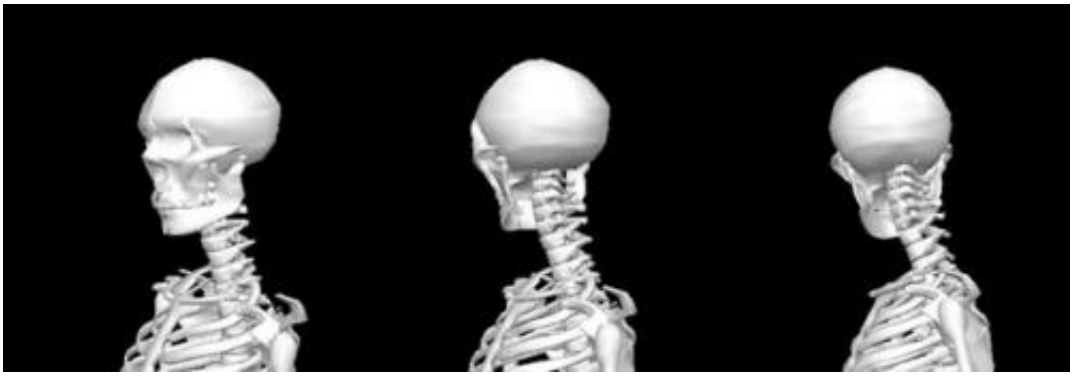
Virtual vehicle vibrations

February 11 2013



Computer models show postures of a tractor's operator in a field experimental study funded by the Injury Prevention Research Center. Credit: John Meusch.

"Sit up straight in your chair!" That command given by countless parents to their children may one day be delivered by vehicle designers to a robot that is actually a computerized model of a long-distance truck driver or other heavy equipment operator, thanks to a University of Iowa research program.

That's because a UI researcher has designed a computer program that allows engineers to accurately predict the role posture plays in transferring the stress of vehicle motion to bone and muscle in the head and neck.

Titled "Human head-neck models in whole-body vibration: Effect of posture," the paper is published in the online Jan. 3 issue of the *Journal*

of Biomechanics.

Lead author Salam Rahmatalla, associate professor of civil and environmental engineering and research engineer at the Virtual Soldier Research (VSR) Program, a part of the College of Engineering's Center for Computer-Aided Design (CCAD), says that a computer model is needed.

"Studies have shown that awkward head-neck postures inside whole-body vibration environments can increase discomfort and the risk of injury," he says. "The goal of this project is to introduce a computerized human model that can be used to predict human motion in response to whole-body vibration when the human takes different head-neck postures."

He notes that the predicted motion data of his current model can be used to drive more sophisticated computer human models—with muscles and internal tissues—that can predict muscle forces and internal strain and stress between tissues and vertebrae.

Significantly, the computer program may reduce the need for actual human subjects to drive test vehicles.

"One major benefit of the current computer human model is the possibility of using it instead of humans in the design/modification loop of equipment in whole-body vibration," he says.

Rahmatalla says a wide variety of industry, university, and other researcher venues likely will learn from his work.

"The automotive industry, and manufacturers of heavy machinery including construction, agriculture, mining, and military vehicles can benefit from the application of this model to the design of their

equipment," he says.

"Also, human factors researchers and ergonomists can use this model to investigate the effect of head-neck posture on human response, performance, human machine interaction, and injury risk in whole-body vibration."

Rahmatalla's long-term VSR objective is to develop a virtual human capable of reproducing complex human responses to a whole body vibration environment that will help answer questions related to potential injury risks and design modifications.

Rahmatalla conducted the study by having 11 male participants sit in a vehicle simulator where they were subjected to white-noise random vibration and the acceleration data of the head and neck for each was recorded. The recorded motion data was used to calibrate the computer human model.

His colleague in the study was Yang Wang, a student in the UI Graduate College and CCAD graduate research assistant.

Provided by University of Iowa