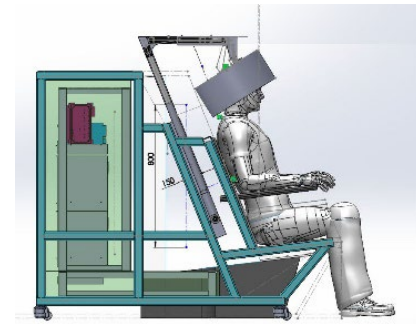


PPE (work & sport), footwear and clothing

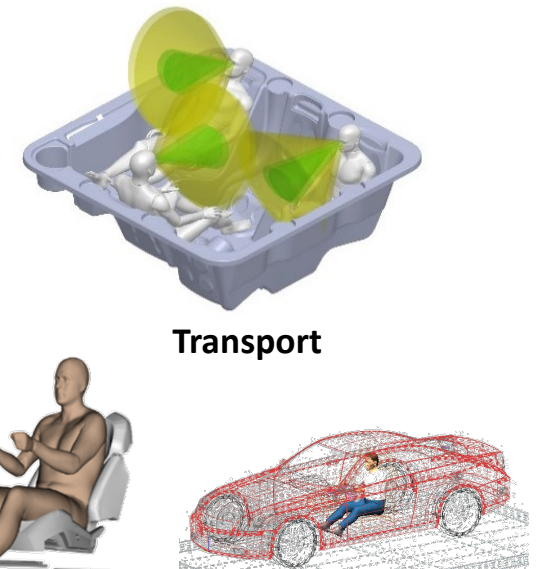


SPACES

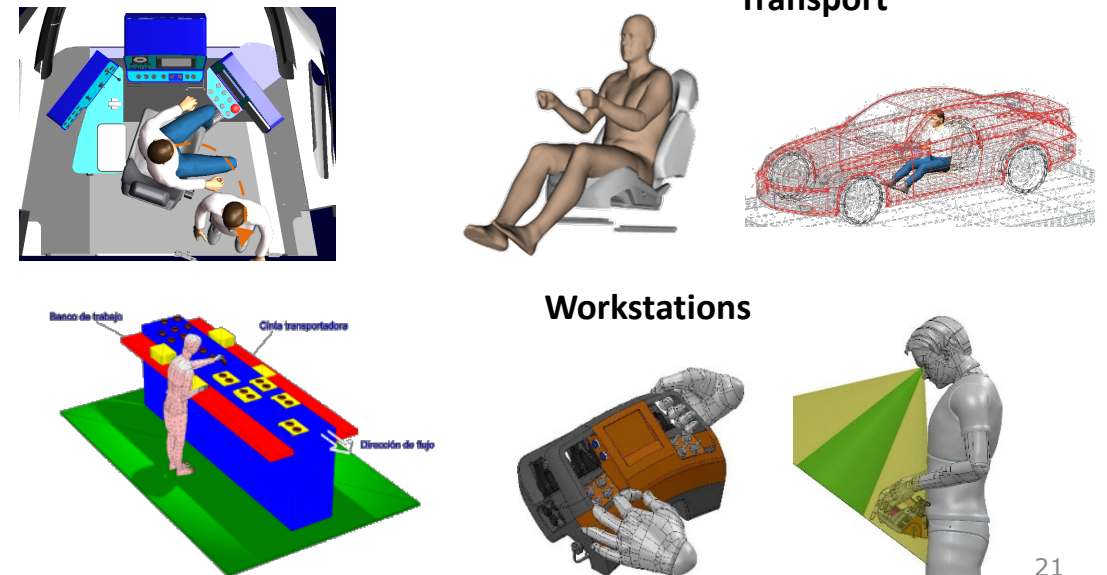
Health Technology



Transport

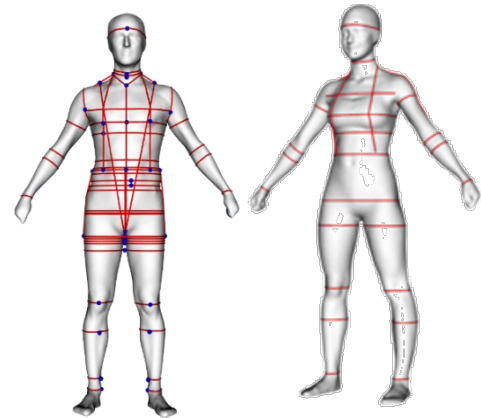


Workstations



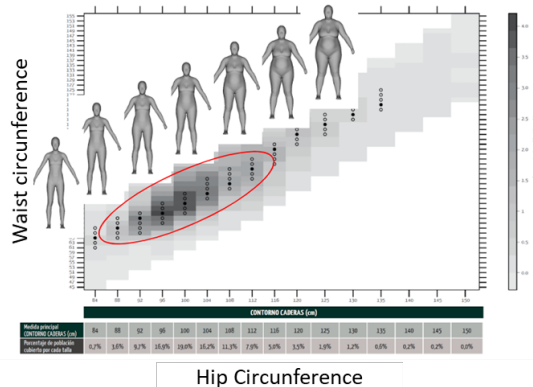
Needs of anthropometric data

WEARABLES

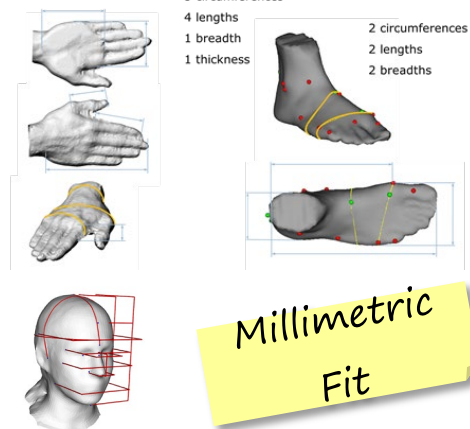


Dimension	Men				Women			
	5th %ile	50th %ile	95th %ile	SD	5th %ile	50th %ile	95th %ile	SD
1. Stature	1575	1653	1790	66	1475	1570	1670	69
2. Eye height	1410	1575	1685	65	1375	1475	1570	29
3. Shoulder height	1230	1380	1480	62	1180	1280	1375	56
4. Elbow height	975	1055	1135	49	910	985	1055	44
5. Hip height	820	895	975	47	740	810	875	41
6. Kneecap height	670	730	785	38	645	705	760	35
7. Fingertip height	575	635	695	36	550	610	670	37
8. Sitting height	815	875	935	36	720	785	845	41
9. Sitting eye height	750	780	815	34	645	710	770	34
10. Sitting shoulder height	520	570	625	32	475	535	590	35
11. Sitting elbow height	375	420	475	29	345	390	440	28
12. Thigh thickness	125	150	175	15	115	145	170	15
13. Buttock-knee length	430	485	535	29	420	475	525	29
14. Buttock-popliteal length	480	525	575	30	455	500	540	26
15. Popliteal height	385	425	470	27	355	395	440	25
16. Shoulder breadth (bilateral)	400	445	485	28	365	405	445	23
17. Shoulder breadth (unilateral)	250	275	300	17	230	250	270	17
18. Hip breadth	305	350	395	28	310	370	410	37
19. Chest (bust) depth	225	260	290	20	220	245	265	26
20. Acromioclavicular depth	245	260	275	13	225	240	255	13
21. Shoulder-elbow length	220	250	285	19	215	240	270	17
22. Elbow-fingertip length	425	460	490	20	390	420	450	19
23. Upper limb length	700	755	810	34	640	690	740	33
24. Shoulder-grip length	595	645	695	30	540	590	635	28
25. Head length	175	180	185	7	165	170	175	7
26. Head breadth	140	150	160	6	130	140	150	5
27. Head breadth	170	185	200	9	155	170	185	9
28. Head breadth	75	85	95	5	65	75	85	4
29. Head breadth	235	255	280	13	210	230	250	12
30. Foot length	85	95	105	6	80	85	90	5
31. Foot breadth	105	115	125	7	95	105	115	6
32. Span	140	155	165	4	130	140	150	4
33. Elbow span	180	195	210	7	170	180	190	6
34. Vertical grip reach (standing)	1110	1265	1395	57	1040	1125	1210	52
35. Vertical grip reach (sitting)	730	775	825	22	690	735	785	20

See notes on pp. 175-6.



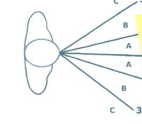
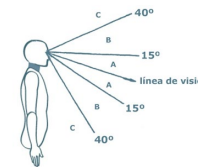
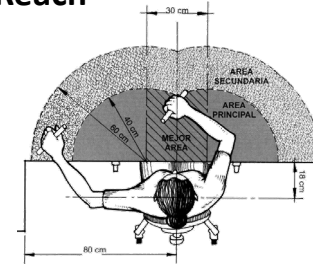
Hand measures



Millimetric Fit

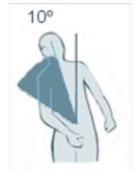
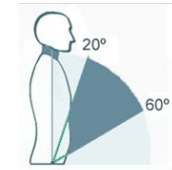
SPACES

Reach

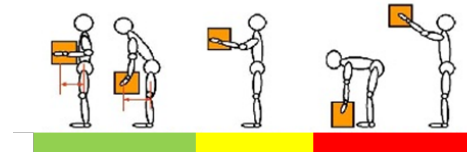


Centimetric Fit

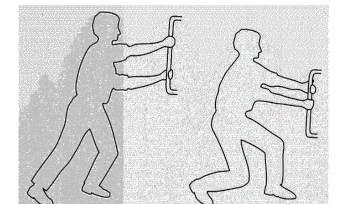
Postures



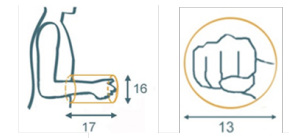
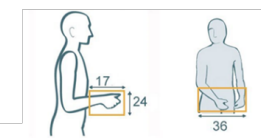
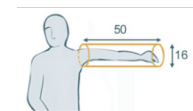
Load handling



Forces



Access and entrapments



Millimetric Fit

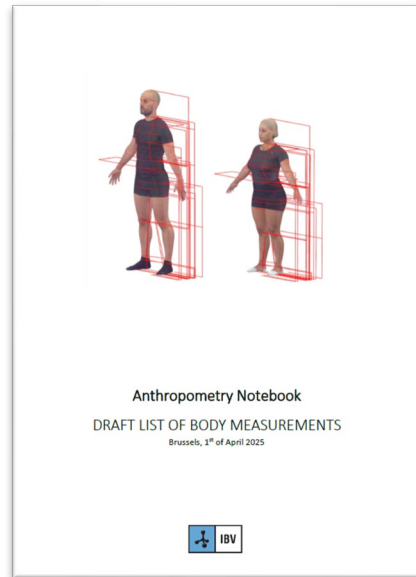
CONTENT

- ▶ Workshop with stakeholders and experts divided in
 - ▶ Wearables
 - ▶ Spaces

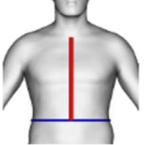


Needs of anthropometric data

► Generation of the Anthropometric Notebook



Contents	
CHAPTER 1: BODY I: NECK TO WAIST	3
CHAPTER 2: BODY II: WAIST TO ANKLE	21
CHAPTER 3: BODY III: UPPER LIMBS	37
CHAPTER 4: HEAD	50
CHAPTER 5: HAND	61
CHAPTER 6: FOOT	80
CHAPTER 7: SITTING	86
CHAPTER 8: SPECIAL POSTURES, REACH AND FUNCTIONAL	96
CHAPTER 9: STRENGTHS	109

Measurement	Description	Relevance	Disagree?
STATURE 	Vertical distance from the floor to the highest point of the head (vertex). Subject stands fully erect with feet together. Head is oriented in the Frankfurt plane.	High 	High Med Low Why?
WHOLE BODY DEPTH, STANDING 	Maximum horizontal depth of the body. Subject stands erect against a wall with feet together and arms hanging freely downwards.	High 	High Med Low Why?
BODY MASS (WEIGHT) 	Total mass (weight) of the body. Subject stands on a weighing scale.	High 	High Med Low Why?
FRONT NECK POINT TO WAIST 	Distance, measured vertically from front neck point to waist level. Subject stands erect with arms hanging freely downward.	High 	High Med Low Why?

Is this area of the body particularly relevant to your field of work? ☐ Yes ☐ No

For which products or environments? _____

How much precision in the measurements is required? (Please, specify units: mm or cm) _____ ☐ mm ☐ cm

Aim: Reduce and optimize the list based on safety, ergonomic and comfort requirements

Needs of anthropometric data

Anthropometric plans:

Core protocol	Extended protocol
179 measurements 7250 +8559 + % reviewed harmonized	205 measurements 7250 +8559 + reviewed harmonized

Strengths plans:

Core protocol	Extended protocol
14 measurements 1 st priority strengths UNE-EN 1005-3 & UNE-EN 894-3	30 measurements 1 st priority strengths UNE-EN 1005-3 & UNE-EN 894-3

Availability of Anthropometric Data

Table 12. Summary table of the databases used in the standard UNE-CEN ISO/TR 7250-2:2024.

Country	Organization	Name of study	Age	Period	Sample		Instrumentation	Error assessment	Percentiles included	No meas. of ISO 7250-1
					M	F				
Germany	German Standardization Institute (DIN)		18-65	1999-2002			Traditional		P5-P50-P95	50
Austria	Austrian Standards Institute									
Italy	Ente Nazionale Italiano di Unificazione (UNI)	"Italia si misura"	17-84	1990-1991	2300	1850	Traditional	Y	Mean, Standard Deviation, P1-P5-P50-P95-P99	33
Japan	Japanese Industrial Standards Committee (JISC)	Size JPN 2004-06 project, AIST data	20-65	2004-2019	3239	2696	Traditional	Y	Mean, Standard Deviation, P1-P5-P50-P95-P100	61
Kenya	Kenya Bureau of Standards (KEBS)		18-73	2006-2007	133	74	Traditional	Y	Mean, Standard Deviation, P1-P5-P50-P95-P100	57
Korea	Bureau of Indian Standards (BIS)	"Anthropometric and strength data of Indian agricultural workers for farm equipment design"	16-69	2015	3189	3221	Traditional	Y	Mean, Standard Deviation, P1-P5-P50-P95-P100	59
Netherlands	Nederlands Normalisatie-instituut (NEN)	Delft study, CAESAR Netherlands	18-65	1999-2000			Traditional & 3D scanner	N	Mean, Standard Deviation, P5-P50-P95-P100	36
Thailand	Thai Industrial Standards Institute (TISI)						Traditional	N	Mean, Standard Deviation, P5-P50-P95	51 (no Age)

Anthropometric databases used in the standard ISO/TR 7250-2:2024.

Table 13. Summary of the databases considered in the review.

Study name	Country	Europe Area	Year	Covered area	Age range		Subjects special	Sample size		Data format	Measuring tools
					Min	Max		Men	Women		
The use of 3D Anthropometric data for morphotype analysis to improve fit and grading techniques – The results [1]	Belgium	MIDDLE	2014	Country	3	75		2500		Aggregated	3D Scanner
Anthropometric clothing measurements from 3D body scans [2]	Finland	NORTH	2019		1	1		194	181	Aggregated	3D Scanner
French sizing survey [3]	France	MIDDLE-WEST	2006		5	70		5500	5500	Aggregated	3D Scanner & Traditional
Grip strength in healthy Caucasian adults: reference values [4]	Germany	MIDDLE	2008		20	95	Caucasian	366	403	Aggregated	Dynamometer
Anthropometric dataset for the German working age population using 3D body scans from a regional epidemiological health study and a weighting algorithm [5]	Germany	MIDDLE	2023	Region	28	67		1161	1152	Aggregated	3D Scanner
Novel Anthropometry Based on 3D-Bodyscans Applied to a Large Population Based Cohort [6]	Germany	MIDDLE	2016	Location	40	79		4117	4363	Aggregated	3D Scanner
SizeGermany [7]	Germany	MIDDLE	2009	Country	6	75		7149	4883	Raw Data	3D Scanner
SizeItaly [8]	Italy	SOUTH	2014	Country	6	75		2537	3336	Raw Data	3D Scanner
The Anthropometric Study of the Portuguese Population Using the 3D Body Scanning Technology - Its Contribution to the Improvement of Size Tables [10]	Portugal	SOUTH	2018		18	89		769	1094	Aggregated	3D Scanner
3D body scanning technology, a method for assessing early risk of diabetes [11]	Romania	MIDDLE-EAST	2012		40	56	159 diabetics / 198 nondiabetics			Raw Data	3D Scanner
3D Body Scanning Surveys in Romania and its Applications [12]	Romania	MIDDLE-EAST	2009	Country	20	65		722	684	Raw data	3D scanner
3D body databases of the Spanish population and its application to the apparel industry [13]	Spain	SOUTH	2025					400	9600	Both	3D Scanner & Traditional
The influence of gender, handle size, anthropometric measures, and vibration on the performance of a precision task [14]	Sweden	NORTH	200						20	Aggregated	Traditional
Swedish anthropometrics for product and workplace design [15]	Sweden	NORTH	2008					105	262	Aggregated	3D Scanner & Traditional

Literature review

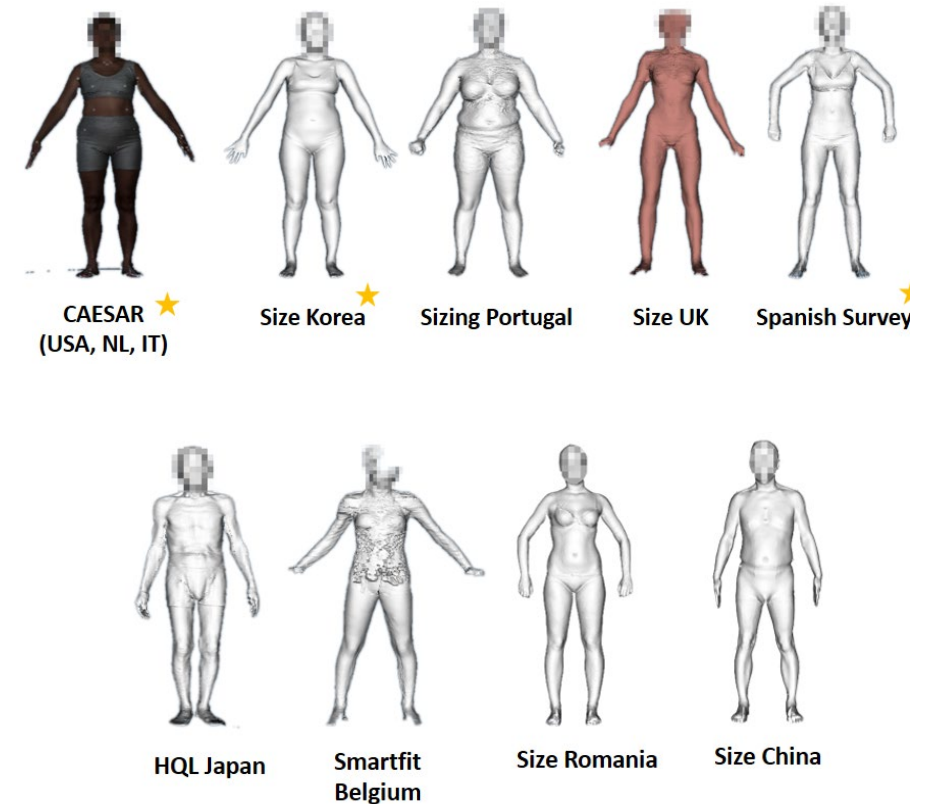
2026-10-06

26

Gaps in existing European anthropometric data

- ▶ *Representativeness:* Unbalance representation across countries, age and population groups.
- ▶ *Recency:* Most datasets were collected before 2010.
- ▶ *Comparability:* Inconsistent scanning technologies, postures and measurement protocols.
- ▶ *Measurements:* At best, only ~30% of required variables are available, with limited hand, foot and head data.
- ▶ *Data availability & accessibility:* Privacy, licensing and interoperability barriers limit data reuse.

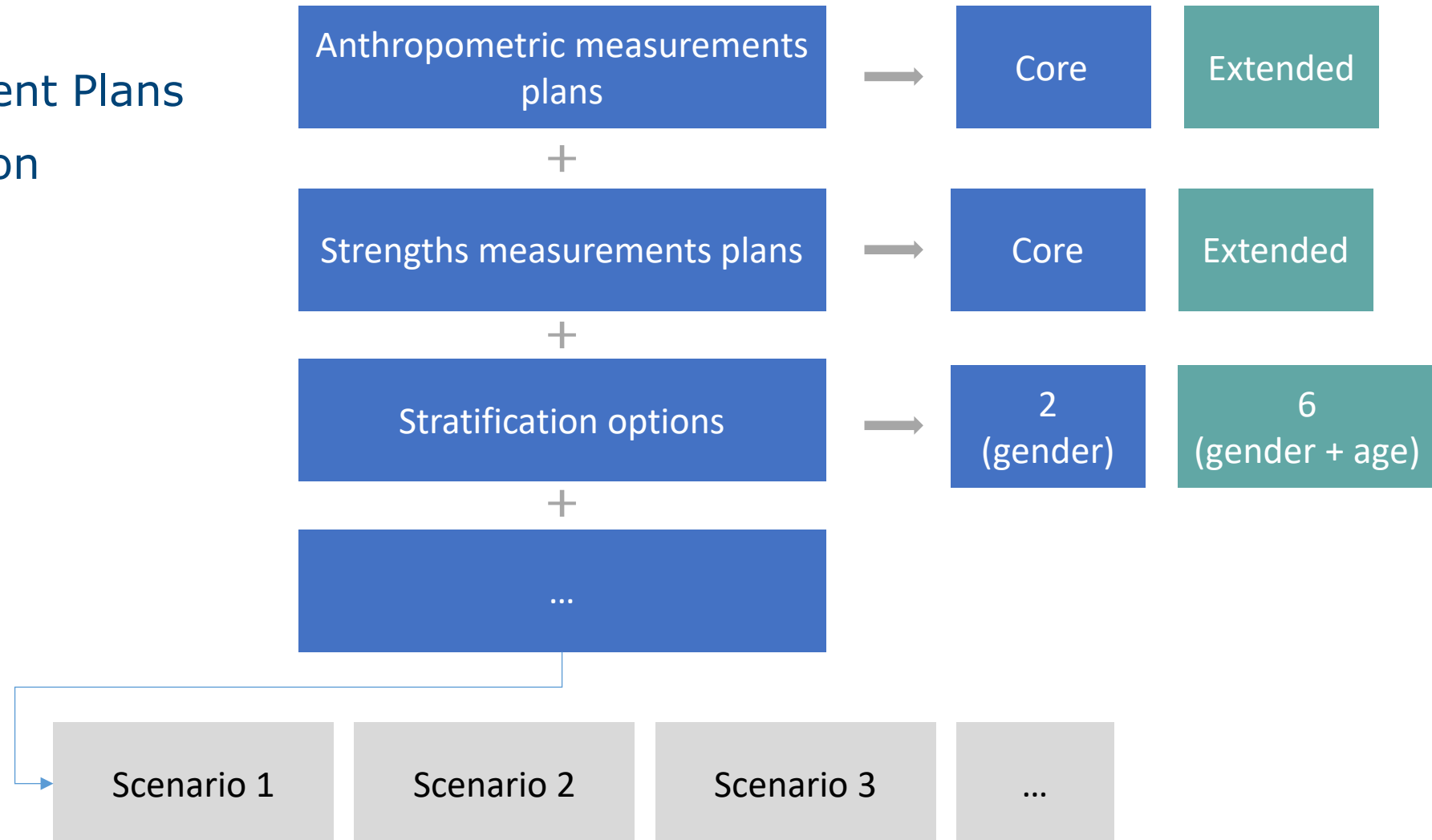
In conclusion, a new, harmonized and inclusive European database is needed



Inconsistent 3D body scan quality

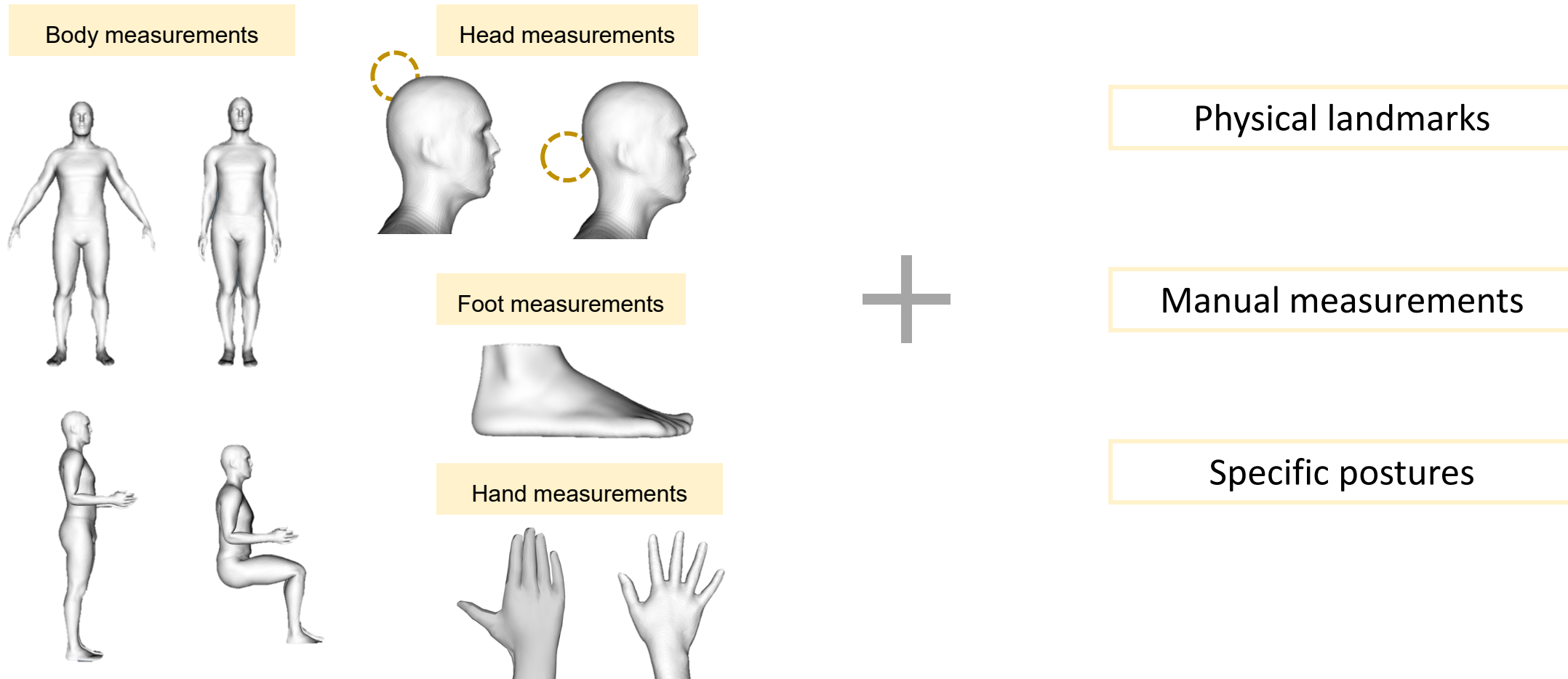
Planning the Anthropometric Survey

- ▶ Factor 1: Measurement Plans
- ▶ Factor 2: Stratification
- ▶ Factor 3: Accuracy



Planning the Anthropometric Survey

► Factor 1: Measurements Plans: Protocol duration



Planning the Anthropometric Survey

► Factor 1: Measurements Plans

Measurement plans: balancing coverage, time and cost

- Measurement plans are defined by priority and acquisition cost.
- Broader coverage requires longer sessions, more processing time and a higher budget.

ANTHROPOMETRY	Core Protocol	Extended Protocol
Total measurements	179	205
3D scan measurements	98 without + 77 with landmarks	98 without + 87 with landmarks
Manual / additional posture measurements	4	20
Session duration	50 min	77 min
Standards coverage	ISO 7250 and ISO 8559; 78% coverage of reviewed harmonised standards	ISO 7250 and ISO 8559; coverage of all reviewed harmonised standards

Planning the Anthropometric Survey

► Factor 1: Measurements Plans

Measurement plans: balancing coverage, time and cost

- Measurement plans are defined by priority and acquisition cost.
- Broader coverage requires longer sessions, more processing time and a higher budget.

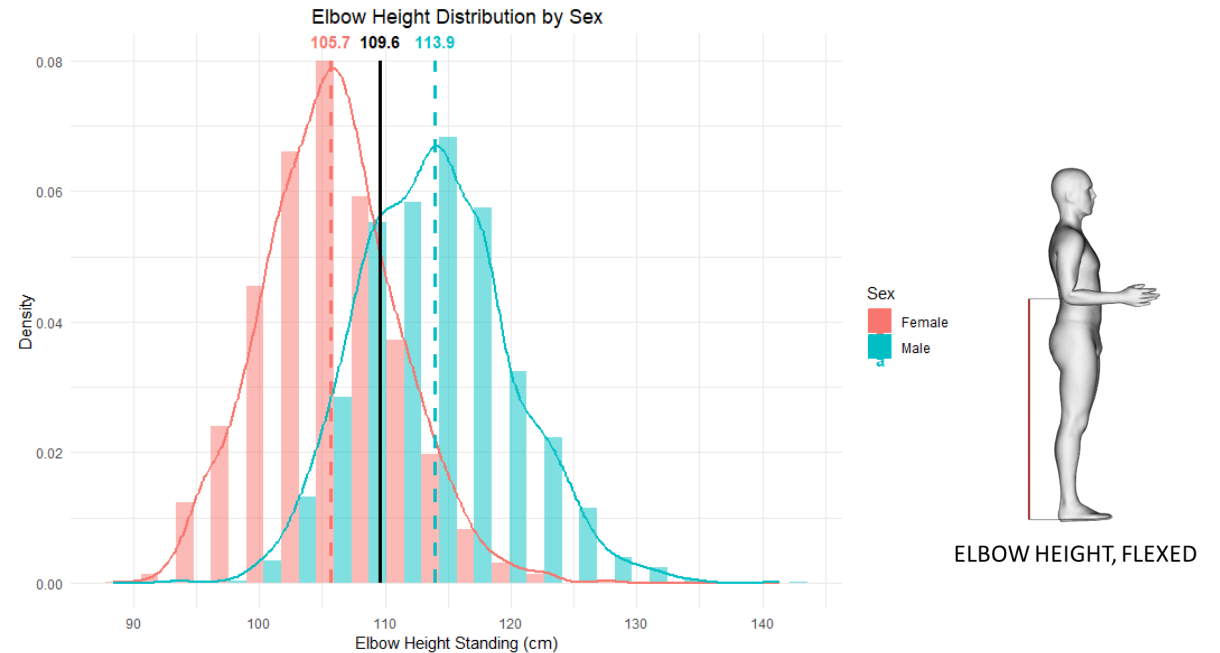
STRENGTHS	Core Protocol	Extended Protocol
Strength measurements	14	30
Scope	First-priority strength measurements	First- and second-priority measurements, plus additional tests
Standards addressed	UNE-EN 1005-3 and UNE-EN 894-3	Broader coverage of the same standards and additional requirements
Session duration	30 min	60 min

Planning the Anthropometric Survey

► Factor 2: Stratification

► Sex Stratification

- Biological sex has a major impact on body size and proportions → Sexual dimorphism.
- Consistently larger differences between men and women than between countries.
- It is mandatory for **inclusive design**.

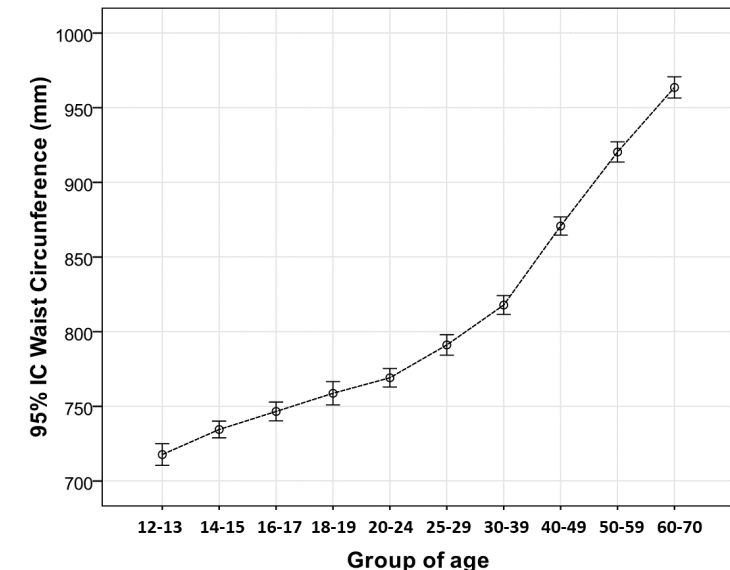
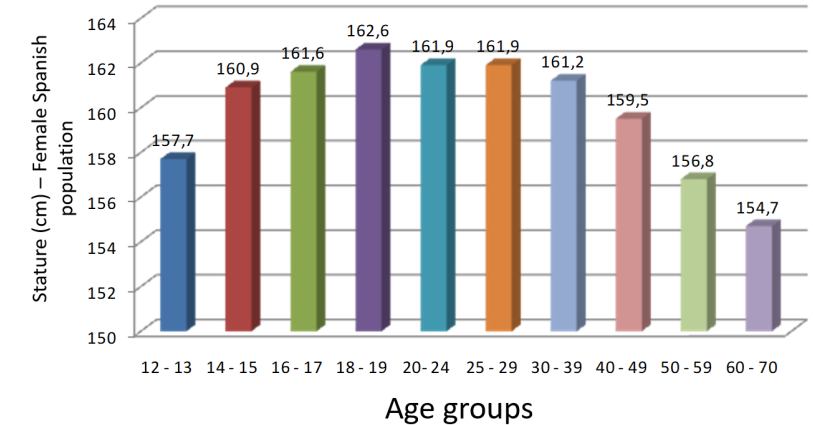


Planning the Anthropometric Survey

► Factor 2: Stratification

► Age Stratification

- **Physiological changes with age:** loss of strength, flexibility, and height (1–3 cm after 40 y/o).
- Work capacity: **muscle force** at 60–65 is ~75% of that at 20–30.
- **Health transitions:** menopause, cardiovascular risk, osteoporosis.
- Implication: **Age strongly influences anthropometric dimensions and functional capacity.**



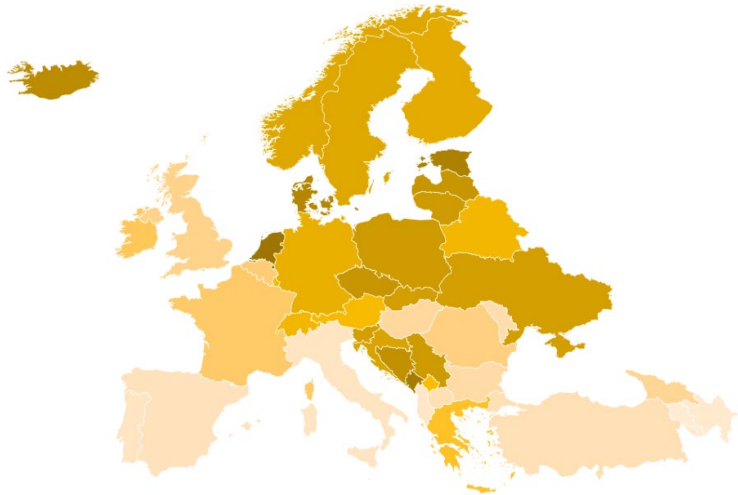
Planning the Anthropometric Survey

► Factor 2: Stratification

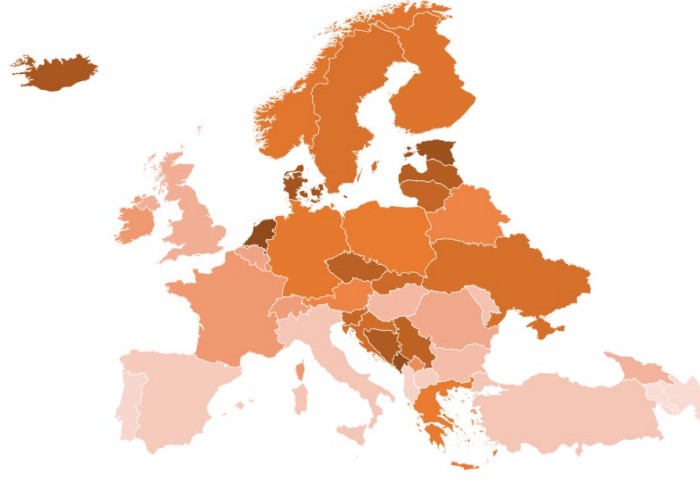
► Geographical sampling

- **Diversity based on existing data.**
- Are there statistical differences between areas?

Female Range (cm)	Male Range (cm)	Classification
161.2 – 163.5	173.0–176.6	Low average
163.5 – 166.6	176.6–181.4	Medium average
166.6 – 170.4	181.4–183.8	High average



European male stature per country



European female stature per country

PCA (Principal Component Analysis)

- Visualizes the separation: the Netherlands at one extreme, France in the center (neutral profile), and Italy/Spain representing the south.
- PCA-based selection of representative sets (France + Netherlands + Italy/Spain) could cover European variability.

DISCLAIMER: Results can include bias related to methodological differences.

► Factor 2: Stratification

► Geographical sampling

Define sampling of Europe as:

Single population

Europe as a single statistical population:

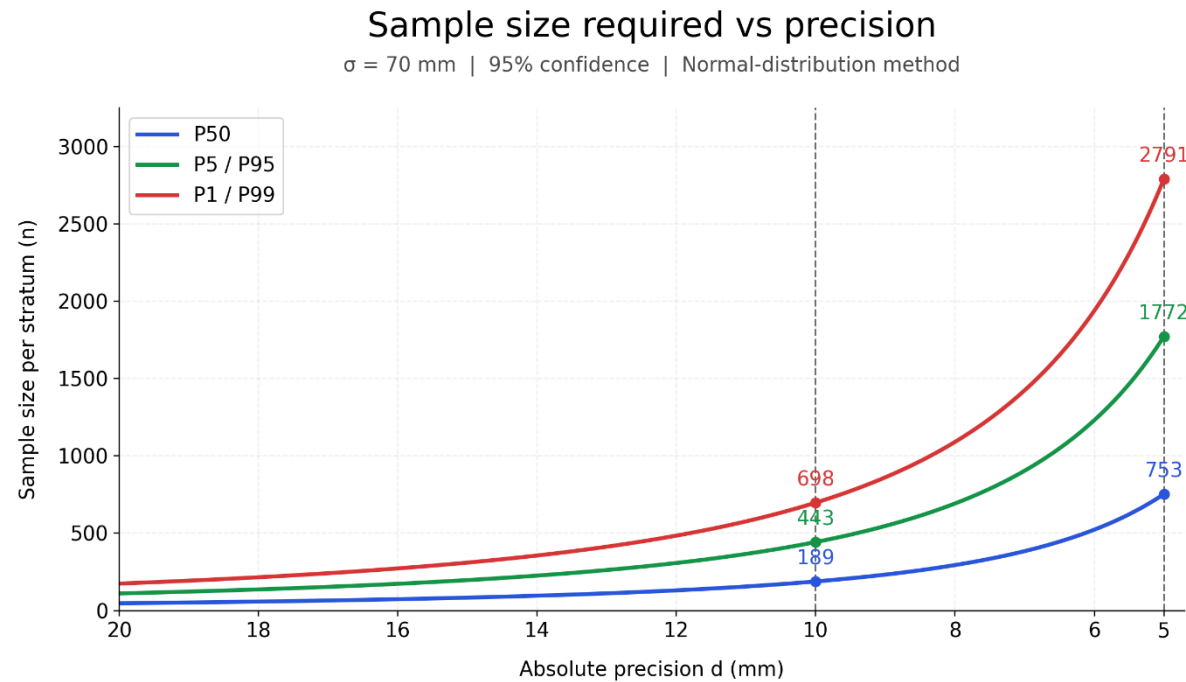
- ↑ intra-European migration
- ↑ homogenization of lifestyles & anthropometrics

- Decide **minimum number of countries** to cover European body type variability:
 - **Minimum:** 2
Higher-Lower.
 - **Optimal:** 3 (+Neutral).
 - **Ideal:** more than 3.
- **Number of locations might be used to manage the timeline in relation to the sample size imposing boundary conditions. We propose:**
 - **to limit the timeline of the anthropometric measuring campaign 2 years.**
 - **to avoid parallel measurements in each country** (they require to duplicate the equipment only for the study).

► Factor 3: Accuracy

ISO 15535:2012 – *General requirements for establishing anthropometric databases.*

- In order to estimate the **5th and 95th percentiles** of a population with a **95% confidence level**:



$n = K \times (\sigma / d)^2$ • Labels rounded up to whole participants.

P5/P95: ISO 15535, Annex A, Eq. A.1. P50 and P1/P99: extension of the same normal-model derivation.

► Factor 3: Accuracy

Accuracies requirements in the standards:

UNE-EN 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

Maximum allowable error between extracted value and traditionally measured value:

Table 4 — Maximum allowable error between extracted value and traditionally measured value

Measurement type	Maximum mean difference (see 5.4) mm
Segment lengths (e.g. buttock-popliteal length)	5
Body heights (e.g. shoulder height)	4
Large circumferences (e.g. chest circumference)	9
Small circumferences (e.g. neck circumference)	4
Body breadths (e.g. biacromial breadth)	4
Body depths (e.g. chest depth)	5
Head dimensions without hair	1
Head dimensions with hair	2
Hand dimensions	1
Foot dimensions	2

Accuracies obtained from the first Workshop:

Chapter	Common Precision (mm)	Average $\pm$ SD (mm)	Precision Trend
Neck to Waist	5 mm, 1.5 mm, 3 mm, 10 mm	5.79 $\pm$ 3.34 mm	Moderate
Waist to Ankle	5 mm, 1.5 mm, 3 mm, 10 mm	5.46 $\pm$ 3.28 mm	Moderate
Upper Limbs	5 mm, 3 mm, 1.5 mm, 2 mm, 10 mm	5.40 $\pm$ 3.48 mm	Moderate
Head	1 mm, 1.5 mm, 2 mm, 10 mm	2.75 $\pm$ 2.72 mm	High
Hand	1.5 mm, 2 mm, 5 mm, 10 mm	2.62 $\pm$ 2.83 mm	High
Foot	1.5 mm, 2 mm, 5 mm, 10 mm	3.15 $\pm$ 2.78 mm	High
Sitting	5 mm, 10 mm, 1.5 mm, 3 mm, 10 mm, 50 mm	9.29 $\pm$ 13.64 mm	Low
Special Postures and Functional Measures	5 mm, 10 mm, 1.5 mm, ~20 mm	11.21 $\pm$ 13.16 mm	Low

Planning the Anthropometric Survey

SCENARIO 1 — BASIC COVERAGE



- **1** adult age group, by sex.
- Anthropometric data collection in **2 countries**.
- Anthropometry Core Protocol + Strength Core Protocol
- Main benefit: Overall adult reference data with the lowest resource requirements.

SCENARIO 2 — AGE-SPECIFIC DATA



- **3** adult age groups, by sex.
- Anthropometric data collection in **3 countries**.
- Anthropometry Core Protocol + Strength Core Protocol
- Main benefit: Age-specific anthropometric references and broader geographic coverage.

SCENARIO 3 — EXTENDED AGE COVERAGE



- **4** adult age groups, by sex.
- Anthropometric data collection in **4 countries**.
- Anthropometry Core Protocol + Strength Core Protocol
- Main benefit: Older-adult inclusion and age-specific strength references.

SCENARIO 4 — COMPREHENSIVE COVERAGE



- **4** adult age group, by sex.
- Anthropometric data collection in **6 countries**.
- Anthropometry Core Protocol (extended in one country) + Strength Core Protocol in 2 countries.
- Main benefit: Widest coverage, additional meas.

Planning the Anthropometric Survey

Option	Age Strat.	Sample	Accuracy P5/P95	N Countries Main Project	Duration (years)	Inclusiveness index
Scenario 2	3 age groups	5.166	<10 mm body	3	2,2 years	 Intermediate inclusivity
				3 x A ANT 1 x Plan A STR		
Scenario 3	4 age groups	6.888	<10 mm body	4	2,3 years	 Balance of diversity and feasibility
				4 x A ANT 1 x Plan A STR		
Scenario 4	4 age groups	10.760	<8 mm body	6	2,5 years	 Highly inclusive
				1 x Plan B 5 x Plan A ANT 2 x Plan A STR		



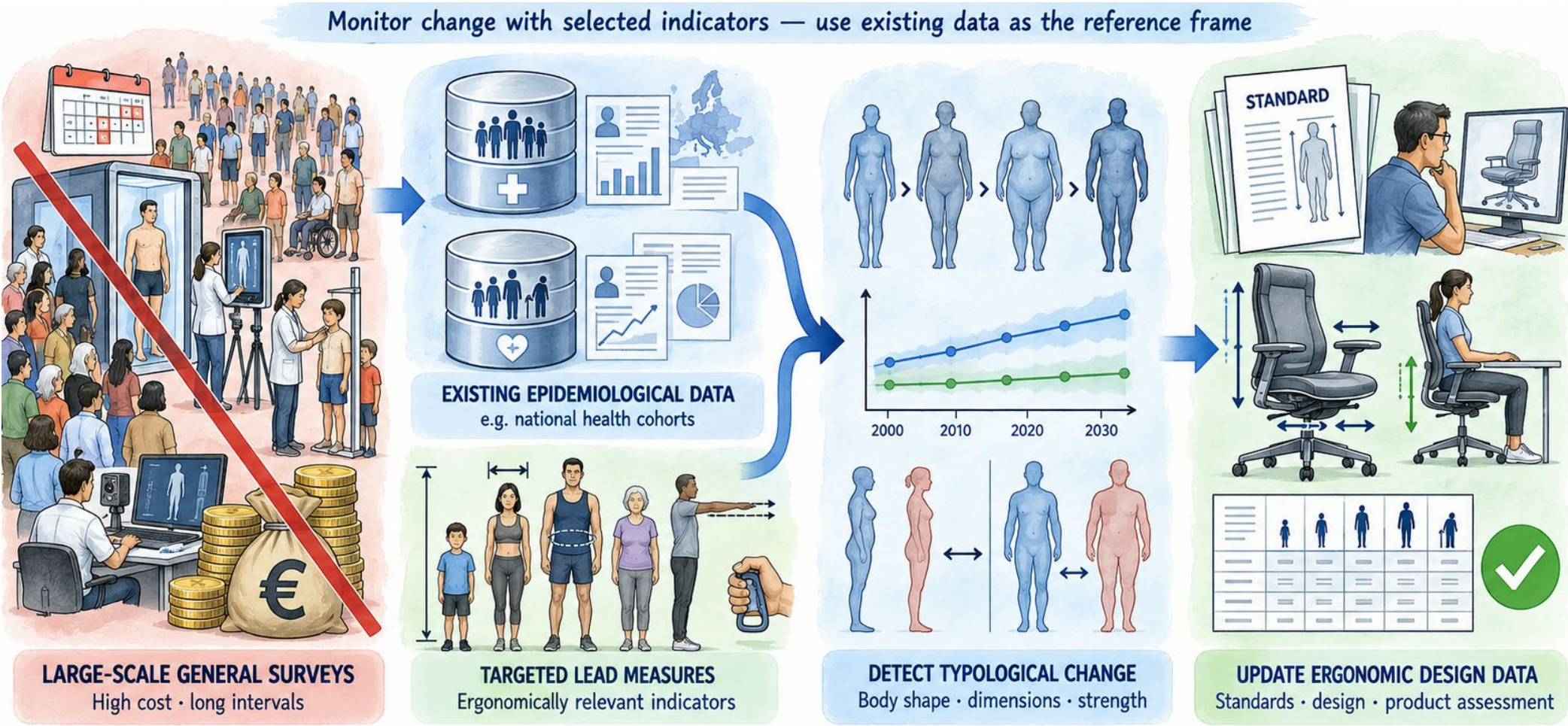
European Standardization Organizations

Typological approach and future methods

Prof. Dr. Christiane Scheffler, University of Potsdam

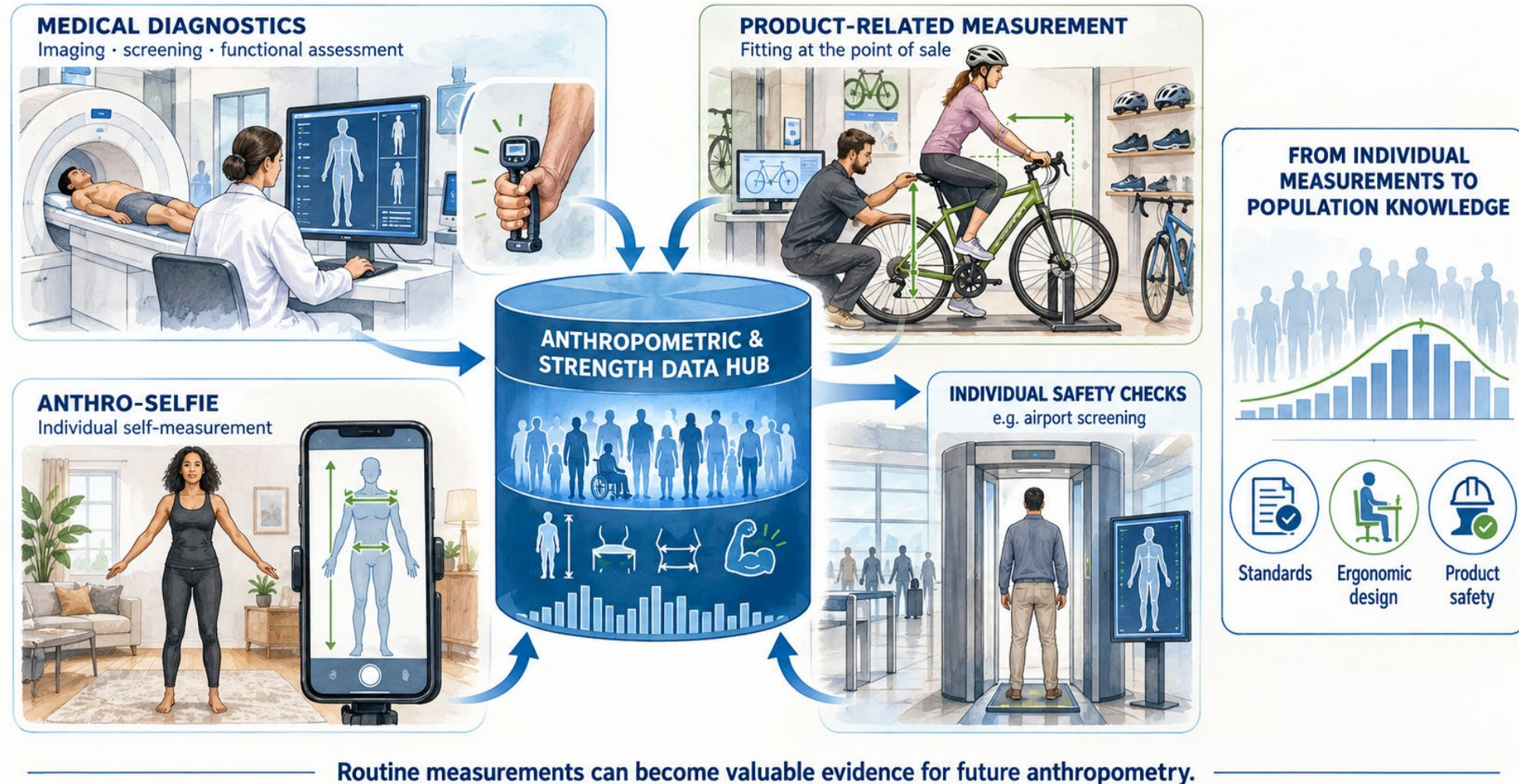
Dr. Gerd Küchmeister, Kiel University of Applied Sciences

Typological Approach to Future Anthropometric Surveys



A resource-efficient strategy for identifying ergonomically relevant population changes

Future Methods: New sources of Anthrop.&Strength Data





European Standardization Organizations

Upcoming project focused on PPE/machinery

Prof. Dr. Christiane Scheffler, University of Potsdam

Dr. Gerd Küchmeister, Kiel University of Applied Sciences

Dr. Sandra Alemany, Instituto de Biomecánica de Valencia

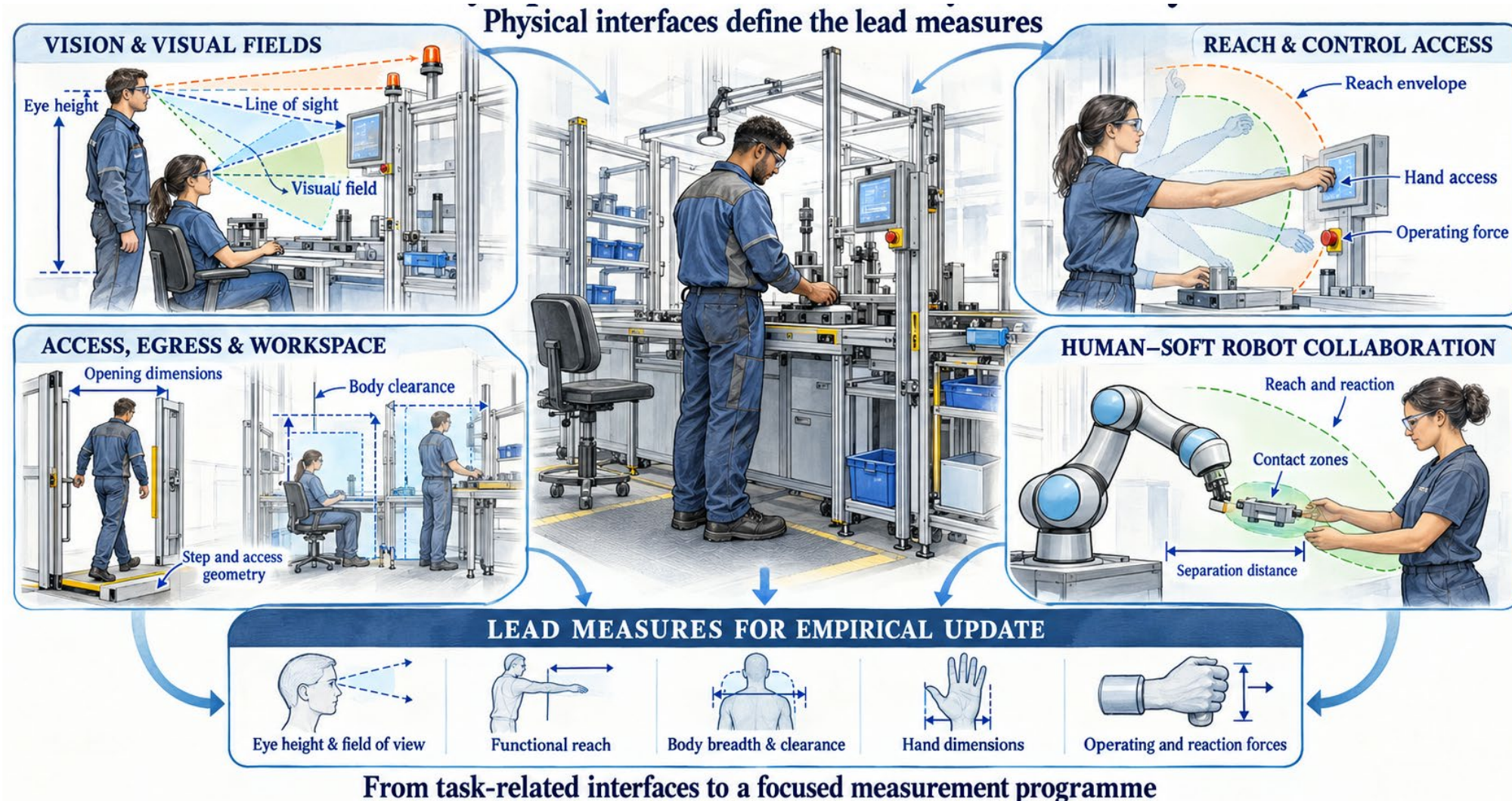
Prof. Toon Huysmans, Associate Professor in Digital Human Modeling, TU Delft

Technical Project Leader: Sandra Alemany, IBV

- ▶ WP1: Anthropometric data needs for machinery/PPE
 - ▶ Prof. Dr. Christiane Scheffler, University of Potsdam
 - ▶ Dr. Gerd Küchmeister, Kiel University of Applied Sciences

- ▶ WP2 Measurement protocol and related processes
 - ▶ Dr. Sandra Alemany, Instituto de Biomecánica de Valencia
 - ▶ Prof. Toon Huysmans, Delft University of Technology

- ▶ WP3 Pilot study/survey
 - ▶ Dr. Sandra Alemany, Instituto de Biomecánica de Valencia
 - ▶ Prof. Toon Huysmans, Delft University of Technology



WP1 - Priority Update of Adult Data: PPE

Body-near interfaces define fit, protection and usability



From body-PPE interfaces to a focused measurement programme

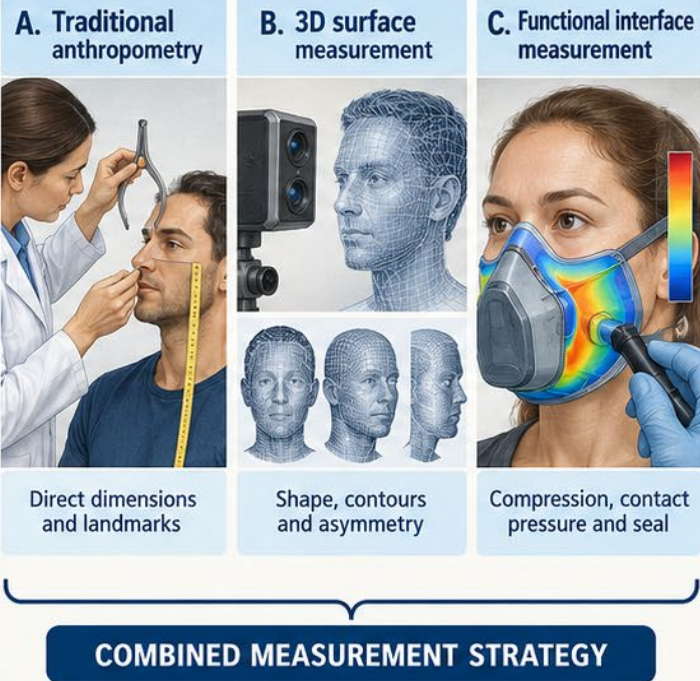
WP1 - Respiratory Protection: Measuring Face-Mask Interface

Dimensions alone are not enough — deformability and tissue distribution affect the seal

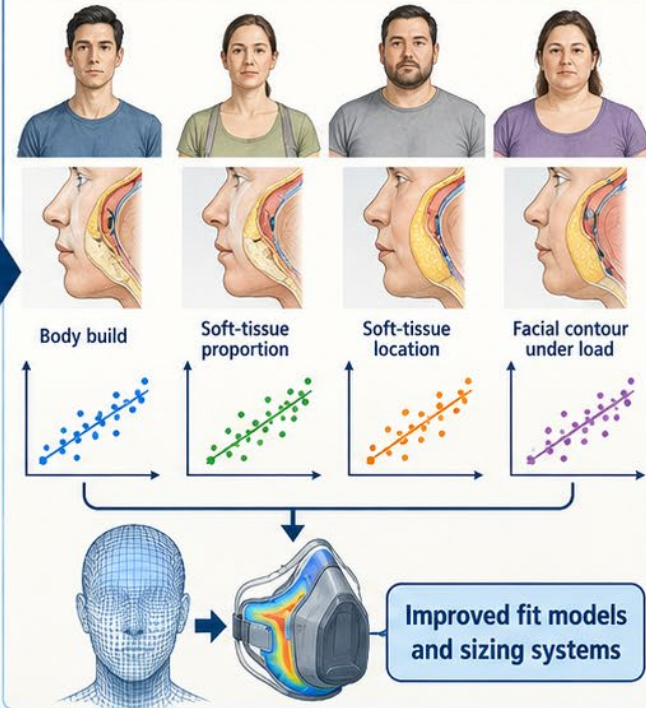
1 INTERFACE ZONES WITH DIFFERENT DEFORMABILITY



2 COMPLEMENTARY MEASUREMENT METHODS



3 BODY-BUILD-RELATED CORRELATIONS



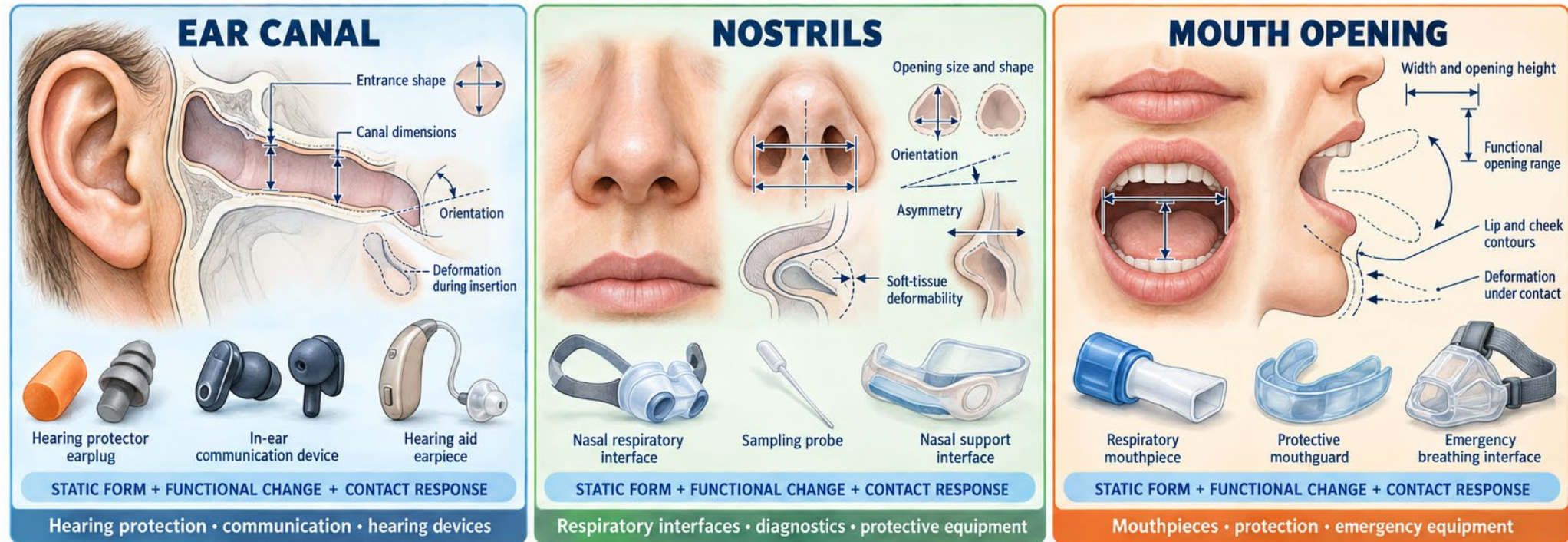
LEAD DATA FOR FUTURE SURVEYS



Static geometry + tissue characteristics + functional loading

Emerging Anthropometric Interfaces: Body Openings

Growing product relevance — limited data for design and standardisation



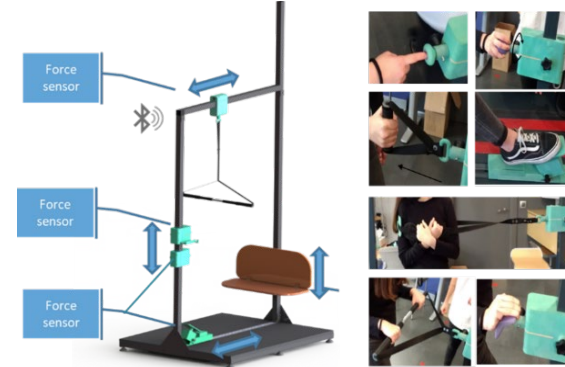
RESEARCH NEEDS AND RESPONSIBLE DATA COLLECTION



Ergonomic relevance is increasing faster than the available anthropometric evidence.

- ▶ Detailed shared protocols provided by TPL
 - ▶ Postures
 - ▶ Landmarking (anatomical references)
 - ▶ Attire
- ▶ Methodological alignment & training meetings
- ▶ Alignment of measurement instruments
- ▶ Inter-laboratory test

WP2 -3D & 4D Scanning Infrastructure



WP2/3 - Recruitment Scenarios in Spain

Recruitment	Main location	External campaign
ValenciaData user database IBV will recruit participants from its existing user database through ValenciaData, with scheduled appointments for the measurement campaign.	IBV facilities Most participants will attend the IBV facilities. Sessions will follow the assigned protocol: Plan A, additional Plan B measurements and/or strength and skinfolds.	Around 10% outside IBV IBV will take the measurement setup to an external site to test protocol mobility and the feasibility of finding suitable measurement locations.

Measurement session	Participants
Plan A only	160
Plan A + strength and skinfolds	115
Plan A + Plan B + strength and skinfolds	45
Total participants (including 20 extra)	320

Measurement totals

Plan A: 320
Plan B: 45
Strength / skinfolds: 160

WP2/3 - Recruitment Scenarios in The Netherlands

Scenario 1

Host partner location

Mobile scanner and measurement team at the company / school site. Subjects take part during working / school hours in pre-booked time slots.

Scenario 2

Central location

Central measurement lab at business parks, industrial sites, or cities, in case of broader interest within the area.

Scenario 3

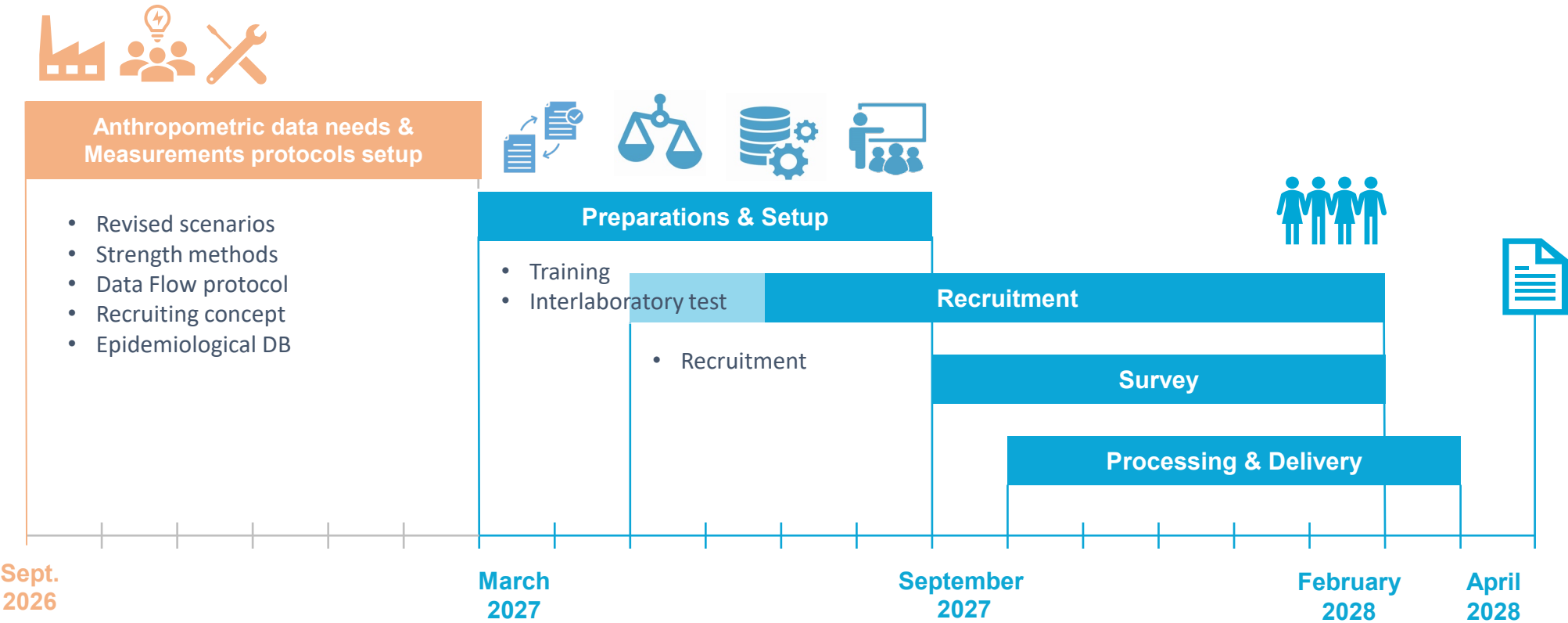
TU Delft measurement lab

Measurement lab at TU Delft for measuring subjects from the general public, companies, and TU Delft students and employees.

	16-25 y	26-35 y	36-45 y	46-55 y	56-67 y
Female	20	20	20	20	20
Male	20	20	20	20	20
Total	40	40	40	40	40

170 x PLAN A
+
30 x PLAN B

Timeline of the Project





European Standardization Organizations

Relevance for standardization community and standards users

Levent ÇAGLAR

Chief Ergonomist @ FIRA International, UK

Who can benefit from the appropriate anthropometric data?



- ▶ Standard developers/makers
- ▶ Product Designers/manufacturers
- ▶ Architects for design of buildings
- ▶ PPE designers/manufacturers
- ▶ Regulators - Enforcers

Why is it important to have appropriate & up to date anthropometric and strength data?



Reliable and appropriate anthropometric & strength data are:

- ▶ the building blocks for the development of ergonomic and safe products and services which fit the intended users and enhance the user experience and comfort;
- ▶ the essential tools for
 - ▶ specifying requirements on how well products dimensionally fit people and how well products can be operated/used safely in product and PPE standards
 - ▶ devising test methods in standards
 - ▶ carrying out risk assessments under Regulations eg GPSR

Appropriate anthropometric data ensures that products people use or come into contact with

- ▶ match the sizes of people
- ▶ are fit for purpose
- ▶ are easy & efficient to use
- ▶ are safe
- ▶ Contribute to people's wellbeing



Products include such as

- ▶ Furniture
- ▶ Clothing
- ▶ Shoes
- ▶ Gloves
- ▶ Walking aids
- ▶ Machinery
- ▶ Positioning of controls not only in machinery but in buildings such door handles. Especially important for safety critical controls.



For Personal Protective equipment dimensional fit and ease of use is paramount.

If PPE

- ▶ does not fit well,
- ▶ can't be easy to use or
- ▶ be comfortable so far as practically reasonable

IT DOES NOT WORK EFFECTIVELY

NOTE some PPE may need to be tailor fit



Why is it important to have appropriate & up to date anthropometric and strength data?

Selection of anthropometric data should be inclusive and some should not be treated as outliers

For safety applications, wider ranges of data may be needed
2.5 to 97.5 %ile ?



Factors to remember when selecting anthropometric and strength data

People change their size, shape and physical strength

- ▶ naturally as they grow older
- ▶ or have an injury or disability

Careful selection of age range is essential



Factors to remember when selecting anthropometric and strength data



Factors which have impact on the anthropometric data include

- ▶ Clothing / shoes / gloves / hats / PPE people wear
- ▶ Personal fashion-based body variations eg long nails, hairstyles
- ▶ Variation in anthropometric dimension due to posture (body position) adopted that is different than the one at which measurement was taken.

In conclusion, having access to the relevant anthropometric and strength data will help

- ▶ the designers architects to develop products and services which are safe, comfortable and joy to use,
- ▶ the standard makers to draw up relevant safety requirements and test methods/equipment for product standards.

Your feedback



Question time

► Use the Q&A panel to submit your questions

Question and Answer

You 04:36 PM

When is the next session?

Type your question here...

☐ Send anonymously

Send



European Standardization Organizations

Thank you for your participation!

Upcoming events/webinars:

2026-11-03 – [‘RISERS Conference - How Europe can drive cross-sectoral resource efficiency? Upscaling industrial symbiosis through standardization’](#)

