

Virtual, Digital Human Modeling



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INTRODUCTION

Three-dimensional manikins are also known as Digital Human Models (DHM).

These are software representations of humans that enable designers to visualize the effectiveness of a design before a physical prototype is constructed.

DHM computer programs are derived from the same types of technology as Computer-Aided Design (CAD) programs and actually allow users to import their 3-D CAD models into a virtual environment.

Then, DHMs of various sizes can be placed into this environment along with the model for design analysis.



There are many current and potential applications of human activities that may be part of a VR system involving virtual humans:

- Simulation-based **learning and training** (transportation, civil engineering etc.)
- Simulation of **ergonomic work environments** in vehicles or manufacturing plants
- **Architectural simulation** with people, buildings, landscapes and lights etc.
- **Computer games** involving people and "Virtual Worlds" for Lunaparks/casinos
- **Virtual-Conferencing**
- **Virtual patient** for surgery, plastic surgery
- **Orthopaedic and prostheses and rehabilitation**
- **Plastic surgery**
- **Virtual psychotherapies**
- **Military:** Battlefield simulation with individual participants, team training, and peace-keeping operations..
- **Design/Maintenance:** Design for access, ease of repair, safety, tool clearance, visibility, and hazard avoidance.

What are Virtual Humans Useful for?

- To perform ergonomic, comfort and safety with the digital mock-up
- To assess accessibility inside a working cabin or cockpit
- <https://www.youtube.com/watch?v=wKc2cNgEk2Y>
- <https://www.youtube.com/watch?v=zwnfB0kpi8g>



JACK AND JILL - HUMAN MODELING & SIMULATION

Digital Humans in product design allows you to gain insight about the customer.

- Positioning and comfort
- Visibility
- Ingress & egress
- Reaching and grasping
- Foot pedal operation
- Multi-person interaction
- Strength assessment
- Ergonomic evaluations

Jack and Jill, digital human models that are part of Siemens PLM Software's Tecnomatix suite, enables automakers like GM or FORD to digitally simulate and study the impact of assembly work environments on humans.

Jack enables you to:

Build a virtual environment

Create a virtual human

Define your human's size and shape

Position the human in your environment

Assign your human tasks

Analyze how your human performs

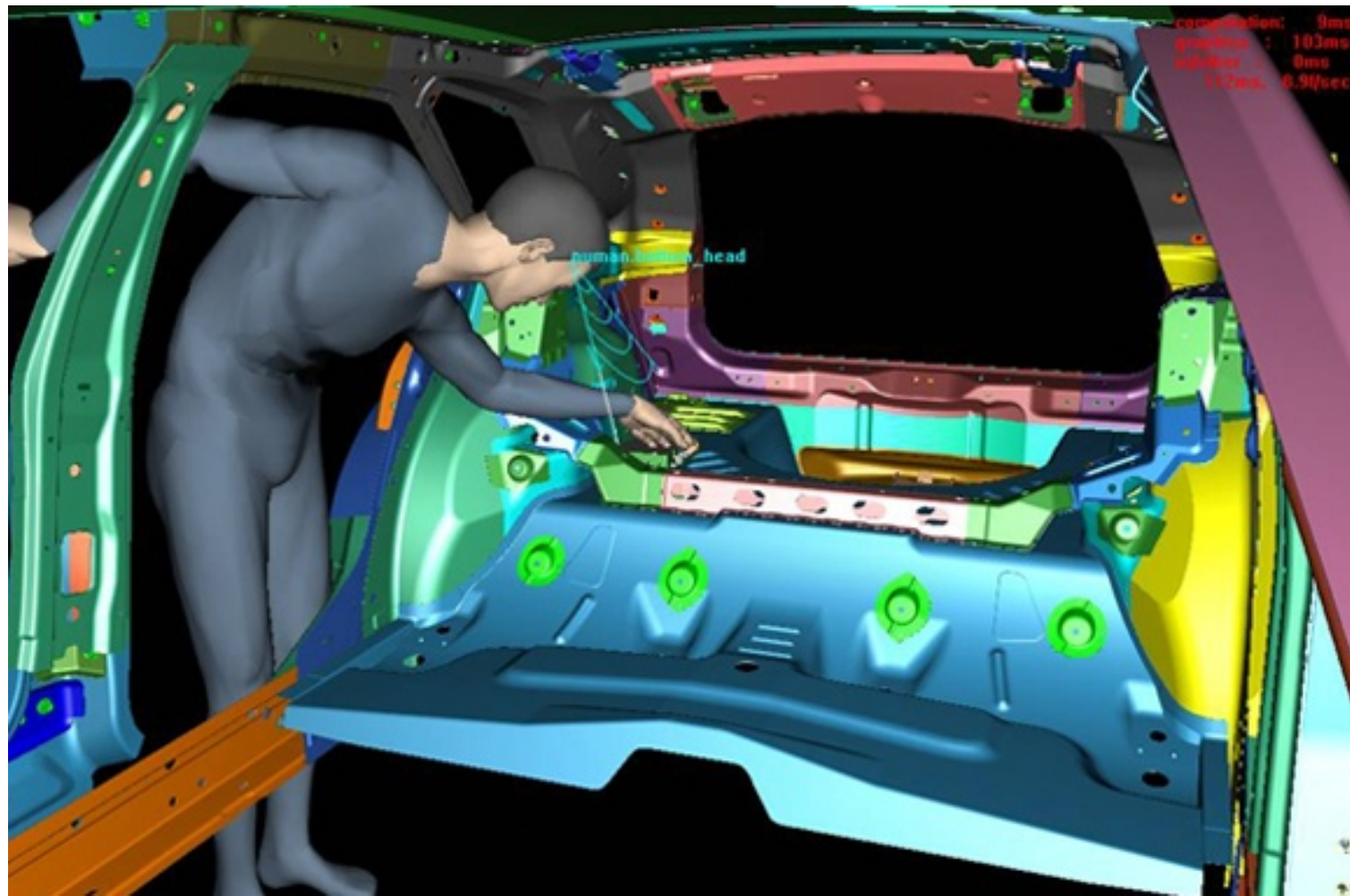
Jack human figures: Have 69 segments, 68 joints, a 17-segment spine, 16-segment hands, coupled shoulder/clavicle joints and 135 degrees of freedom.



At Ford Motor Co., Jack works the manufacturing line, testing out production cells to identify possible safety hazards or ergonomic issues like awkward postures or hard-to-fit assemblies.

FORD'S ERGONOMICS LAB AND USE OF JACK AND JILL

https://www.youtube.com/watch?v=3fQ1aau_7P0



DIGITAL MODELING OF
“JACK” GETTING INTO A
VEHICLE WITH VIEWS
FROM THE SIDE AND FROM
THE FRONT.

**THE JACK PROGRAM
INCLUDES ANALYSES
RELATED TO:**

- RAPID UPPER LIMB
ASSESSMENT (**RULA**)
- PROPER LIFTING
- COMFORT LEVELS
- POSTURAL ANALYSIS &
ENERGY EXPENDITURE

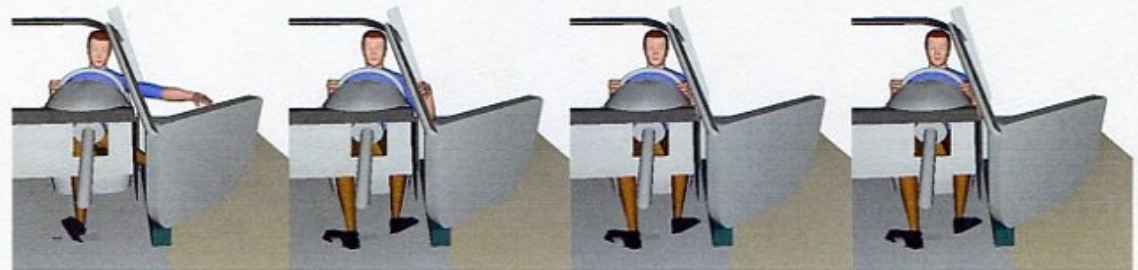
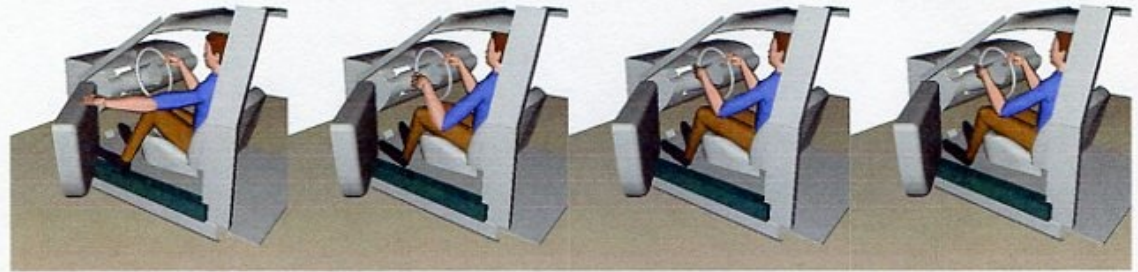


Figure 4. Frames from an ingress simulation using hip-first strategy.

Santos™ is a complete environment for human modeling and simulation.

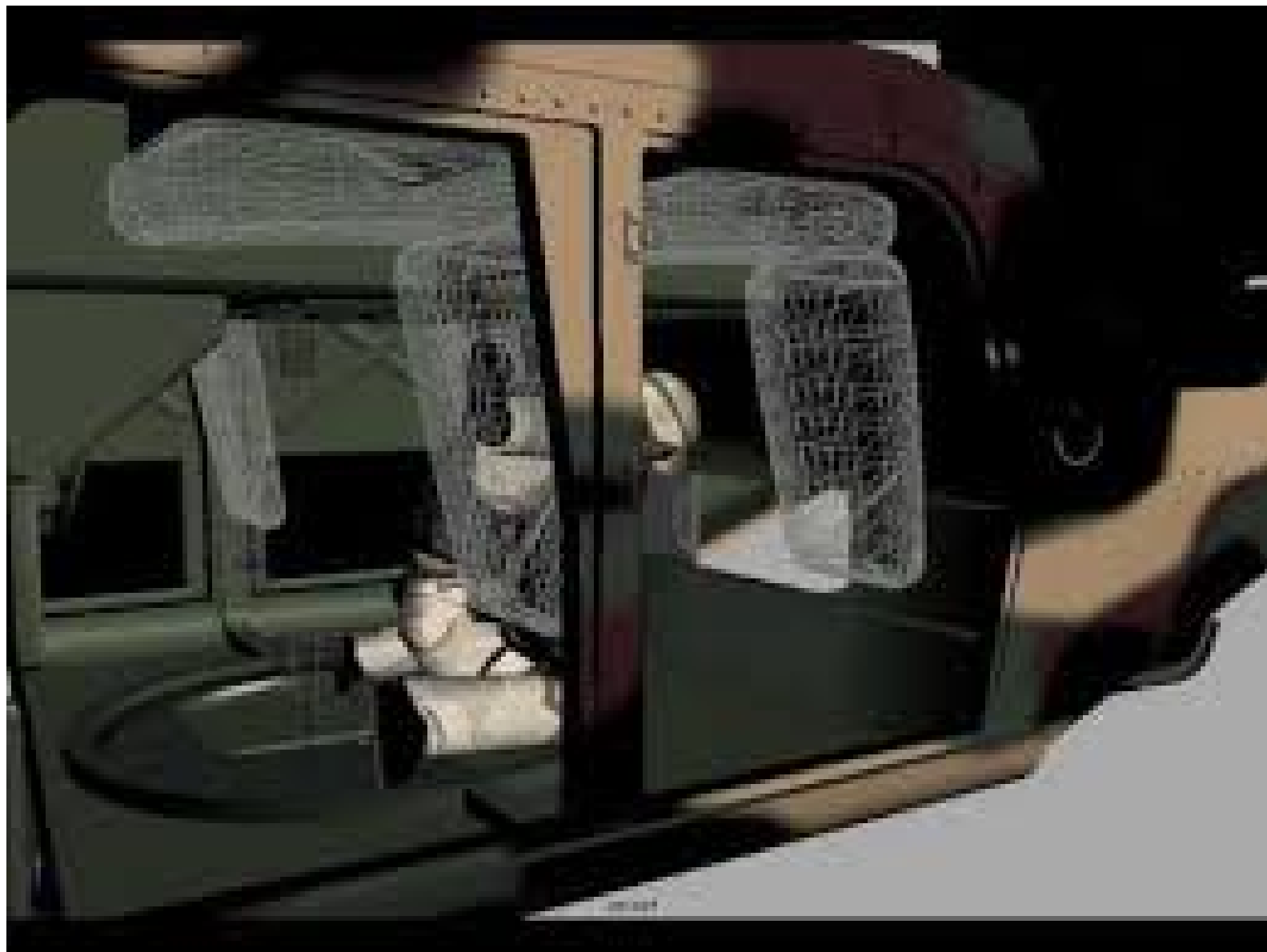
It is an anatomically correct digital human that has intelligence, has a complete musculoskeletal system, his skin deforms, and his muscles contract.

He can predict realistic motions and postures, and can interact with the environment. A user can monitor **Santos™**'s vitals, energy, discomfort, and other human performance measures while he performs a task un-aided. **Santos™** is a fifth generation human model.



<http://www.youtube.com/watch?v=byMiqbZsHl4>

SANTOS VIRTUAL SOLDIER ESCAPING FROM AN OVERTURNED HUMVEE



https://www.youtube.com/watch?v=5Js8r_Yp3Hg

SANTOS VIRTUAL SOLDIER GETTING ON, INTO, AND OUT OF A MILITARY TANK



<https://www.youtube.com/watch?v=JkXNVwzq-8Q>

Meet Sophia, SantosHuman Inc.'s first female avatar.

Sophia embodies the same biomechanically accurate modeling and simulation of human activities as Santos, the SantosHuman male avatar, with one exception.

Her strength settings have been modified to simulate that of 65% of North American women.

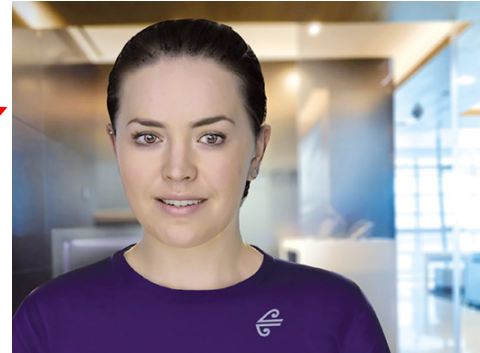


WHAT WOULD YOU DO IF YOU MET A DIGITAL HUMAN?

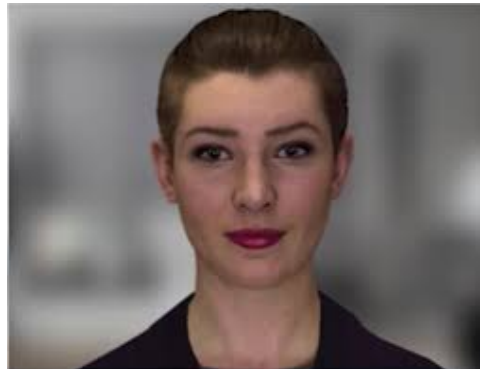
As it turns out, digital humans are already among us. All of these digital assistants were developed by the **Soul Machines Co.**:



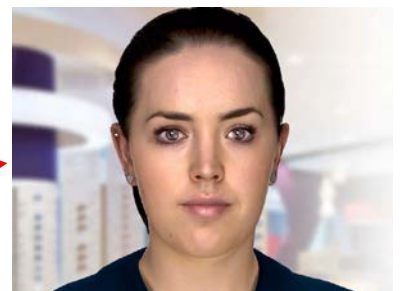
Autodesk users have been interacting with **AVA** since the end of last year, when calling into customer support.



Travelers on **Air New Zealand** have been utilizing the services of **Sophie**, its digital travel concierge for a little more than six months.



Australians with disabilities are now able to work with a digital human named **Nadia**, designed to help users better navigate the **National Disability Insurance Scheme** (NDIS) and find the information they need. Nadia can read users' emotions by "watching" their faces – not to mention give them the experience of talking to a celebrity, sort of: **Nadia's voice is provided by Academy Award-winning actress Cate Blanchett.**



Very soon, the **banking customers of NatWest** will meet **Cora**, their new personal banking assistant.

She's smart, a master of high-end design software. She's kind, ready to help at any time of day or night.

She's the new AVA—an acronym for automated virtual assistant—a next-generation digital assistant created by Autodesk Inc. to help its customers with its software.

Autodesk hopes AVA's animated face, New Zealand-accented voice and touch of emotional savvy will engage customers at a deeper level than current conversational software can. "If a customer tells [the virtual-human version of] AVA, 'I'm having trouble,' I want her to frown a bit and say, 'I'm sorry, let me see if I can help,'"



Soul Machine's Sophie is being used as a Customer Service assistant for New Zealand Airways.



<https://www.youtube.com/watch?v=qpCl-axNgbs>

The **Soul Machines company** is a ground-breaking, high tech company of Artificial Intelligence (AI) researchers, neuroscientists, psychologists, artists and innovative thinkers; re-imagining how we connect with machines.

They bring technology to life by creating incredibly life-like, emotionally responsive artificial humans with personality and character that allow machines to talk to us literally face-to-face!

Their vision is to humanize artificial intelligence to better humanity.

They developed the concept of Baby X, and many computer generated persons to use as personal assistants for various businesses.



Soul Machines is on a mission to create intelligent, emotionally responsive avatars that can learn and react just like you, and it all started with an incredibly life-like computer model known as Baby X. Mark Sagar is the CEO of the Soul Machines Co.

Taking inspiration from Sagar's own daughter Francesca, Mark scanned her when she was sleeping to create her digital appearance. This digital baby can respond, learn and express itself in a human-like way. Make a loud noise and she looks concerned, hold up a picture of an apple, Baby X can name it.



<https://www.youtube.com/watch?v=eAwqB9W-HQ4&t=50s>

Mark Sagar says one of his early motivators for Baby X was the challenge of creating a digital character that could animate itself – one with its own stream of digital consciousness, the ultimate animation.

"BabyX" was created as an autonomously animated psycho-biological model of a virtual infant with a bio-based brain that is controlled by the computer program.

In simple terms, BabyX is able to see you when you stand in front of her, via camera input that does facial tracking and voice analysis. She then has a bio-based 'brain' that reacts and she displays her emotional response. You can show her a pretty picture of a sheep and she will smile and say 'sheep'.



<https://vimeo.com/103501130>

Sagar's approach on this front may be his most radical contribution to the field.

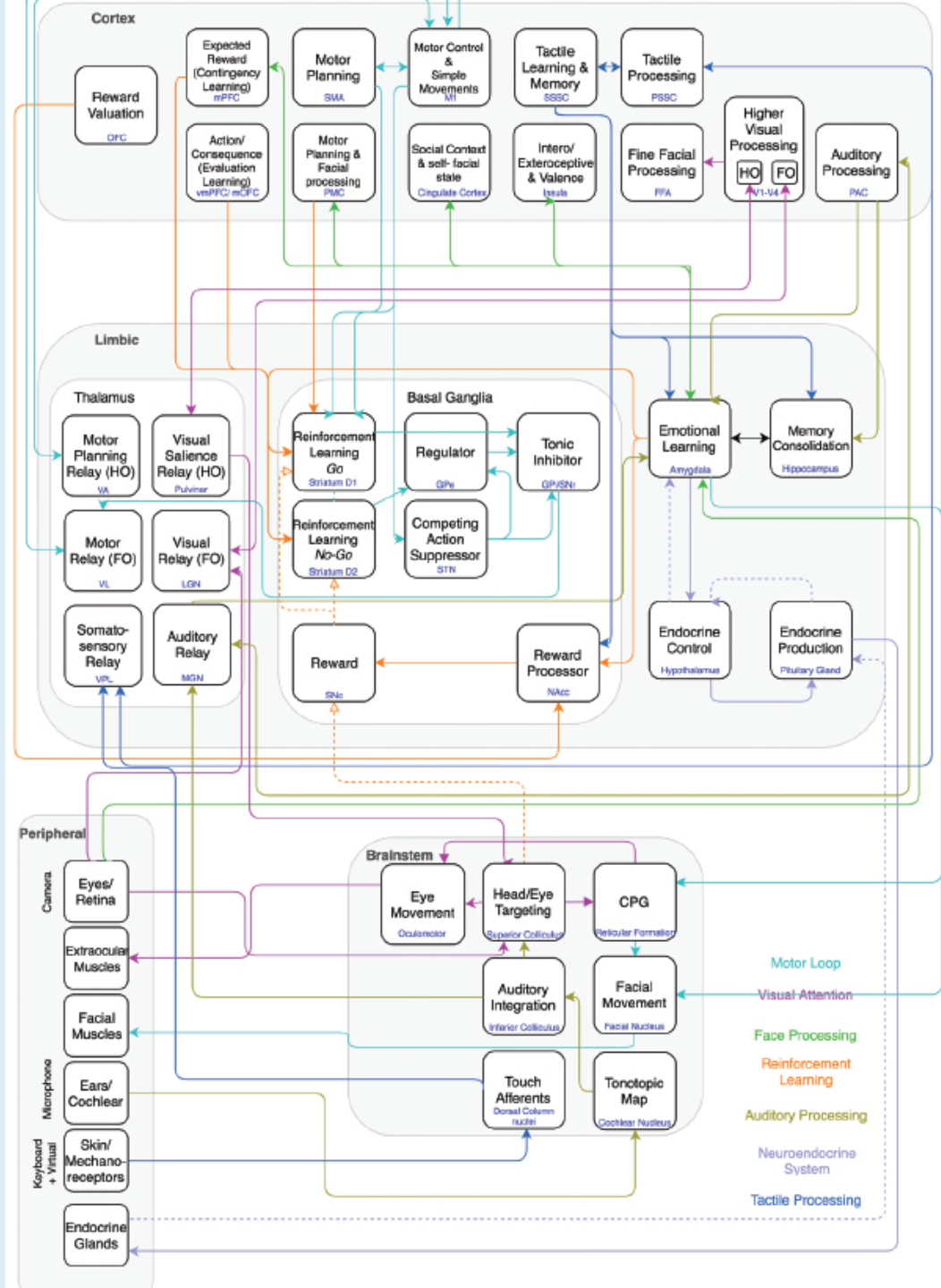
Behind the exquisite faces he builds are unprecedented biological models and simulations. When BabyX smiles, it's because her simulated brain has responded to stimuli by releasing a cocktail of virtual dopamine, endorphins, and serotonin hormones into her system.

This is part of Sagar's larger quest, using **Artificial Intelligence (AI)** to reverse-engineer how humans work.

We are trying to make a virtual (computerized) central nervous system for human computing."



The BabyX project defines a computer program architecture that is able to interconnect all of these models as a virtual nervous system, like that shown here.



In a first for education, the Vector Energy company is exploring the use of “digital human” technology in its energy education programs in primary schools.

In conjunction with New Zealand’s leading AI company Soul Machines, Vector has created Will, a “digital teacher” being trialed in its award-winning [‘Be Sustainable with Energy’ schools program](#), which is offered free of charge to schools within Vector’s Auckland electricity network. The school's program was launched in 2005 and has since educated more than 125,000 children about energy.



https://www.youtube.com/watch?time_continue=33&v=Ab0DCzFz82s



Thank you for your attention !