

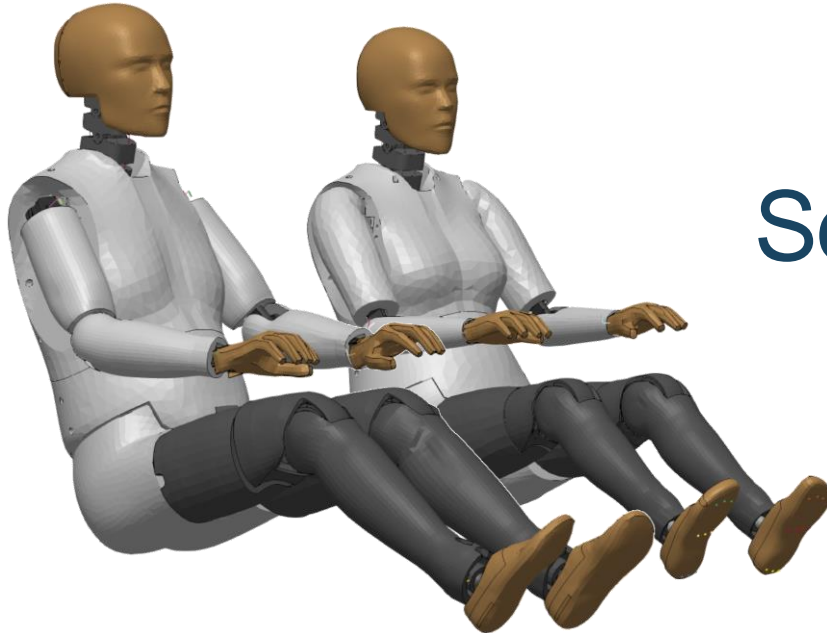


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FE-SETs

Finite Element – Seat Evaluation Tools

Jobin John

Victor Alvarez

Mats Svensson

Tommy Petersson

Astrid Linder

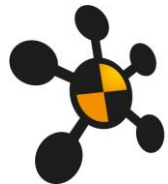
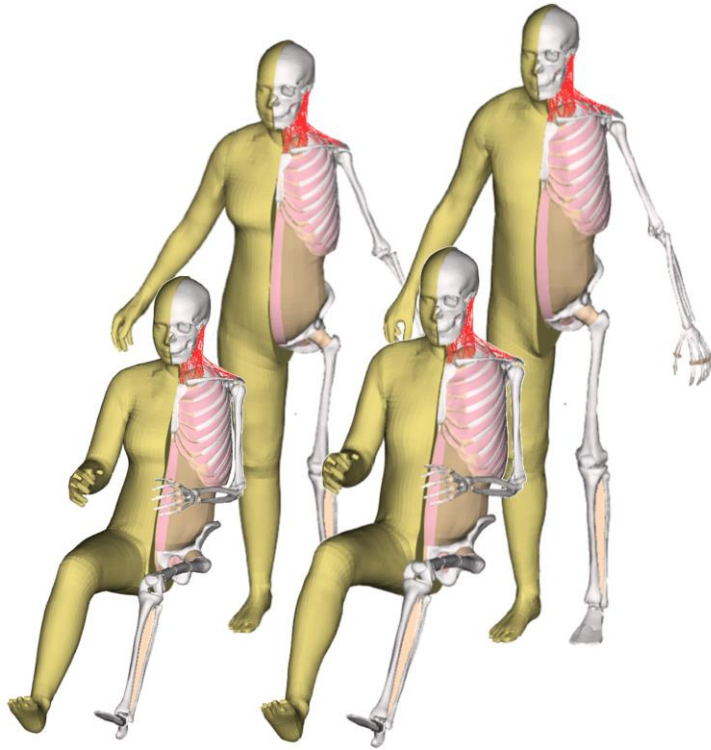


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VIVA+

Open Source Human Body Models

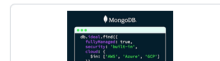


Full Model

- Blunt Impacts
- Frontal Impact
- Rear Impact
- Lateral Impact
- Standing

Submodels

- Head
- Neck
- Thorax
- Lower Extremity



VIVA+ Validation Catalog

VIVA+ is a lineup of open source finite element models of the human body, developed primarily for injury assessment in vehicle safety. This catalog documents the validations performed for the VIVA+ models.

The documentation for the VIVA+ models are available at <https://vivaplus.readthedocs.io/>

The validation simulations, including the setup and postprocessing notebooks, can be accessed at the repository <https://openvt.eu/fem/viva/vivaplus-validation/>

Recently added

Gold Standard 2 Frontal Sledtest



Crandall et al. (2011, 2013, and 2016)

Farside Sledtest



Forman et al. 2013

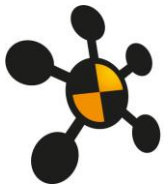
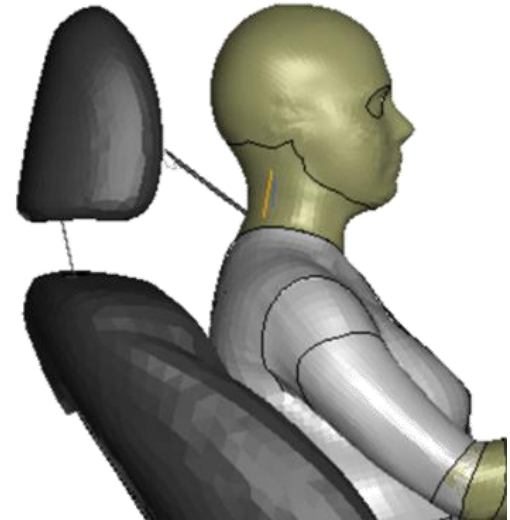
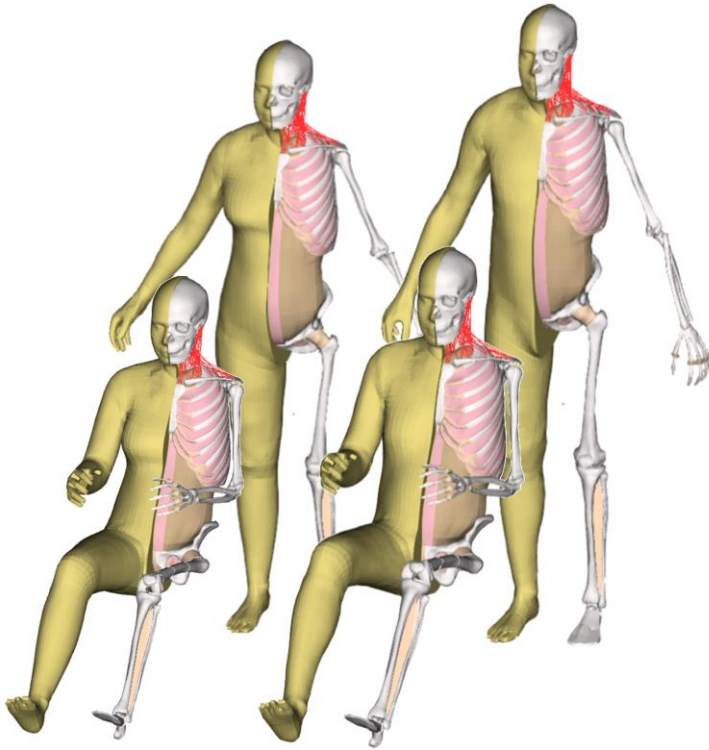


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VIVA+

Open Source Human Body Models

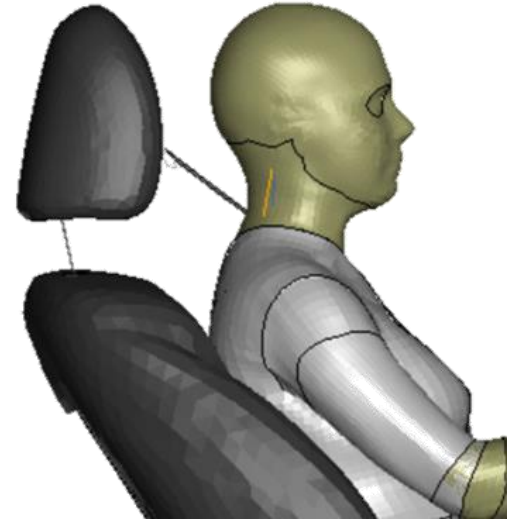
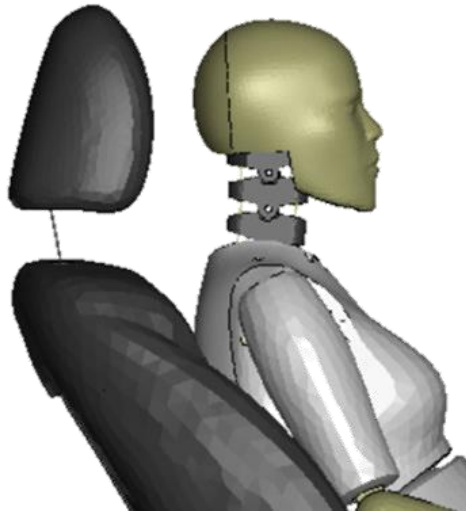


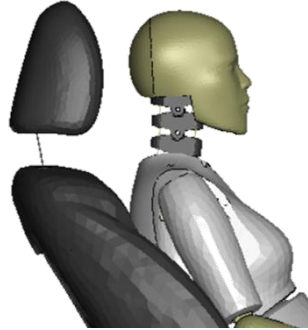
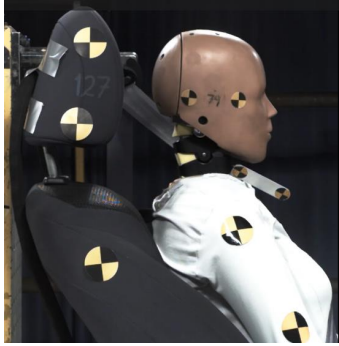
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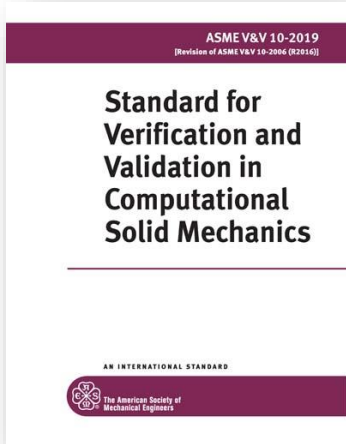
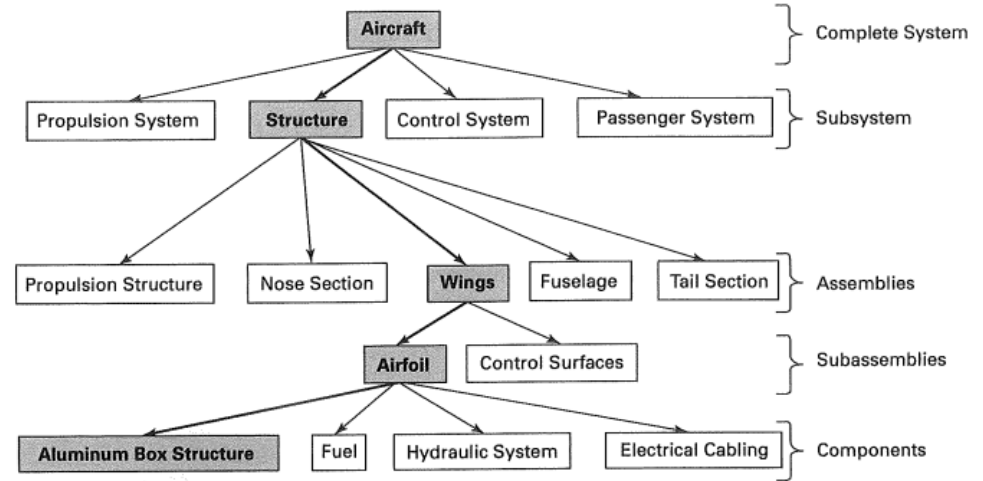
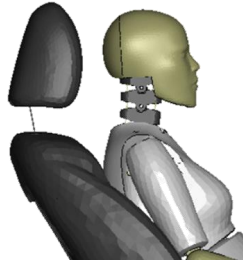
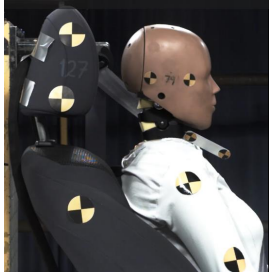


Figure 3.1-1 Hierarchical Structure of Physical Systems



Having both physical and virtual versions of SETs opens new opportunities for faster development



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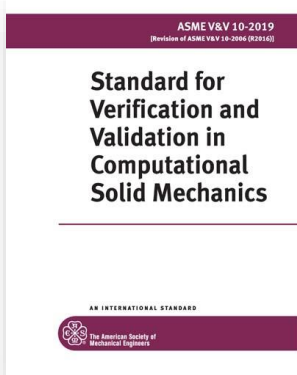
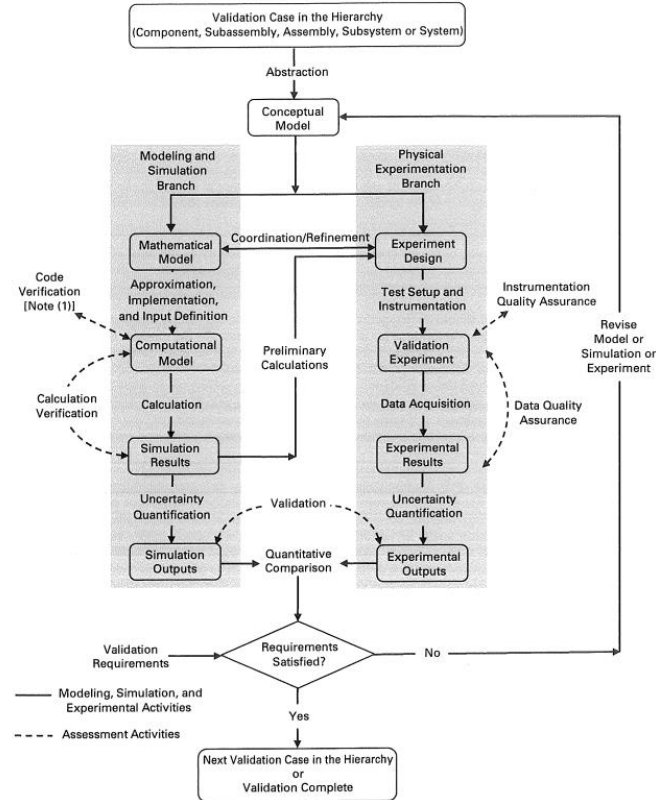


Figure 3.3-1 V&V Process





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Finite Element Modeling of the Seat Evaluation Tools (SETs)

Victor Alvarez, Karin Brolin, [Jobin](#) John, Mats Y Svensson, Astrid Linder



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September 11, Wednesday

14.10 – 14.20

Session 2-3 Computational Modeling



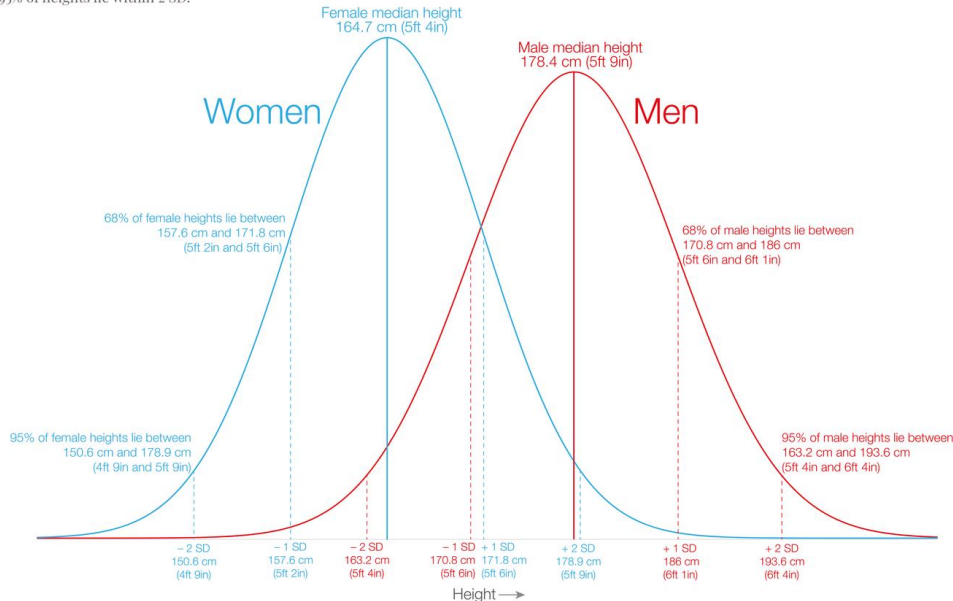
Female and Male Anthropometry

The distribution of male and female heights

The distribution of adult heights for men and women based on large cohort studies across 20 countries in North America, Europe, East Asia and Australia. Shown is the sample-weighted distribution across all cohorts born between 1980 and 1994 (so reaching the age of 18 between 1998 and 2012).

Since human heights within a population typically form a normal distribution:

- 68% of heights lie within 1 standard deviation (SD) of the median height;
- 95% of heights lie within 2 SD.





Female

2.7 Summary of Family Constitution and Subject Selection Criteria

As a result of the rationale and considerations highlighted in Sections 2.1 through 2.6, development of a four-member dummy family was recommended to the NHTSA as optimal. These four ATDs would consist of:

1. A **small female** whose height and weight are approximately the 5th percentile values for all U.S. adult females;
2. A **mid-sized female** whose height and weight are approximately the 50th percentile values for all U.S. adult females;
3. A **mid-sized male** whose height and weight are approximately the 50th percentile values for all U.S. adult males;
4. A **large male** whose height and weight are approximately the 95th percentile values for all U.S. adult males.

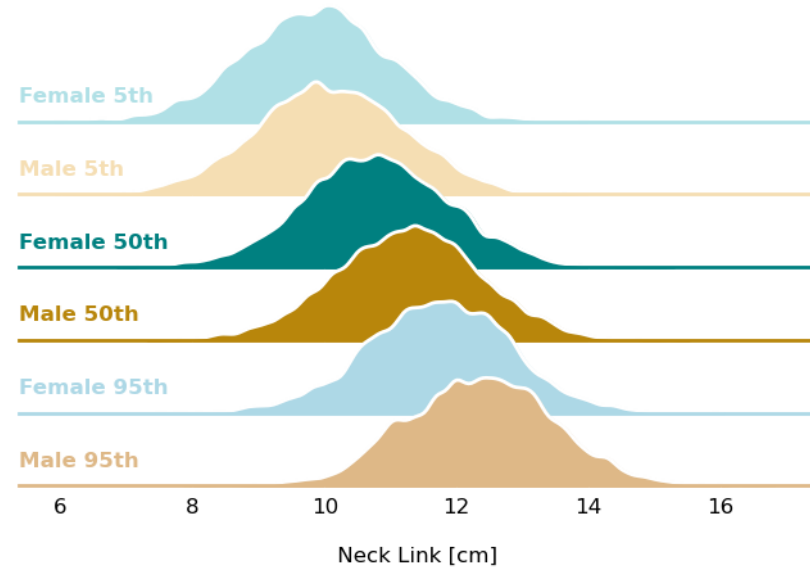


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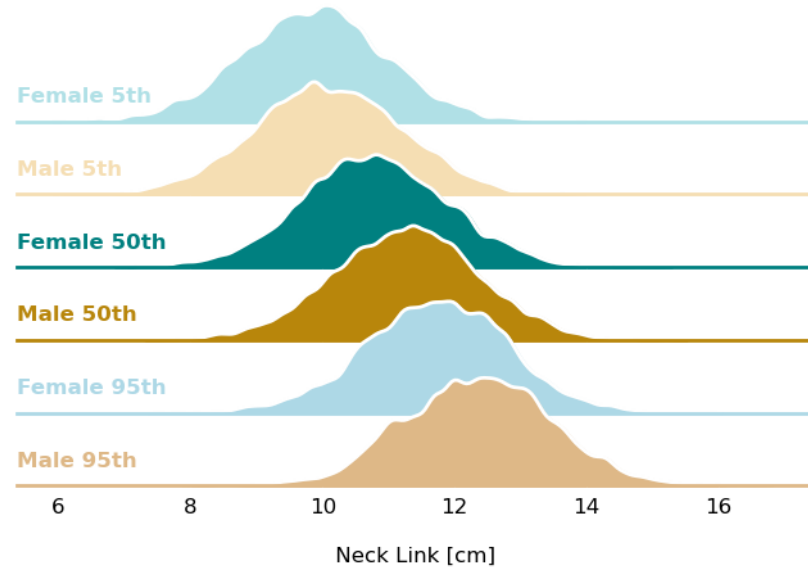
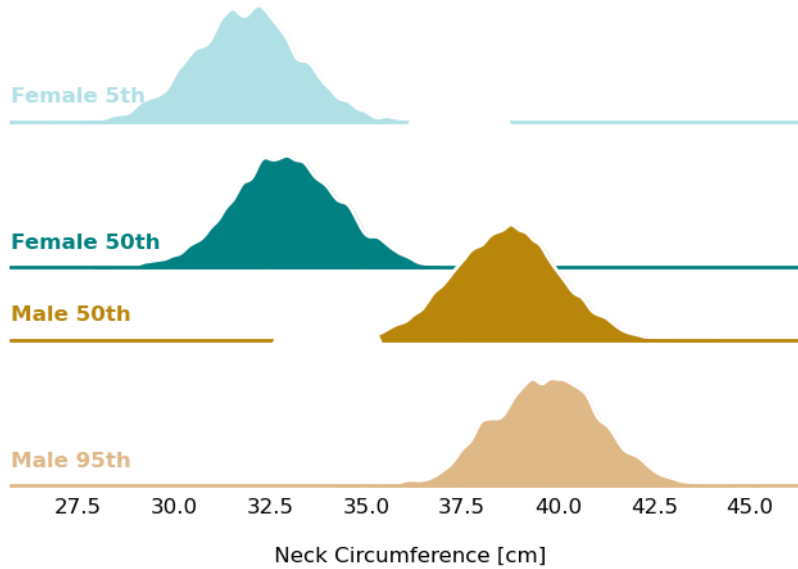


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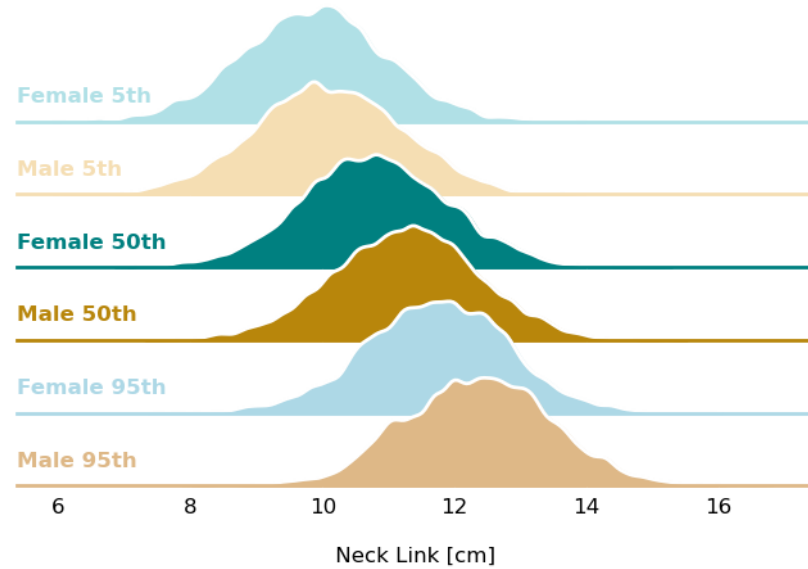
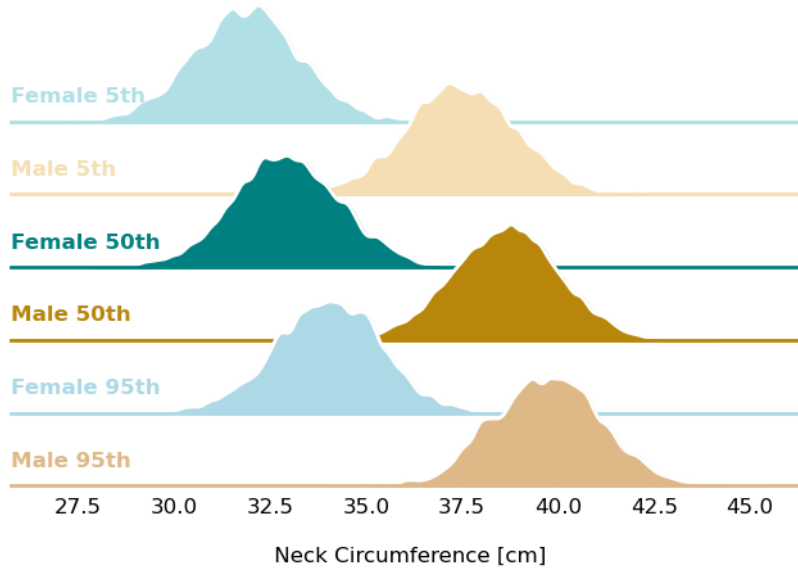


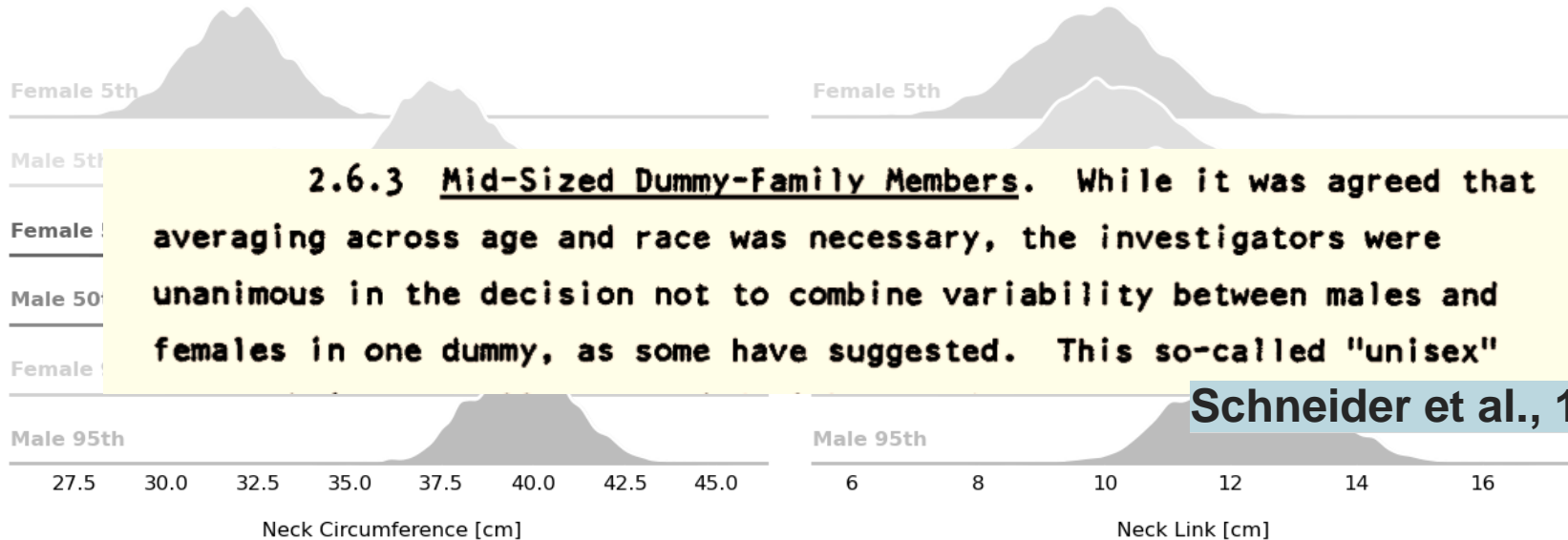
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2.6.3 Mid-Sized Dummy-Family Members. While it was agreed that averaging across age and race was necessary, the investigators were unanimous in the decision not to combine variability between males and females in one dummy, as some have suggested. This so-called "unisex"

Schneider et al., 1983



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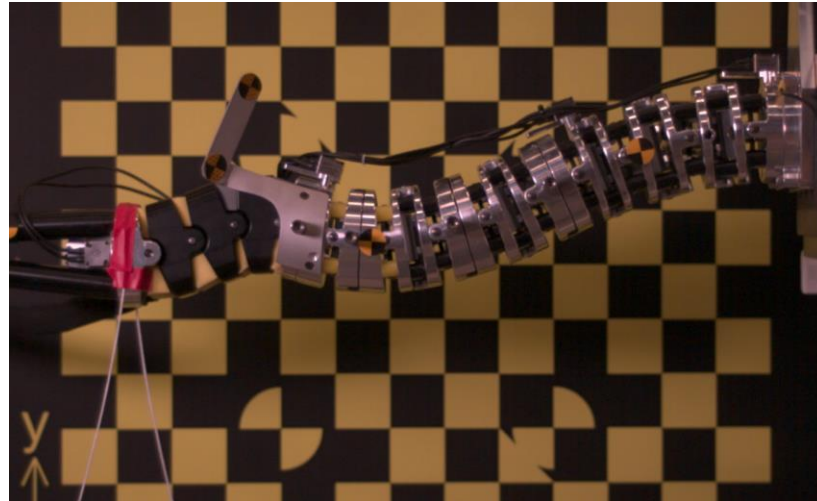
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Ongoing development

- Physical testing on material and subsystem level
 - To be used for both material modeling and joint stiffness tuning
- Rear impact sled tests in generic and detailed vehicle seat models
 - Promising initial validation results





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