

Table A1: Shoulder muscles in the HBM. All shoulder muscles insert on the humerus (Standring 2008).

Muscle	No.	PCSA^a	Origin^b	Function
Teres major	1	300	Inferior angle of scapula	Shoulder Extension
Latissimus dorsi	3	760	Spinous process of T12, L3, and L5	Shoulder Extension
Deltoid, anterior	1	820	Lateral third of clavicle	Shoulder Flexion
Deltoid, middle	1	820	Lateral margin of the acromion	Shoulder Flexion
Deltoid, posterior	3	190	Acromion and scapular ridge	Shoulder Extension
Pectoralis major ^c	1	260	Sternal half of clavicle	Shoulder Flexion
Coracobrachialis	1	170	Coracoid process	Shoulder Flexion

No. = Number of elements. ^a Physiological Cross-Sectional Area in mm² from Holzbaur et al. (2005). ^b Muscle origin points from Standring (2008). ^c Only clavicular part of pectoralis major included in model.

Table A2: RMS sum of the WIF values for the HBM in the validation simulations, the best, median, and worst match individual volunteer for the force and kinematic measurements in Table 2. Each row corresponds to the bottom row in Table 2, with the difference that the muscle activation data has been omitted in the calculations here. SB = Standard Belt; PT = Pre-Tensioned Belt; D = Driver; P = Passenger.

	SB		PT	
	D.	P.	D.	P.
HBM	0.44	0.49	0.48	0.51
Best Volunteer	0.54	0.70	0.60	0.66
Median Volunteer	0.35	0.54	0.41	0.49
Worst Volunteer	0.24	0.45	0.24	0.14

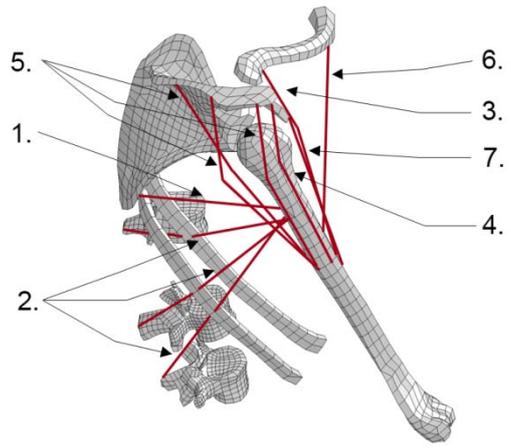


Figure A1: HBM shoulder muscle geometry: 1. Teres major; 2. Latissimus dorsi; 3. Anterior deltoid; 4. Middle deltoid; 5. Posterior deltoid; 6. Pectoralis major, clavicular head. 7. Coracobrachialis.

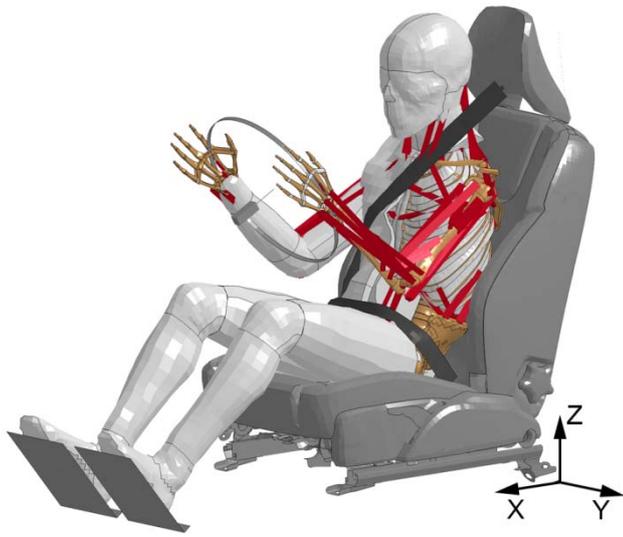


Figure A2: The HBM in a driving posture for the validation simulations. Soft tissues of the left thorax and upper extremity are not included to show the musculoskeletal structure of the model.

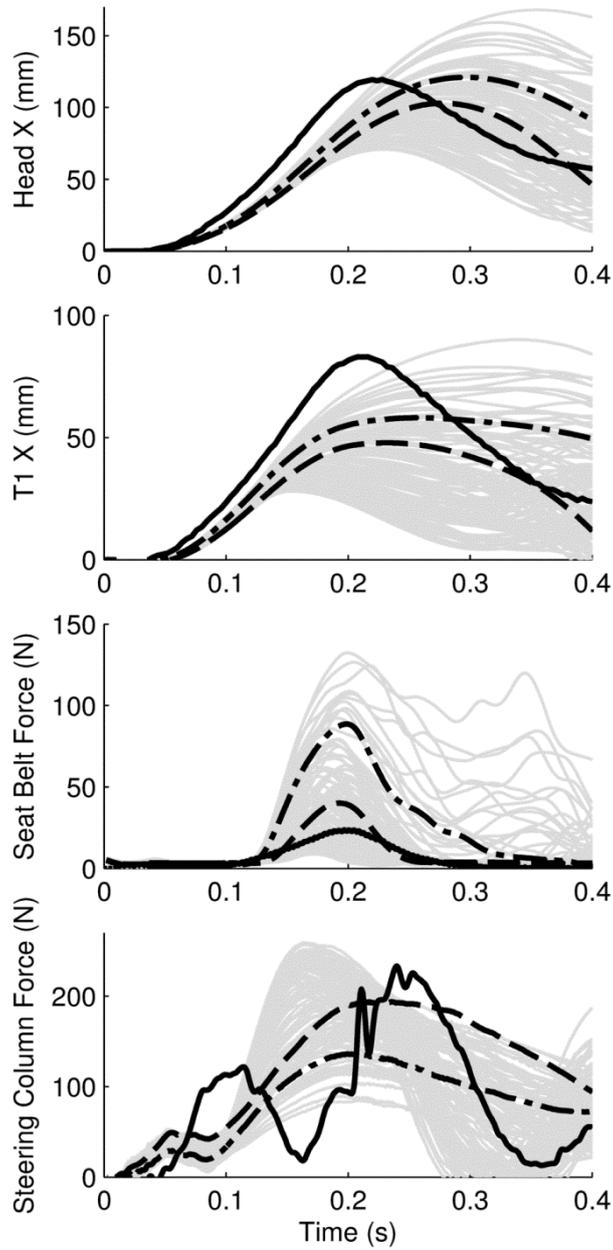


Figure A3: Displacement and interaction force data from the controller tuning simulations. The solid line indicates data from the volunteer (Ejima et al. 2008); the dash-dotted line show base line HBM response and the dashed line the HBM response with the tuned controller gains as predicted by the meta-model. Light-grey lines in the background show the range of model responses for all combination of gains simulated. Head X represents the displacement of the head center of gravity.

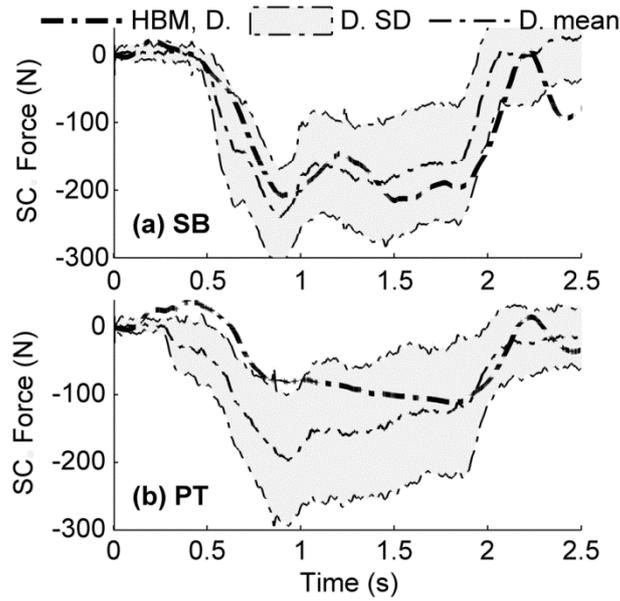


Figure A4: SC = steering column force for the HBM in the (D) driver validation simulations in comparison with volunteer mean \pm one SD (Östh et al. 2013). Positive force corresponds to tension in the steering column, negative to compression. (a) SB = Standard Belt; (b) PT = Pre-Tensioned Belt; SD = standard deviation (shaded area).

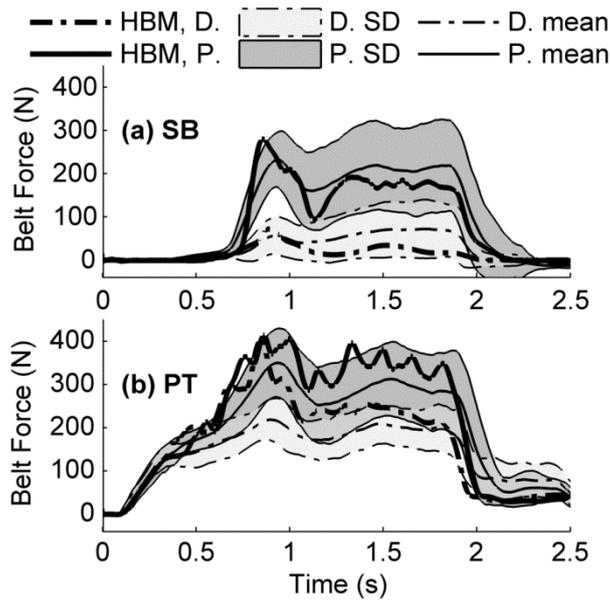


Figure A5: HBM shoulder belt force in the validation simulations compared with volunteer mean \pm one SD (Östh et al. 2013; Ólafsdóttir et al. 2013). D = driver (dashed line); P = passenger (solid line); (a) SB = Standard Belt; (b) PT = Pre-Tensioned Belt; SD = standard deviation (shaded areas).

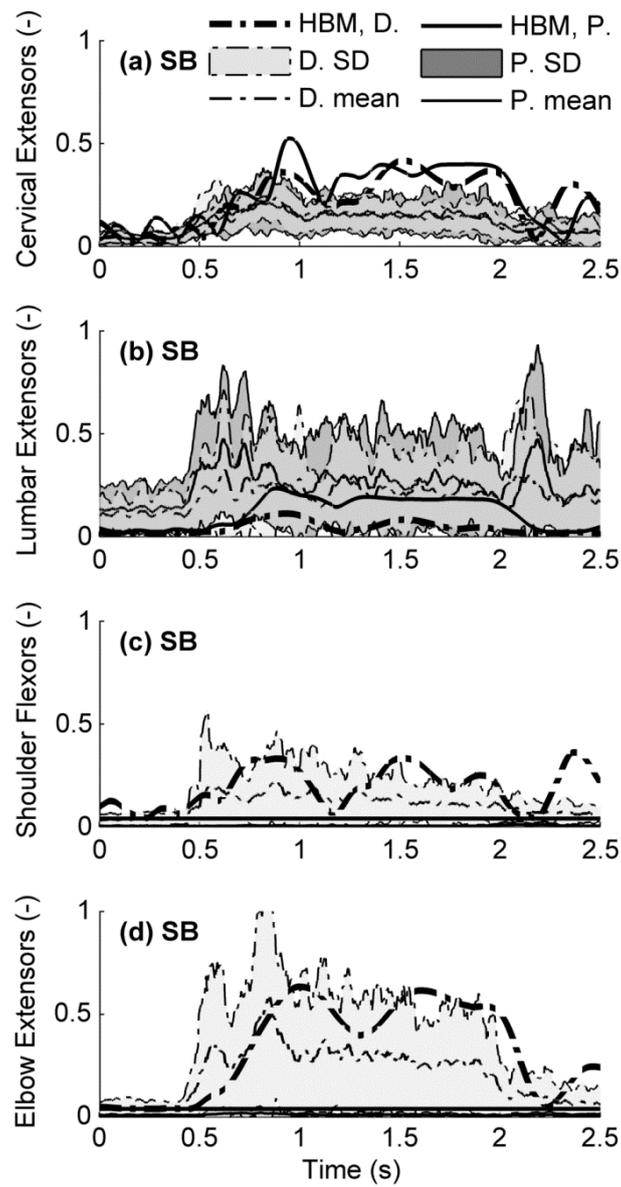


Figure A6: HBM muscle activation levels and volunteer MVC normalized EMG (Östh et al. 2013; Ólafsdóttir et al. 2013) in the (D) driver (dashed line) and (P) passenger (solid line) positions with (SB) standard seat belt for the agonist muscles during autonomous braking in the validation simulations. SD = standard deviation (shaded areas).