Validation of the Human Motion Simulation Framework: Posture Prediction for Standing Object Transfer Tasks

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The Human Motion Simulation Framework is a hierarchical set of algorithms for physical task simulation and analysis. The Framework is capable of simulating a wide range of tasks, including standing and seated reaches, walking and carrying objects, and vehicle ingress and egress. In this paper, model predictions for the terminal postures of standing object transfer tasks are compared to data from 20 subjects with a wide range of body dimensions. Whole-body postures were recorded using optical motion capture for one-handed and two-handed object transfers to target destinations at three angles from straight ahead and three heights. The hand and foot locations from the data were input to the HUMOSIM Framework Reference Implementation (HFRI) in the Jack human modeling software. The whole-body postures predicted by the HFRI were compared to the measured postures using a set of measures selected for their importance to ergonomic analysis. The results demonstrate that the HUMOSIM Framework standing posture predictions agree well with motion capture data, with particularly high correlations observed for the important predictions of torso inclination and hand-to-shoulder distance.