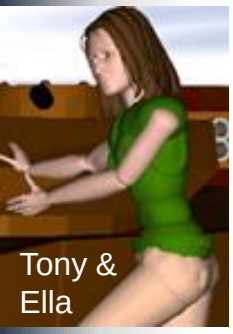
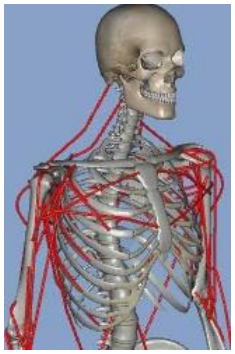
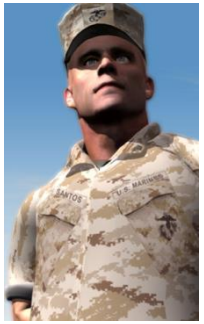
History of Santos







2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017

Robotics
Optimization
Biomechanics
Interactive
Real time
High fidelity
CAD import

Posture prediction
Ergonomics

Strength & fatigue

Real-time

Task simulation

Musculoskeletal Injury

Vision

Physiology

Armor

Realism
Anthropometry
Physics based

Thermal, hydration, energy

PPE-Blast

Human Predictive dynamics

Psychological

Hand & grasping

Human performance

AI Deep learning

Training

Clothing/armor

Validation Validation Validation Validation Validation

History Narrative: The Virtual Soldier Research

The Virtual Soldier Research program was established in 2003. Dr. Karim Abdel-Malek, an expert in robotics was working, at the time, on mathematical formulations for the analysis and prediction of robotic arm manipulators. He collaborated with Dr. Jasbir Arora, an expert in the field of optimization, and their approach was shown to predict human motion. Upon presenting at the Digital Human Modeling conference that year, it was well received as it was the first time that a rigorous mathematical method was used in the calculation and prediction of human motion. Indeed, the first time that methods from robotics and optimization were used in successfully addressing real human simulation problems. The team then received a considerable contract from the US Army TACOM to advance these concepts, and SANTOS® was born in 2003.

Subsequently, the team expanded over the years, reaching about 55 researchers, from all walks of life, including experts in physical therapy, physiology, computer graphics, musculoskeletal injury, and many more. The VSR program was funded over the years by the US Army, US Navy, US Marines, and companies such as Caterpillar, Deere, Rockwell Collins, Ford, GM, Chrysler, and many more. Total funding into the VSR program to-date is over $60M.

VSR has made a significant impact on the science of human movement, with many scholarly publications, a number of national and international awards including three best paper awards, several books chapters, and a recent book dedicated to the unique method called *Human Motion Simulation: Predictive Dynamics*, by Abdel-Malek and Arora, Elsevier, 2013.

The VSR program has transitioned to the US Military several products, most notably “GruntSim”, a comprehensive system for simulation trade-off analysis for the US Marine, including new equipment.

The VSR program has had an economic impact on the community, creating high-tech positions, hiring scientific experts, and has educated undergraduate and graduate students over the 14 years since its inception, including community outreach, the Iowa Summer Simulation Institute for high school students, and hosting international visiting professors.

SANTOS® has transitioned to a commercial company, benefiting the community and the University and continues to engage with Fortune 500 companies such as P&G and Ford.

The VSR program continues to conduct research at the forefront of human simulation, extending into sports science and athletics, injury prediction, and artificial intelligence.