OBJECTIVE: Design and develop an open Application Programming Interface (API) and data fusion framework for the integration of current and future commercial human modeling software; and that has the ability to incorporate the output of commercial off-the-shelf (COTS) digital human modeling and medical modeling software to create a whole-body simulation of a human.

DESCRIPTION: Digital human modeling (DHM) efforts in the DoD have primarily been used to assess ergonomic and human factors situations. The current commercial software on the market is highly specialized toward providing human analysis for narrow tasks and situations. It does not, contrary to the name, typically model the whole human system. The result of this software specialization is a plethora of part-task analysis software that operates mostly independently. Each software by itself is unable to inform the larger picture and holistically model the human system.

For example, existing ergonomic software incorporates anthropometric survey data to accurately model humans with diverse size and shapes. However, the software does not incorporate a variety of other factors that can affect the interpretation of an ergonomic analysis. Combining anthropometric data with musculoskeletal modeling data and injury modeling data would enable the generation of a highly accurate human reach envelope for both normal and abnormal human avatars. Likewise, dehydration data, hypoxia data, and other stressor data can be combined to provide a more accurate cognitive task analysis for humans operating under abnormal conditions and in stressed environments.

The goal of this SBIR topic is not to replace existing software, but to enhance the ability of the existing software packages to leverage data developed from each other by developing an architectural framework that can incorporate the output of COTS digital human and medical modeling software to build a detailed digital representation of a human. As a more developed and accurate digital representation of a physical human begins to develop, this software can provide input for these existing software packages to provide more accurate task analysis results.

Previous attempts at exploring this issue have met with limited success [Ref 1]. This project should build on previous efforts to form the architecture and underlying framework for a system that would enable the interpretation and storage of human modeling data to be usable on a variety of consumer computer hardware. The proposer should convert the data that is output from various COTS software into an interface agnostic format, easily transformed to other industry formats. For example, the anthropometric and posture data developed in an ergonomics-focused software could be exported into this developed open standard and then be imported into another ergonomic software package, either through the software's support of this open standard or through the transformation of the open standard to a proprietary standard that this software supports. Through this, the project would enable additional functionality in existing COTS software without modification of the underlying software. In addition, this storage of data in an interface agnostic format would allow for the standard representation of a human's physiological state and enable the creation of standard medical use cases, such as through the incorporation of existing open human body modeling standards [Ref 2].

PHASE I: Identify the major factors and attributes that are essential for generating a basic digital model of the human body and its associated components. Identify the initial software packages that will provide the input and output of this human model. Design, develop, and demonstrate a simple proof of concept framework that can ingest at least two sources of data, create a human model, and export the data for use in a COTS task analysis software. The Phase I effort will include prototype plans to be further developed under Phase II.

PHASE II: Develop an extensible and scalable framework for current and future modeling software. Develop the API for ingesting and exporting data from the human system model, and also the graphical user interface (GUI) for examination and manipulation of data stored in the human model. Integrate the major modeling packages task analysis software into the previously developed framework. Identify and incorporate sources of physiology data to better inform the human model.

PHASE III DUAL-USE APPLICATIONS: Refine the framework and continue to add capability, in terms of both functionality and support of
existing and future COTS software. Develop capability to support modeling in the private industry.

This SBIR topic will result in a framework that will enable cross-collaboration between COTS software. This framework will enhance the value of existing software packages, promote development of new features, and enable interoperability between software packages. Potential use by forensics or the medical community where human modeling would be useful.

REFERENCES:


KEYWORDS: Medical Modeling; Digital Human Modeling; Statistical Models; Physiology; Data Fusion