European Standardization Organizations

Webinar ‘Anthropometric and strength data of children for use in standardization’

We start at 14:00 CET

30 November 2021

European Commission

EFTA

Your webinar moderator

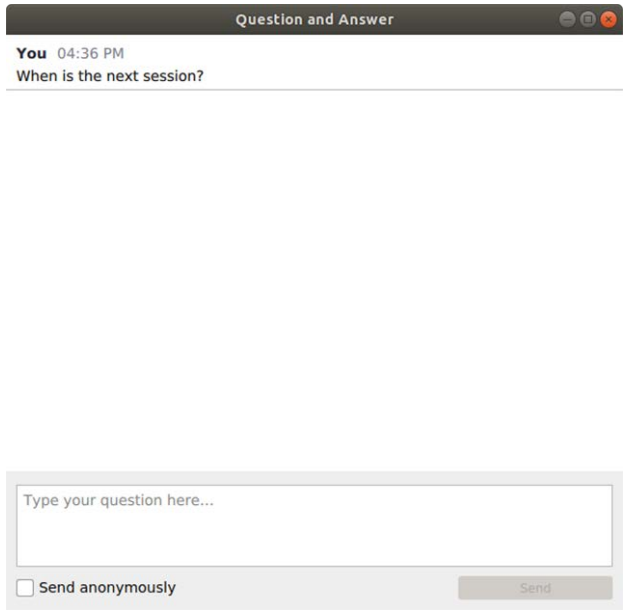
Els Somers

Project Manager Engagement Governance & Partnerships

esomers@cencenelec.eu

Get the most out of the webinar today

- Use the Q&A panel to submit your questions



- Talk about us on Twitter #training4standards @Standards4EU

Agenda

- Introduction to European Standardization
- Background project
- Importance of anthropometric data
- Description of the project
- Guidelines for the correct application of anthropometric data
- Q&A

Your speakers today

Jennifer OGBONNA

Project Manager ‘Energy & Living’

CEN-CENELEC

jogbonna@cencenelec.eu

Introduction to CEN and CENELEC

CEN and CENELEC

Two public standardization organizations with a common secretariat and common system of rules, to serve the interest of their members

Members:

- Standardization organization of the 27 Member States of the EU

+

- United Kingdom, North Macedonia, Serbia, Turkey

+

- Iceland, Switzerland, Norway (EFTA)

Decision rules: a weighting system based on the size of population (CEN - Lisbon Treaty and CENELEC – Nice Treaty)

Introduction to CEN and CENELEC

Austria
Belgium
Bulgaria
Croatia
Cyprus
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Italy
Latvia
Lithuania
Luxembourg
Malta
Netherlands
Norway
Poland
Portugal
Republic of North Macedonia
Romania
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Turkey
United Kingdom

Introduction to CEN and CENELEC

CEN

- Partner organizations 10
- Liaison organisations 288
- European Agencies 5

CENELEC

- Partner organizations 13
- Liaison organisations 28
- European Agencies 5

Introduction to CEN and CENELEC

European Standards (EN)

Prime deliverable by excellence

Technical Specifications (TS)

Pre-standard

Technical Reports (TR)

Informative document / Guide

Workshop Agreements (CWA)

Document, developed by a Workshop, which reflects an agreement between identified individuals and organizations responsible for its contents

Introduction to CEN and CENELEC

Technical Report (TR)

- Informative document
  - to provide information on the technical content of standardization work
  - it may include e.g. data obtained from a survey, laboratory tests, data on the work in other organizations
- Adoption at simple majority
- Made available to the CEN and CENELEC national members by the CEN-CENELEC Management Centre
- No time limit is specified for its lifetime

Background

Background

- Mandates from European Commission for standardization projects on childcare articles, toys and other products destined for or used by children
- Precise measurement of the end users of these products → incorrect or out-of-date data may cause risk (entrapment, strangulation)
- Childrens' dimensions (body sizes and shape) changed in the past 30 years and no European-wide collection of anthropometric data specifically for children
- Therefore, the availability of correct anthropometric data is essential to define appropriate safety requirements

Background

- CEN's letter to the European Commission (EC) for a study to update anthropometric data of children between 0 and 14 years
- **Workshop with stakeholders** to discuss the aim, scope and methodology (split) of the project , >20 experts from NSB
- EC interest for funding ⇒ Formal request ⇒ Funded by EC & EFTA

Objective

To **identify**, **acquire** and **measure** the **anthropometric data of children** required by the relevant stakeholders and to **develop guidance** for them and for standards writers on the **correct application of anthropometric data** (body measures and physical strength) and to publish this information in CEN Technical Report(s)

Background

- The project is being carried out by CEN/TC 122 “Ergonomics” and in particular CEN/TC 122/WG 1 “Anthropometry” *(both secretariats are held by DIN)*
- Several other committees were involved in the project (e.g. by taking part in interviews, workshops or attending meetings) or still are involved in the project (e.g. by liaison), for example:
  - CEN/TC 52 “Safety of toys”
  - CEN/TC 136 “Sports, playground and other recreational facilities and equipment”
  - CEN/TC 136/SC 1 “Playground equipment”
  - CEN/TC 152 “Fairground and amusement park machinery and structures – Safety”
  - CEN/TC 159 “Hearing protectors”
  - CEN/TC 207 “Furniture”
  - CEN/TC 248 “Textiles and textile products”
  - CEN/TC 252 “Child care articles”
  - CEN/TC 333 “Cycles”
  - CEN/TC 364 “High Chairs”
  - CEN/TC 398 “Child Protective Products”
  - CEN/TC 402 “Domestic pools and Spas”

Background

First phase: Specific Agreement (SA 2014-09)

- Research on the existence and availability of anthropometric data of children in Europe
- Research on the demands from relevant stakeholders on anthropometric data of children regarding the application of anthropometric data
- Gap analysis based on mapping (1st task) and data needs (task 2)

Outcome: publication of **CEN/TR 17698** 'Ergonomics - Demands and Availability of anthropometric and strength data of children in Europe' and project phase formed the basis for the ongoing 2nd project phase

Background

Second phase: Specific Agreement (CEN/2019-07)

- Acquisition of relevant **anthropometric** and **strength** data of children in Europe
- Elaboration of guidelines on how to correctly apply anthropometric and strength data of children
- Result in the publication of two Technical Reports:
  - containing statistical **anthropometric/strength data**
  - the **application of anthropometric/strength data**

Your speakers today

Levent ÇAGLAR

FIRA International Ltd

Expert of CEN / TC 122 / WG 1 “Anthropometry”

lcaglar@fira.co.uk

Importance of Anthropometric Data

Who can benefit from the appropriate anthropometric data?

- Product Designers
- Standard Developers/makers
- Regulators - Enforcers

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

Reliable and appropriate anthropometric & strength data are:

- the building blocks for the development of ergonomic and safe products which enhance the user experience and comfort;

- the essential tools for
  - specifying safety requirements in product standards
  - devising test methods in standards,
  - carrying out risk assessments

Benefits of using anthropometric data

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

- match the sizes of children
- are fit for purpose
- are easy & efficient to use
- are safe
- improve the development, health and well being of children (unlike the pictures !)

Benefits of using anthropometric data

To prevent entrapment and compression risks

- Holes & gaps in products,
- gaps in railings/banisters,
- Gaps between moving parts

Benefits of using anthropometric data

To prevent entrapment and compression risks

- Holes and gaps in products,
- gaps in railings/banisters,
- Gaps between moving parts of any product

Benefits of using anthropometric data

For example, to prevent entrapment and compression risks

Having identified what is at risk, safe gaps can be defined as

- either as being smaller than the body part
- or as being larger than the body part

Benefits of using anthropometric data

Ensuring operation of controls part of a product are beyond the strength of children, by stopping them having access to danger

Or in other circumstances where children should be able to get away from danger, by ensuring the operation of controls should be within the strength capability of children

Benefits of using anthropometric data

Correctly sized furniture allows children
adopt healthy postures
avoiding back pain in the long term

Producing clothing, shoes, gloves fit well
improves the user experience and
helps the development of children

Importance of Anthropometric Data

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

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

Your speakers today

Sandra ALEMANY

Lead Researcher - Anthropometry

Instituto de Biomecánica de Valencia

sandra.alemany@ibv.org

Description of the project

Project outline

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
Approved 2021.09

PHASE2

Anthropometric and strength study of children in Europe

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

Guidelines for the application of anthropometry and strength data in Europe

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

Results:
- New CEN Technical Report on anthropometric and strength data of children in Europe
- New CEN Technical Report on the application of anthropometric and strength data

Results of phase 1

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

Anthropometric data needed by the stakeholders

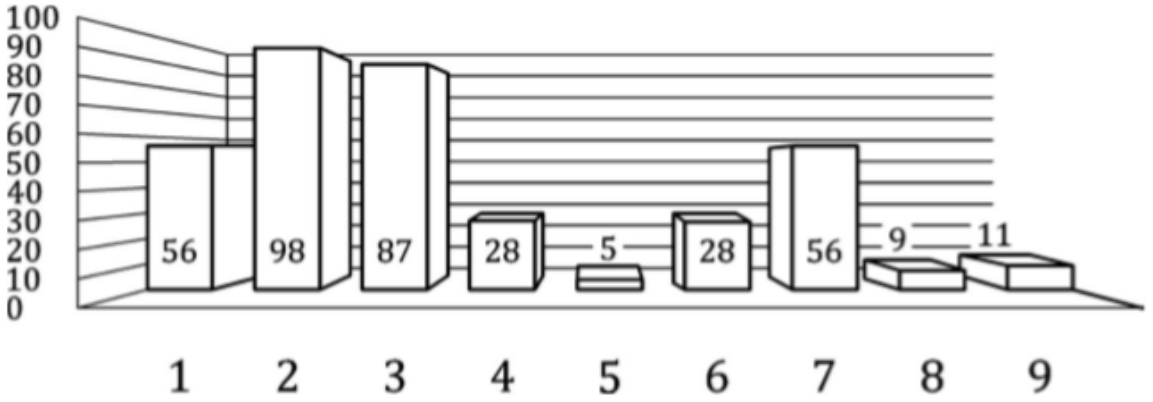
- **On-line questionnaire:**
  - data distributed along different groups whose professional activity is related with the design, evaluation and/or commercialization of products for children.
- **Workshops and individual interviews:**
  - to obtain more detailed information about the demands on children anthropometry and strengths.
  - 20 participants from 18 organizations, institutions and companies.

251 participants from 204 institutions answered the questionnaire

20 participants from 18 institutions

Anthropometric data needed by the stakeholders

▶Profile of the participants in the questionnaire:



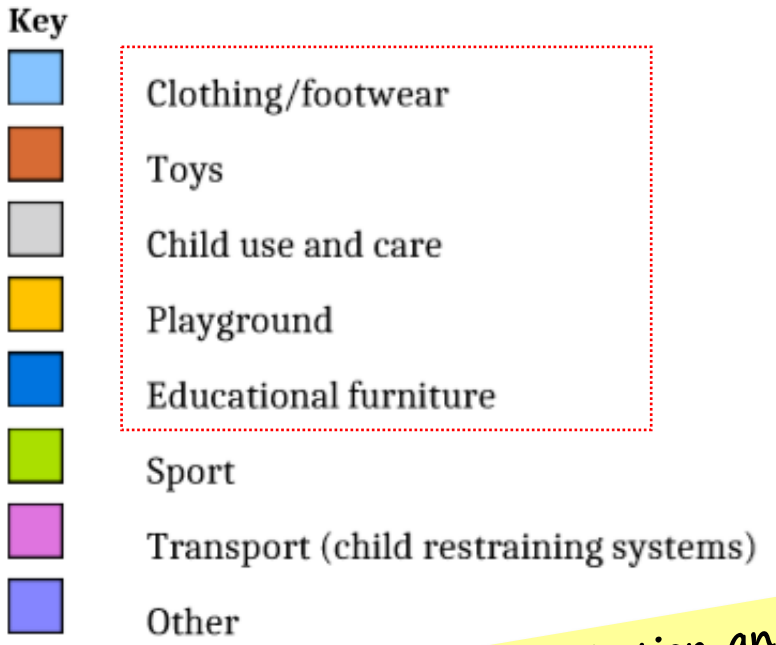
Key

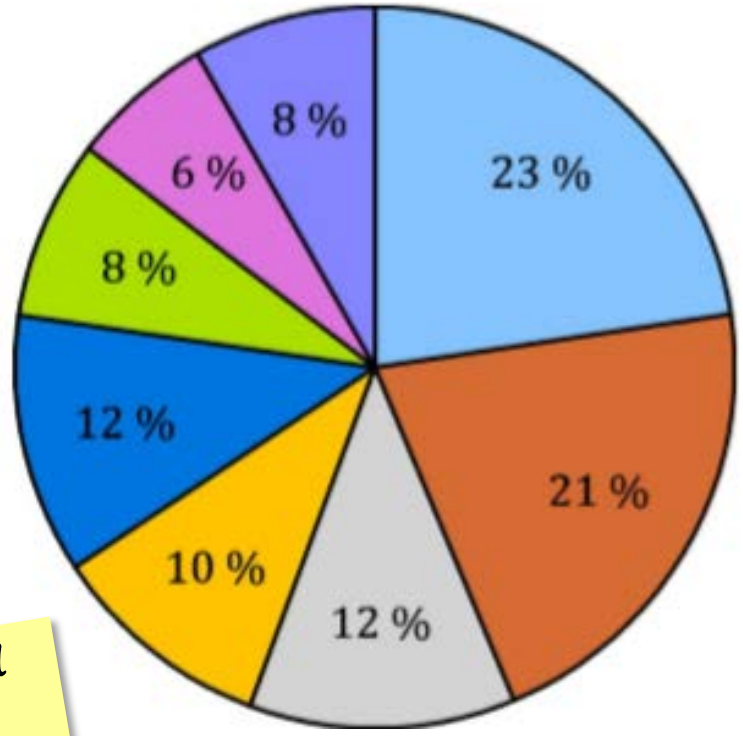
1 Standardization
2 Industry – Designer/Product Developer
3 Industry – Quality Expert
4 Industry – Other
5 Laboratory – Dummy/Mannequin Developer
6 Laboratory – Other
7 Research
8 Consumer Association
9 Representative Body of Sector

Most of the stakeholders belong to the areas of industry

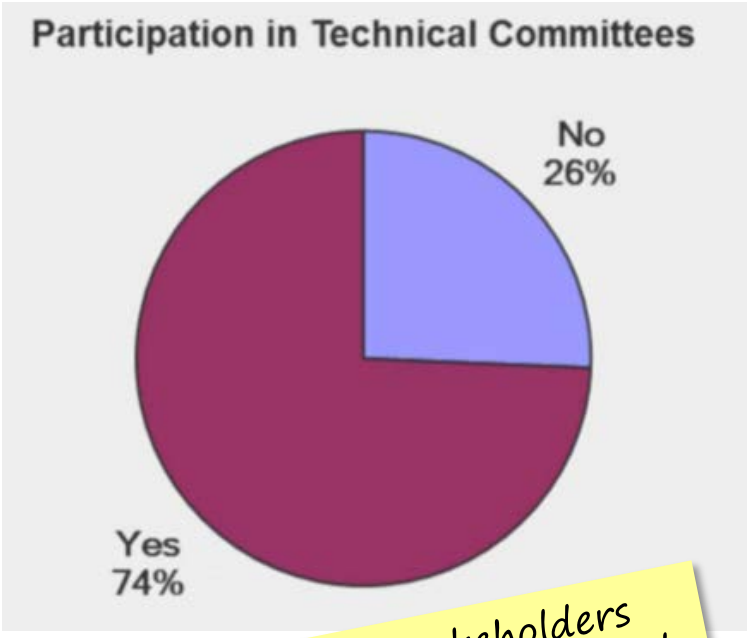
Anthropometric data needed by the stakeholders

▶Profile of the participants in the questionnaire by sector:





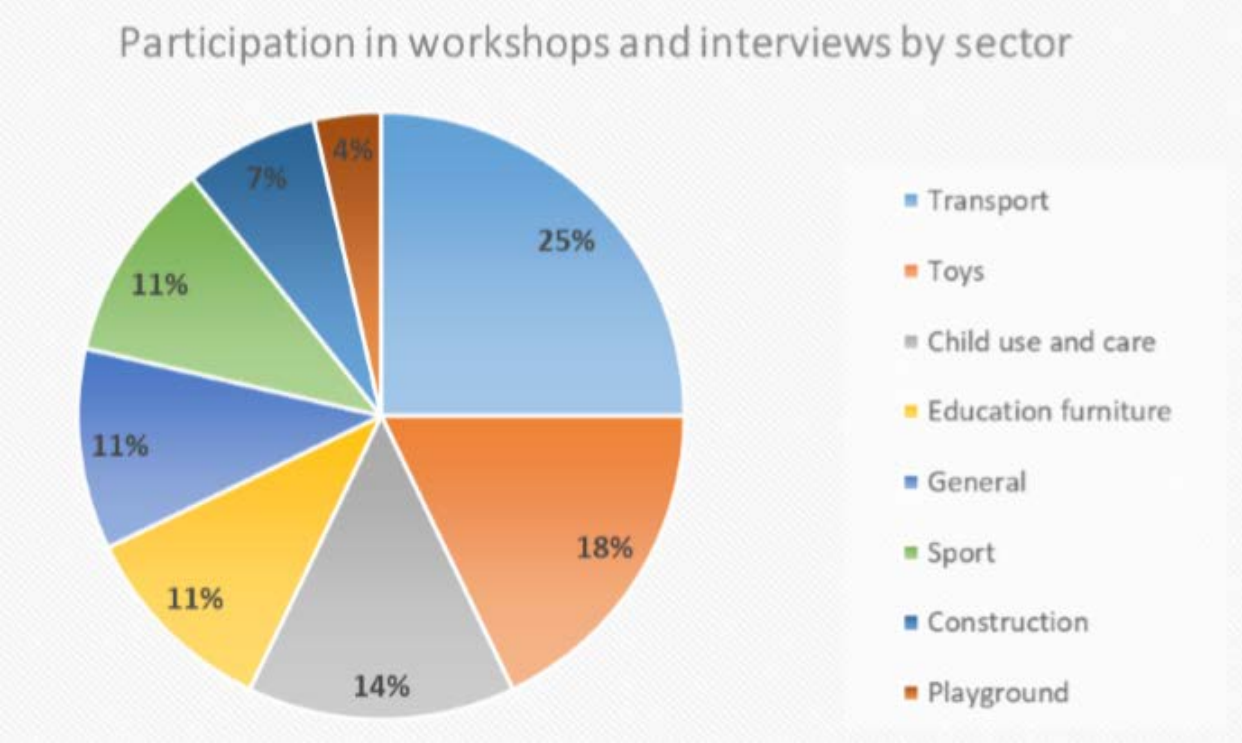
Good distribution and representation of different sectors



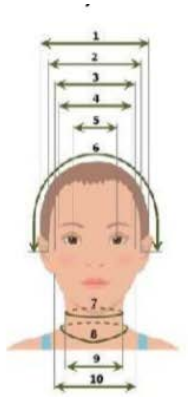
74% of stakeholders participate in technical committees

Anthropometric data needed by the stakeholders

- Profile of the participants in the workshops and interviews by sector:

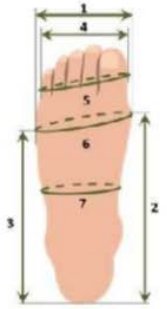


Anthropometric data needed by the stakeholders

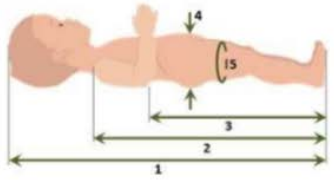


HEAD, FACE AND NECK MEASURES

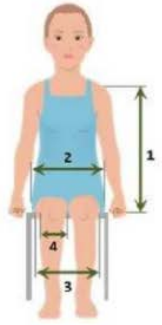
HAND MEASURES



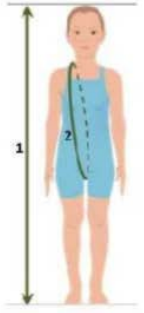
FOOT MEASURES



BODY MEASURES RELATED TO LYING POSTURE (SUPINE)

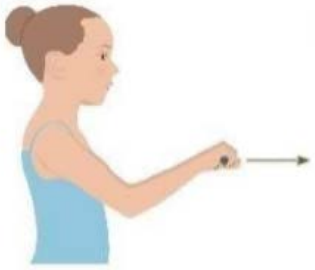


BODY MEASURES RELATED TO SITTING POSTURE



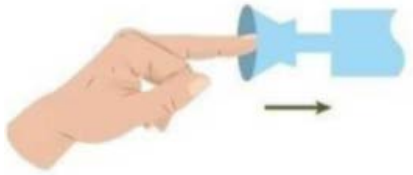
BODY MEASURES RELATED TO STANDING POSTURE

REACH MEASURES



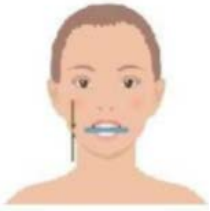
UPPER BODY/TRUNK STRENGTHS

WRIST STRENGTHS (TORQUE STRENGTHS)



HAND STRENGTHS

LEGS/FEET STRENGTHS



MOUTH STRENGTHS

Review of standards and papers to define an extended list (>200) of body measurements and strengths

Anthropometric data needed by the stakeholders

- Considering ergonomic and safety aspects, measurements demanded are:

Group	Highly relevant	Relevant	Total	New meas.
HEAD MEASUREMENTS	9	4	**13**	1
HAND MEASUREMENTS	33	4	**37**	0
SITTING MEASUREMENTS	16	0	**16**	1
STANDING MEASUREMENTS	41	44	**87**	4
FOOT MEASUREMENTS	11	10	**21**	0
REACH MEASUREMENTS	15	6	**21**	1
SUPINE MEASUREMENTS	9	5	**14**	2
UPPER BODY/ TRUNK STRENGTHS	7	2	**9**	0
LEG/ FEET STRENGTH STRENGTHS	3	0	**3**	2
HAND STRENGTH STRENGTHS	8	0	**8**	3
WRIST STRENGTHS	3	0	**3**	0
MOUTH STRENGTHS	1	1	**2**	4
TOTAL	156	76	232	18

Anthropometric data needed by the stakeholders

RELEVANCE OF THE MEASUREMENTS

- The measurements are sorted by sector and kind of measurement that are relevant for the participants.
- The colour of the cell is related with the importance of the measurement for the sector.
  - Green colour: 50 % of the respondents of the questionnaires and the participants in the workshops consider them highly relevant.
  - Yellow colour: 25 % of the respondents of the questionnaires and the participants in the workshops consider them relevant.
  - White colour were not mentioned as relevant or necessary for the sector.

Anthropometric data needed by the stakeholders

RELEVANCE OF THE ANHTROPOMETRIC AND STRENGTH MEASUREMENTS. EXAMPLE - HEAD

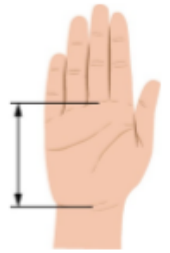
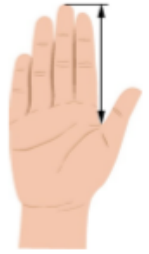
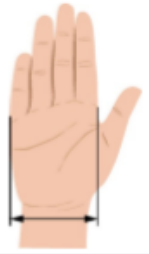
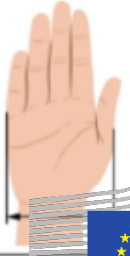
Head	Toys	Playground	Child use and care	Sport	Educational furniture	Clothing	Restraint transport	Construction	Global
1 Head breadth	R	HR	R	HR	HR	R	HR	HR	HR
2 Ear-to-ear (bitragion) breadth		R							R
3 Face breadth (bizygomatic or cheekbones)									
4 Face breadth (brow ridges)									
5 Jaw breadth									
6 Eye separation (Interpupilar distance)									
7 Neck breadth	R	HR	R		R	R	R	HR	HR
8 Bitragion arc of the head									
9 Neck circumference/Neck girth	R	HR	HR		HR	HR	R	R	HR
10 Neck-base girth	R		R			R		R	R
11 Head circumference/Head girth	R	HR	HR		HR	HR		R	HR
12 Sagittal arc of the head		R		R		R			R
13 Head length		HR	R		R	R	HR		HR
14 Maximum head diameter (chin to back of head)		HR	HR		HR				HR
15 Head height (7th Cervicale)			R			R	R	R	R
16 Head height (Vertex to chin)	R	HR	HR	HR		R	R	R	HR
17 Face height									
18 Face length (menton-sellion)									
19 Mouth breadth			HR						HR
20 Mouth opening (between incisors)	R		HR						HR

Anthropometric data needed by the stakeholders

Anthropometry and strength dictionary

Annex A (informative) 111 Definition of body measurements

218 anthropometric measurements
25 strengths

	Hand	
2	**Palm length (EN ISO 7250-1:2017,6.3.2 — ISO 8559-1:2017, 5.5.3)** The distance from the midpoint of the proximal crease at the base of the middle finger to the most distal wrist crease. Subject holds forearm horizontal with hand stretched out flat, palm up. *Instrument:* Sliding caliper.	
3	**Hand length (to thumb crotch) (Childata: 72)** The distance from the crotch of the thumb to the tip of the middle finger. The subject extends the right hand with the palm up and thumb away (abducted) from hand.	
4	**Hand breadth at metacarpals (EN ISO 7250-1:2017, 6.3.3)** Projected distance between radial and ulnar metacarpals at the level of the metacarpal heads from the second to the fifth metacarpal, measured perpendicular to the long axis of the middle finger. Subject holds forearm horizontal with hand stretched out flat, palm up. *Instrument:* Large sliding caliper	
5	**Hand breadth at thumb (Childata: 75)** The maximum distance across the hand and thumb at the level of the middle joint of the thumb. The subject extends the hand and the thumb is held against the side of the palm.	

Existing anthropometric & strength data sources

The search of data performed on an exhaustive set of scientific, technical and commercial literature. The descriptive parameters considered were:

- **Geographical scope**. Studies considering population from the EU-27,UK, Switzerland, Turkey, Norway, Russia and Belarus.
- **Year of generation of the database**. The review has been focussed on data acquired in the year 2000 or later. Previous data could be affected by secular changes.
- **Demographic aspects**. Children from 0 to 18 years old of both genders. Studies focused on pathologies have not been considered. In the case of strength, studies focused on sport activities have not been considered.
- **Sample size**. It represents the number of children measured to generate the database. No limitation was applied to identify existing databases.
- **Measuring protocols**. Manual and 3D body scanning methods.

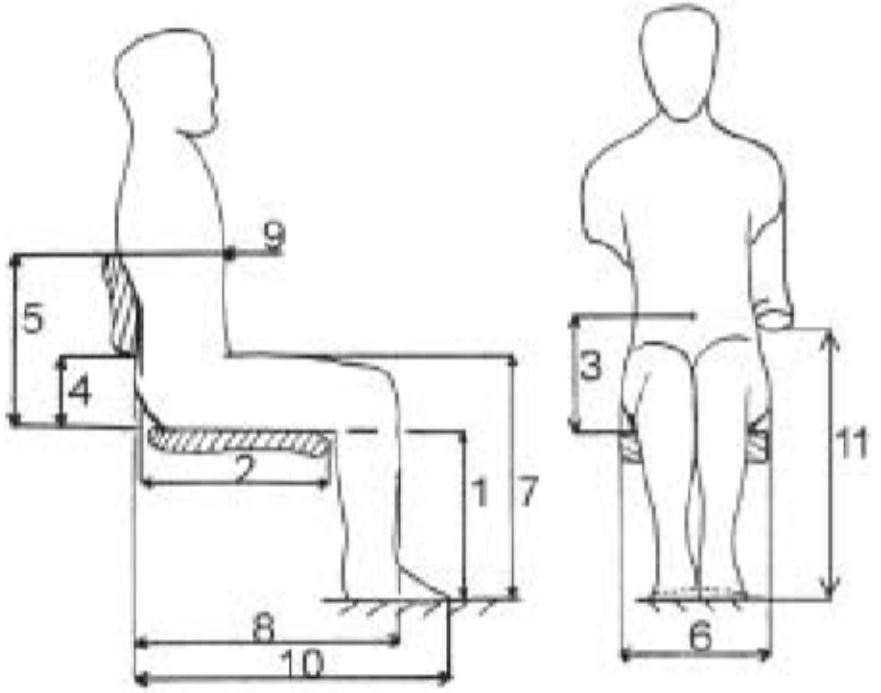
Existing anthropometric & strength data sources

Table B.1 — Description of the existing anthropometric and strength data sources

Code of database[a]	Study name (Title)	Name of the Database/ Study	Year of publication	Year of the survey	Author/Organization	Country	Area of Europe	Age range	Gender	Boys sample size	Girls sample size	Category	Measurement method	Part of the body
1 ALB-2009-A0-01	Blood pressure and anthropometric measurements in Albanian versus Turkish children and adolescents		2009	2007	Borici, S. (Department of Cardiology, Marmara University School of Medicine, Istambul)	Albania	Southern Europe	11-12 and 15-17 y.o.	M&F	82	109	Ant-Basic	Traditional	Full body
2 AUT-2010-A0-01	Körperbaulicher Status der 10- bis 12- jährigen Schüler und Schülerinnen der Sportmittelschulen Wien im Zeitraum von 2004–2006	SPORTMITTELSCHULEN WIEN 2004-2006	2010	2004-2006	Dr. Alena Kos (Institute of Medical and Sports Science Consulting)	Austria	Western Europe	10-12 y.o.	M&F	1652	566	Ant-Basic	Traditional	Full body

Table includes the description of 159 European anthropometry and strength databases

Example of Application: School Furniture



JFM, Molenbroek et al. Revision of the design of a standard for the dimensions of school furniture. Ergonomics, 2003, vol. 46, no 7, p. 681-694.

Existing anthropometric & strength data sources

Example of Application: School Furniture

16 CZE-2013-A0-01	Children anthropometry in relation to school furniture/The importance of methodology evaluation of school furniture for Czech children with mobility disability in relation to children's anthropometry		2013	2012	Martin Zach (Expert Engineering Department, Institute of Lifelong Learning, Mendel University in Brno)	Czech Republic	Eastern Europe	4-18 y.o.	M&F	186	180	Ant-Extended	Traditional	Full body
52 GBR-2001-A0-01	The UK Anthropometric Survey of School Children 2001	UK Anthropometric Survey of School Children 2001	2001	2001	Ms. Beverly Norrys & Ms. Sara Atkinson (University of Nottingham)	United Kingdom	Northern Europe	4-16 y.o.	M&F	727	666	Ant-Reduced	Traditional	Full body

Measurements taken in the standing position
1 – Mass
2 – Body height
5 – Elbow height / V_ elbow

Measurements of a sitting child
14 – Eye line height in sitting position / Eye-line_height_sitting
17 – Elbow height in sitting position / Elbow_Height_sitting
22 – Width over elbows (width of elbows) / Elbow_width_sitting
23 – Seat width / Width_sitting
24 – Height of popliteal / Popliteal_height_sitting
Functional dimensions
45 – The forward reach toward the grip / Reach_grip
46 – Length elbow – grip / Elbow_grip
49 – Length of popliteal in sitting position / Popliteal_length_sitting

Age groups:

4-7 years old
7-11 years old
11-15 years old

Existing anthropometric & strength data sources

Conclusions Phase 1

- Publication of the review of existing data that can be useful as a reference for some applications.
- Statistical summaries are not always organized in the age groups required for children products.
- The studies are focussed on specific countries. It is not possible to combine results from different regions due to methodological variations.
- Lack of data for some specific body parts such as hand and head.
- Strength studies are limited and focussed on isometric strengths or fitness activity not applicable to product interaction.

Phase 2. Generation of anthropometric and strength data of children in Europe

Anthropometric & strength data of children in Europe

Objectives Phase 2:

- **acquisition of relevant existing available anthropometric and strength data** of children in Europe;
- **development of a measurement programme** for obtaining anthropometric and strength data of children in Europe to complement existing data (based on the needs identified in project phase 1);
- practical evaluation of existing and actualized databases and **processing and harmonization of data coming from both**, acquired databases and the measuring campaign;
- **estimation of measures** in order to complement acquired and measured data to fill identified gaps;
- development of **statistical anthropometric and strength tables**;
- elaboration of guidelines on how to correctly apply anthropometric and strength data of children (TPL2);
- publication of **2 CEN technical report on anthropometric and strength** data of children in Europe and on the correct application of such data.

Anthropometric & strength data of children in Europe

Key specifications of the measuring program

- Age range: 0-16 years old.
- Extended list of anthropometric measurements and strengths.
  - 0-3 yo: 93 anthropometry and 6 strengths.
  - 4-16 yo: 186 measurements and 14 strengths.
- Representative distribution of sample size.
- Two European countries.

Table 4 – Overview on list of measures

Age range *years*	Standing /supine *amount*	Sitting *amount*	Reaches *amount*	Head *Amount*	Hand *amount*	Foot *amount*	Strengths *amount*
0-3	13	11*	4	17	26	22	6
4-16	88	16	14	17	29	22	14

		Sample size of strength measures	
		BOYS	GIRLS
Sampling groups	≥ 2 year to < 3 years	60	60
	≥ 7 year to < 8 years	70	70
	≥ 11 year to < 12 years	70	70
	≥ 13 year to < 14 years	70	70

		Sample size of anthropometric measures							
		BODY MEASURES		HEAD MEASURES		FOOT MEASURES		HAND MEASURES	
		BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS
Sampling groups	≥ 3 months to < 6 months	60	60	40	40	40	40	45	45
	≥ 6 months to < 9 months	60	60	40	40	40	40	45	45
	≥ 9 months to < 12 months	60	60	40	40	40	40	45	45
	≥ 1 year to < 2 years	60	60	40	40	40	40	45	45
	≥ 3 year to < 4 years	75	75	40	40	40	40	45	45
	≥ 5 year to < 6 years	75	75	40	40	40	40	45	45
	≥ 7 year to < 8 years	75	75	40	40	40	40	45	45
	≥ 9 year to < 10 years	105	105	40	40	40	40	60	60
	≥ 11 year to < 12 years	105	105	40	40	40	40	60	60
	≥ 13 year to < 14 years	105	105	40	40	40	40	60	60
	≥ 15 year to < 16 years	105	105	40	40	40	40	60	60

Anthropometric & strength data of children in Europe

Manual Anthropometry

0 – 2 years old

Anthropometric & strength data of children in Europe

REACH (11)

Anthropometer

Sliding Caliper

SITTING (11)

Anthropometer

Segmometer

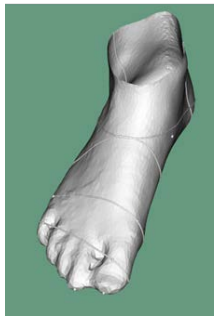
STANDING

Tape Measure

Abdominal Caliper

Sliding Caliper

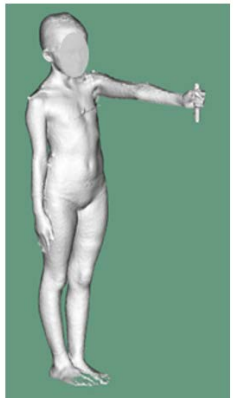
FOOT



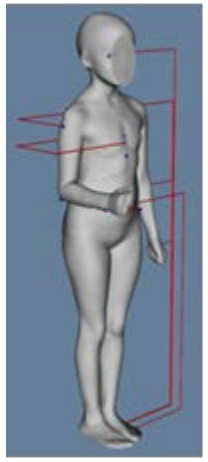
HAND

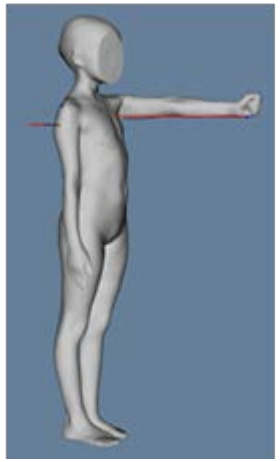
BIP_FUNCTIONAL

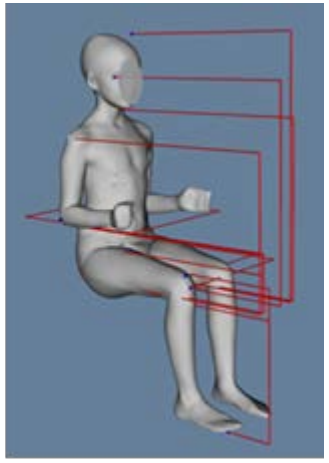
BIP_REACH



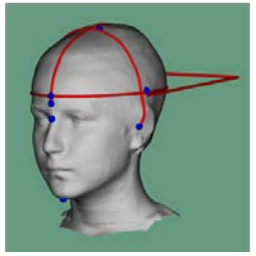
SIT_FUNCTIONAL





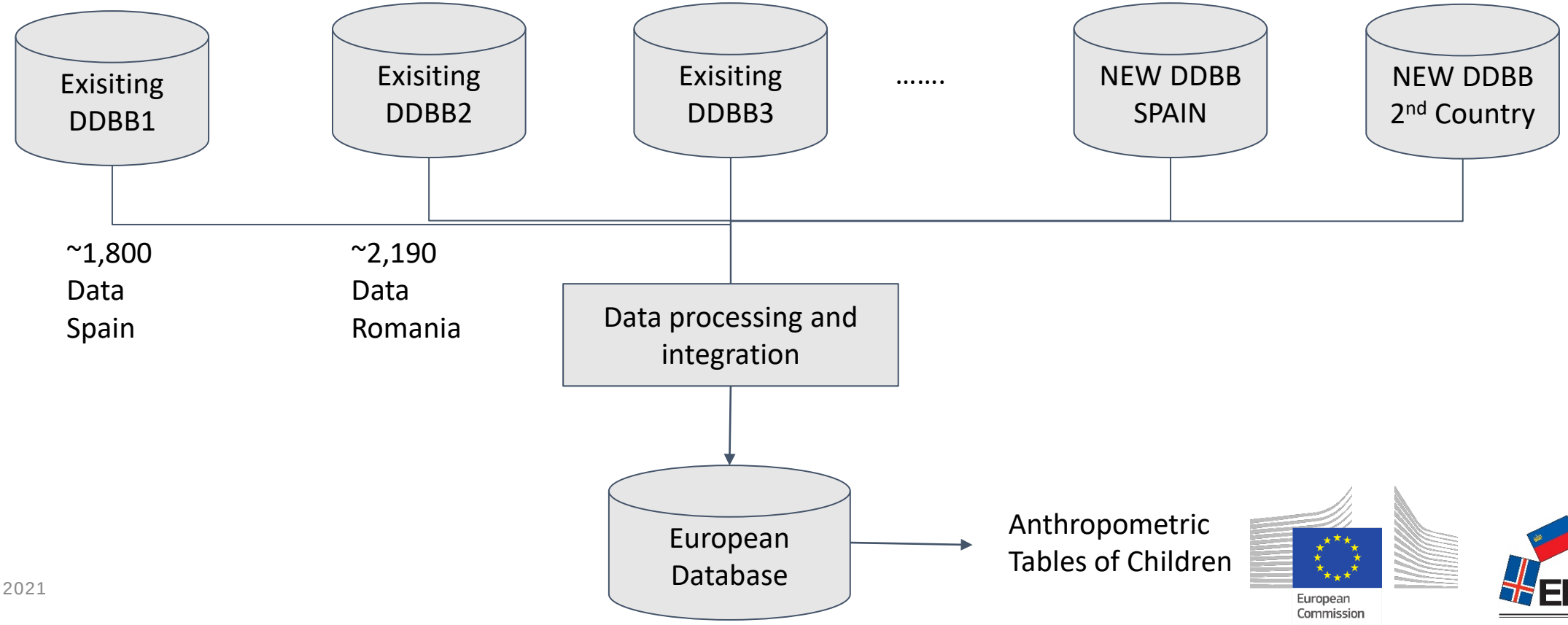


HEAD



Anthropometric & strength data of children in Europe

- Algorithms for the harmonization of anthropometric data removing the bias among the different acquired databases.

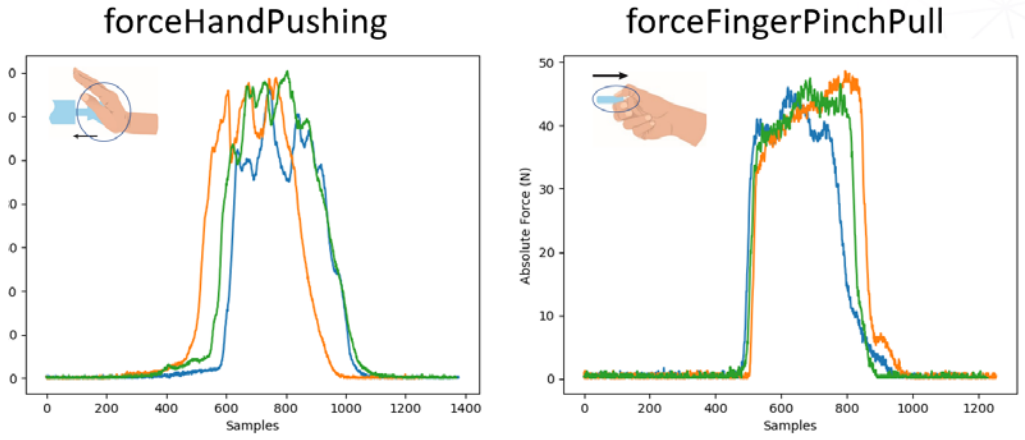


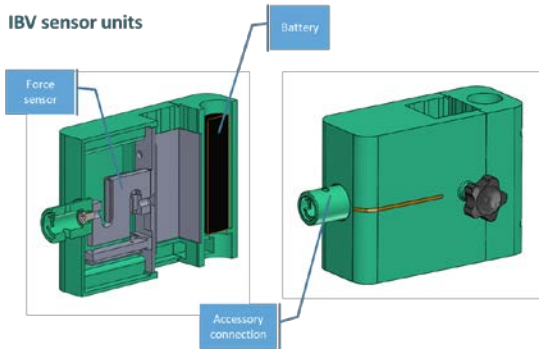
Anthropometric & strength data of children in Europe

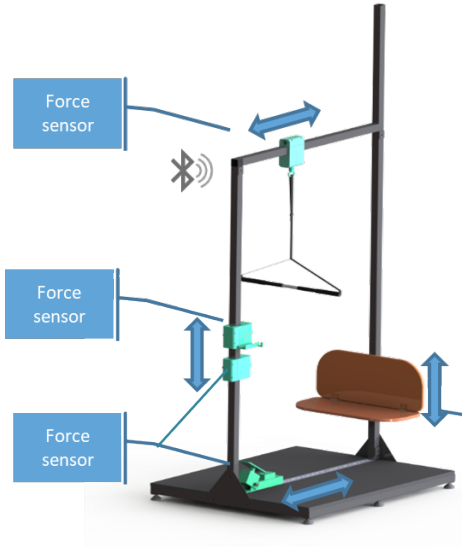
Station: Frame & wireless sensors

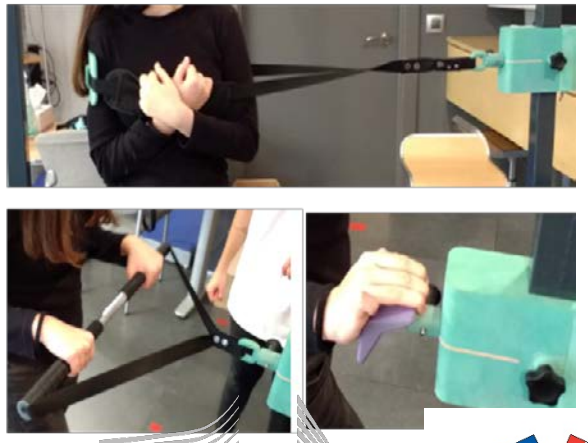
Minimal structure of steel to have enough robustness to prevent vibrations and deformations. Composed by:

- Four sensors units: two for traction forces, one for compression, one for torques. The unit includes the load cell, battery and Bluetooth connection.
- Two additional commercial sensors.
- A set of accessories to perform the strengths.









Current status of Phase 2

- Set up of the protocols and methodologies.
- Pilot study.
- Selection of measuring points.
- Ethical approval.
- Measuring campaign kick off pending due to COVID-19.

Your speakers today

Gerd KÜCHMEISTER

Project Leader Guidelines for Application of Children Data

Kiel University of Applied Sciences

gerd.kuechmeister@fh-kiel.de

Transfer of anthropometric data

Special transfer project: Guidelines for the correct application of anthropometric and strength data

Task force - members from

- 3 universities (all active in (inter)national standard committees
- University transfer company

Guidelines - purpose

Ensure that all the data collected in the main project will

- find their way into the practical work of designers …
- increase the purpose of the whole project
  - Direct: Safer and comfortable products for children
  - Indirect: Safer and ergonomic products for adults in contact with products and procedures for a child's environment
  - Macro: less health care costs, economic advantage for EU-products on the market

Transfer of anthropometric data

- Example: New database for the correct representation of children by dummies

Dummies in comparative product testing

- Example

Safety seat

Dummies in comparative product testing

- Comfort (?)

Buggy test

Can the product be adapted?

Dummies in comparative product testing

- Example

Buggy test 2

Handling by adult

Dummies in comparative product testing

- Focus: Space and anthropometry

Buggy test

Comfort for the child

Comparative product testing - interfaces

- Child carriers

Comfort and safety for child and adult in complexe interfaces

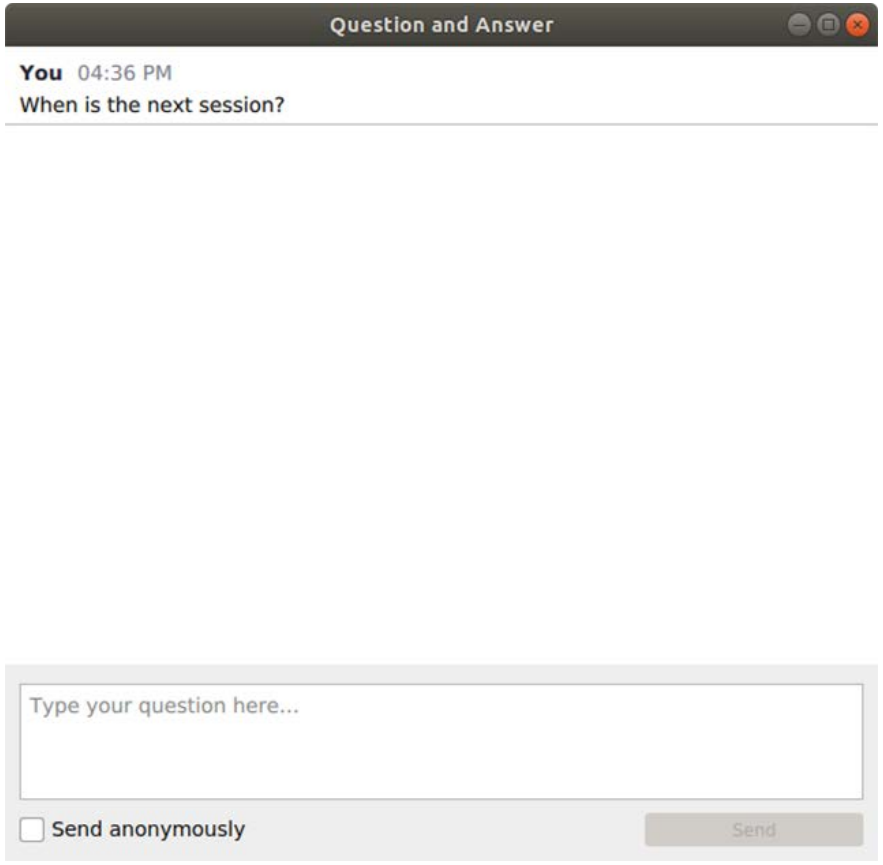
Transfer of anthropometric data

Guidelines for the correct application of anthropometric and strength data will

- lead industry and consumers to suitable decisions facing the actual physical changes in the population (of children and adults)
- improve the market chances of well adopted products and procedures for European products
- show that standardization is a prominent example for a direct transfer of scientific results into society and economy

Question time

- Use the Q&A panel to submit your questions



European Standardization Organizations

Thank you for your participation!

Next webinars

2021-12-03 – Webinar Standard Drafters: Simple Template – Quick-start guide & drafting guidance

2021-12-08 – Online CEN-CENELEC Technical Body Seminar