Virtual Human Creation Pipeline

Virtual Human Toolkit Workshop

Patrick Kenny | 9/24/2008

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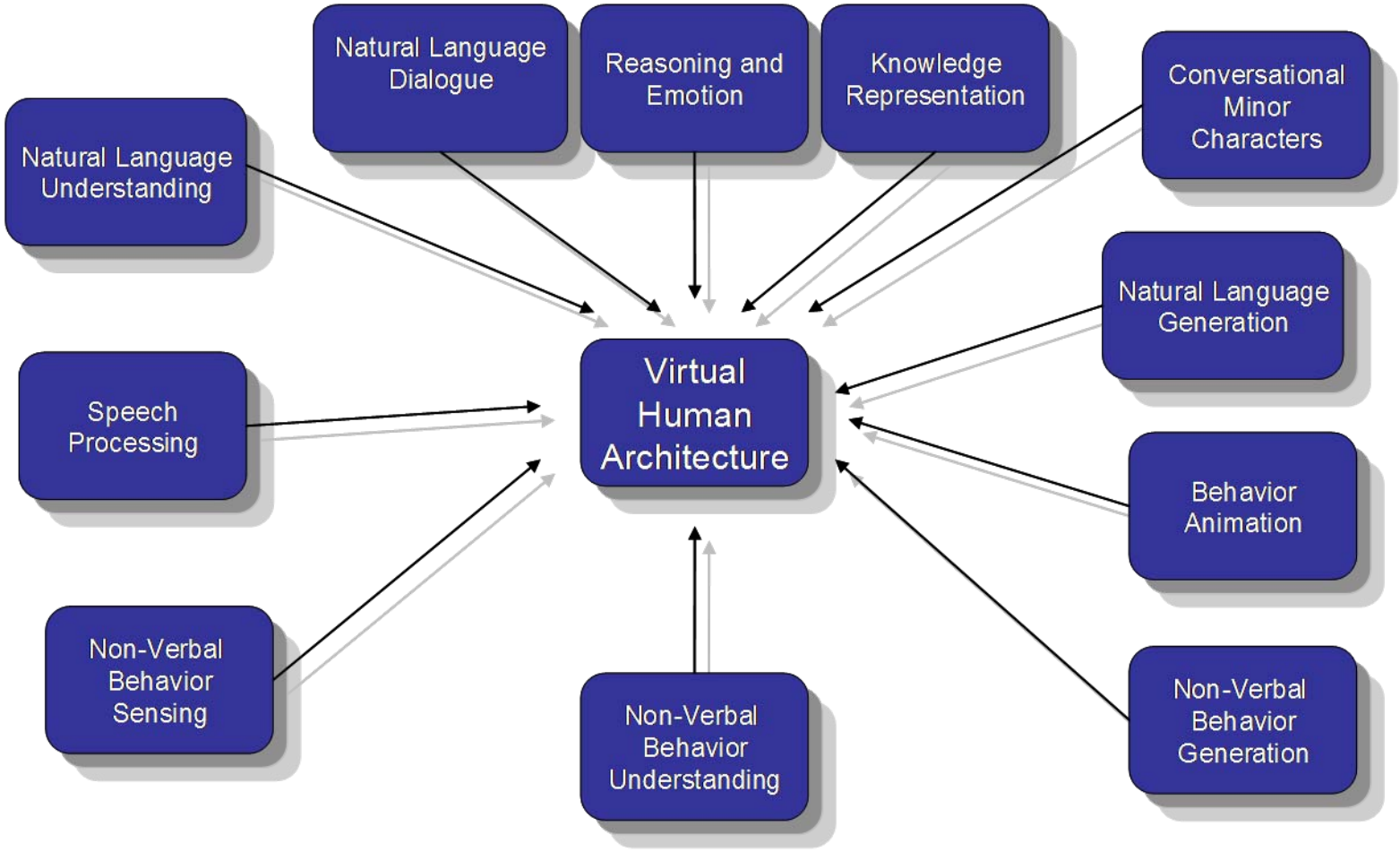
Virtual Human Architecture and Research Areas

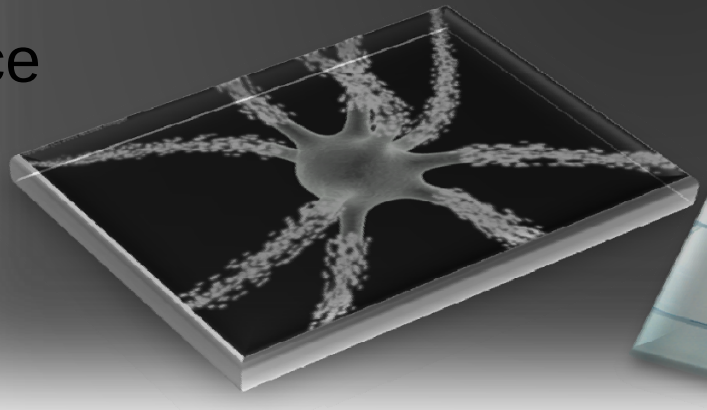


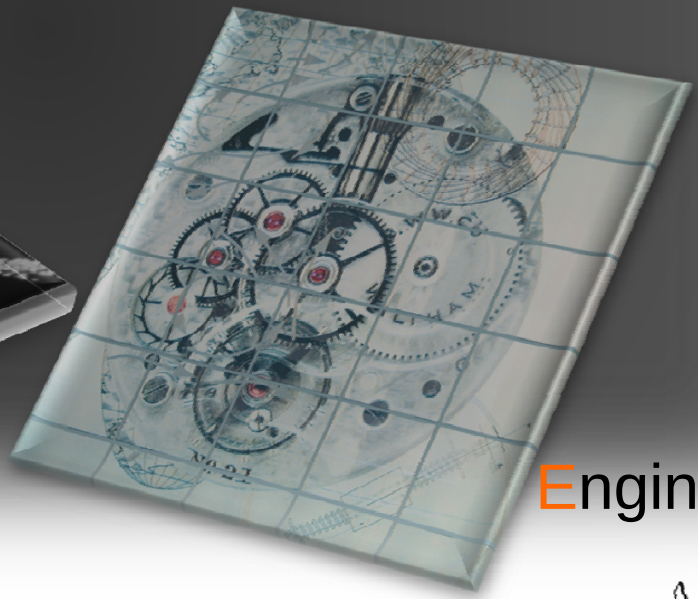
S-E-A-D

Art

Design

Science





Engineering

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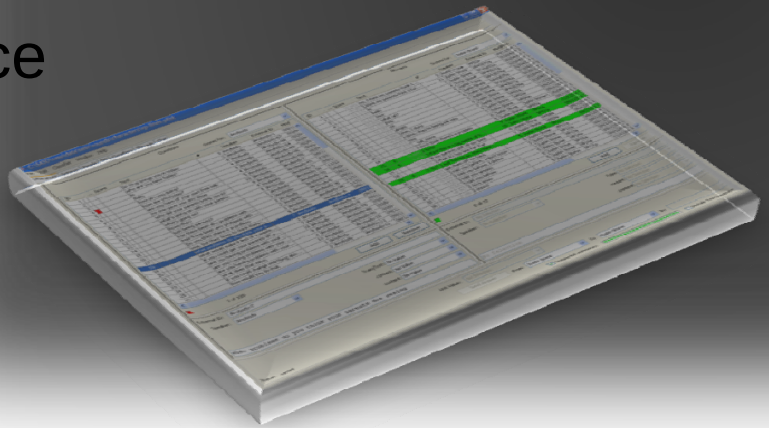
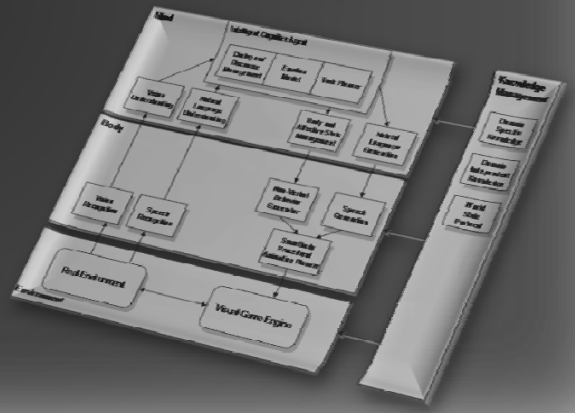
Virtual Human S-E-A-D

Design

Art

Science





Engineering

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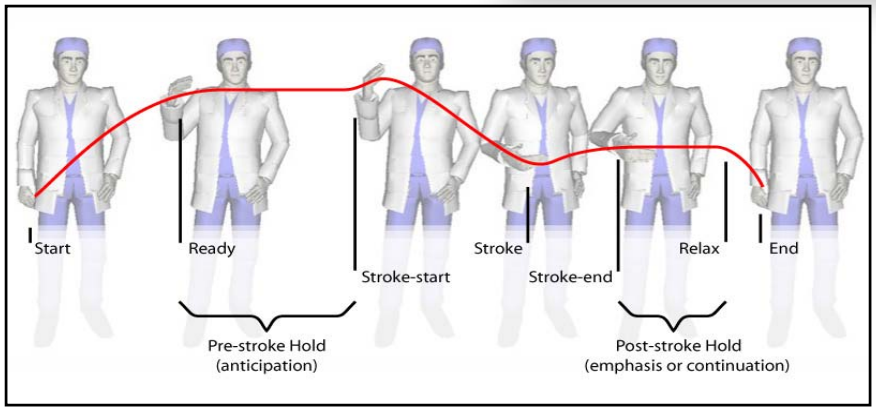
Art

Models
Textures
Animations

Things to consider:
Skeleton
Poses
Animations -
Face, Body



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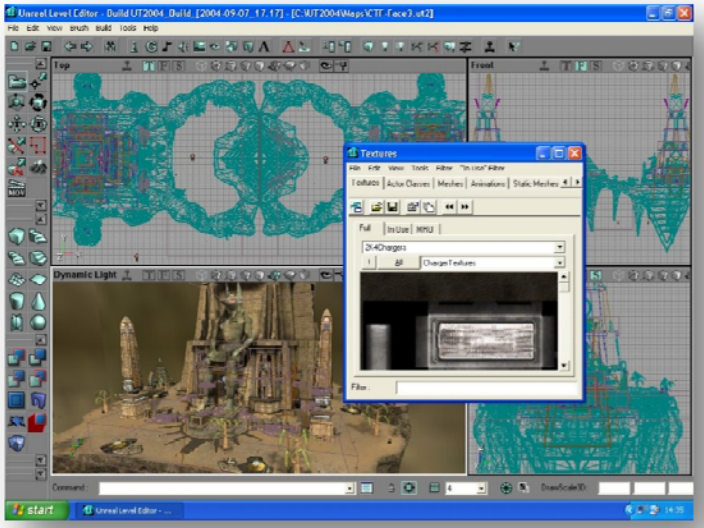
Design



Level /
Game
Design

Look
Feel
Story
Domain

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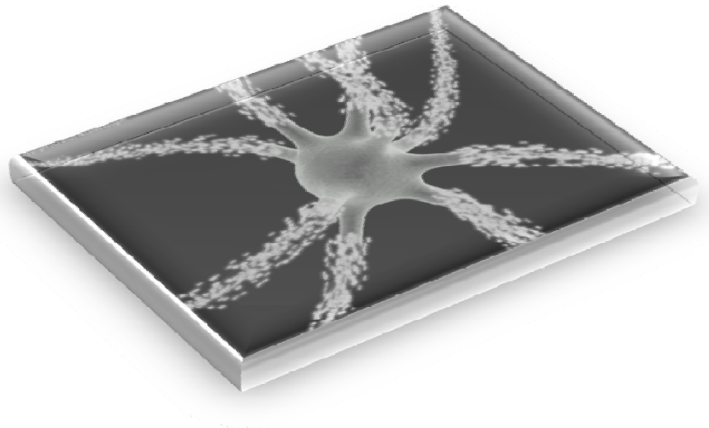
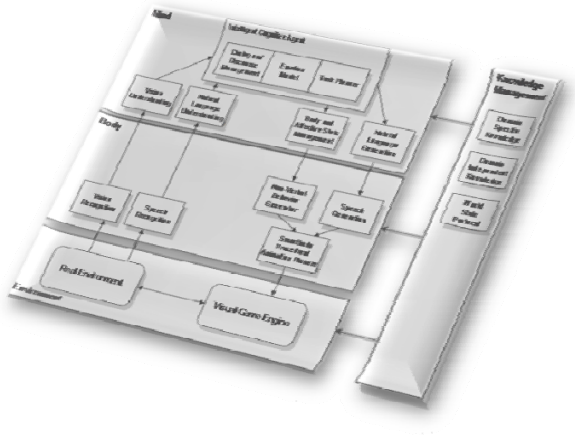
Science

- **Make VH characters more believable**
- **Use VH characters to understand human behavior more**
  - Natural Language
  - Non-Verbal behavior
  - Speech
  - Appearance
  - Vision and Gestures Detection
  - Facial Expressions
- **Applications**
  - Trainers
  - Tutors



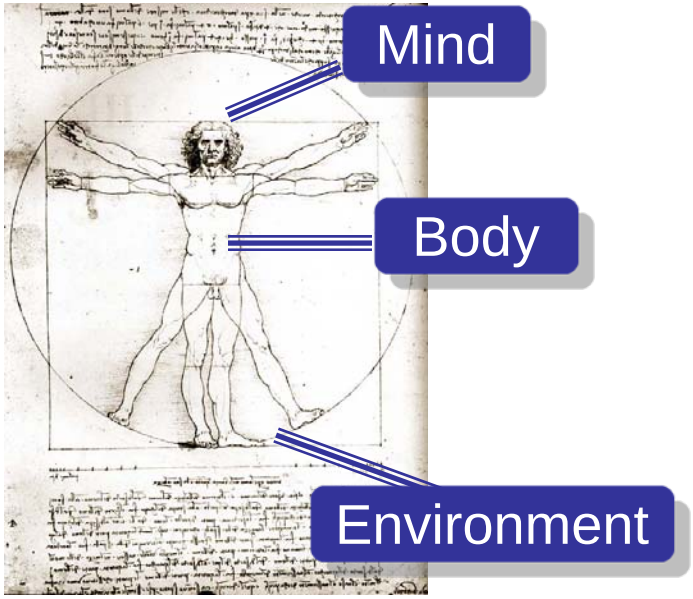
Engineering

- Designing the system and underlying technology
- How does it all fit together
- Software Engineering of large system
- Distributed and Multi-agent system

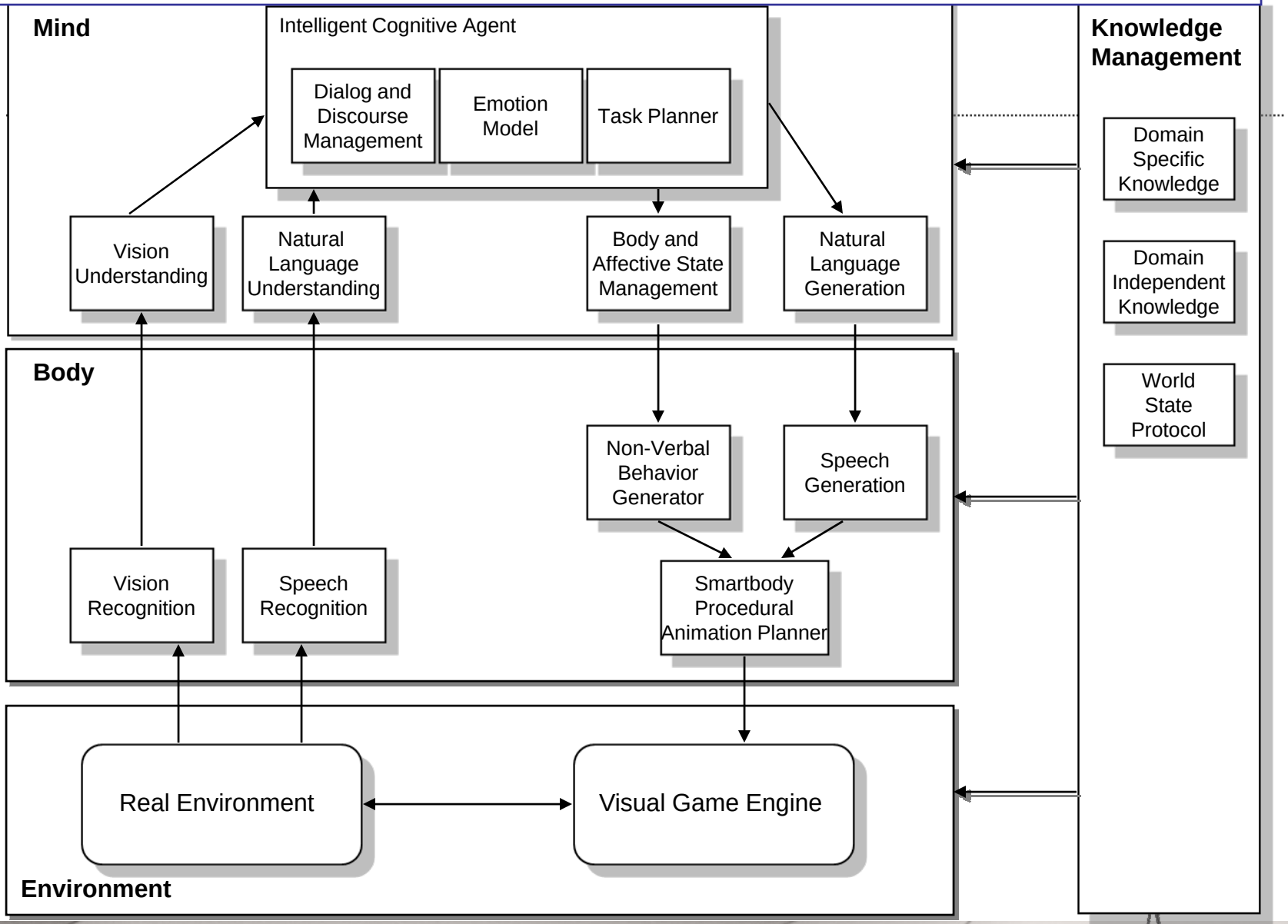


Architecture Design Principals

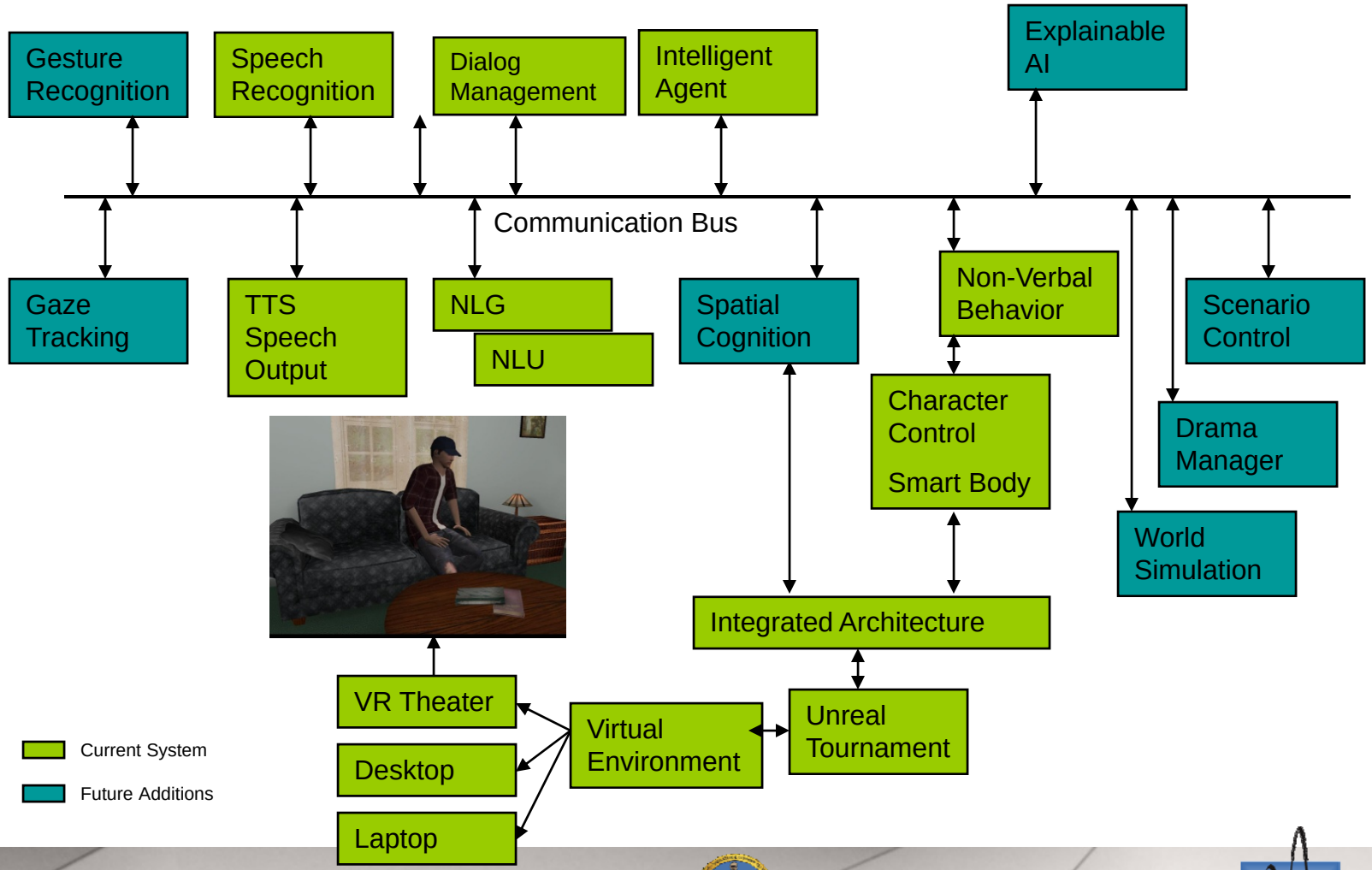
- **Modular System – One or more components from research areas**
- **Plug and Play – Easy to replace components**
- **Distributed – Allows research group to work on own piece**
- **Cognitively and psychologically plausible**
- **Open API's**
- **Not a monolithic system**
- **Multi-layered**



Virtual Human Architecture



Virtual Human Architecture

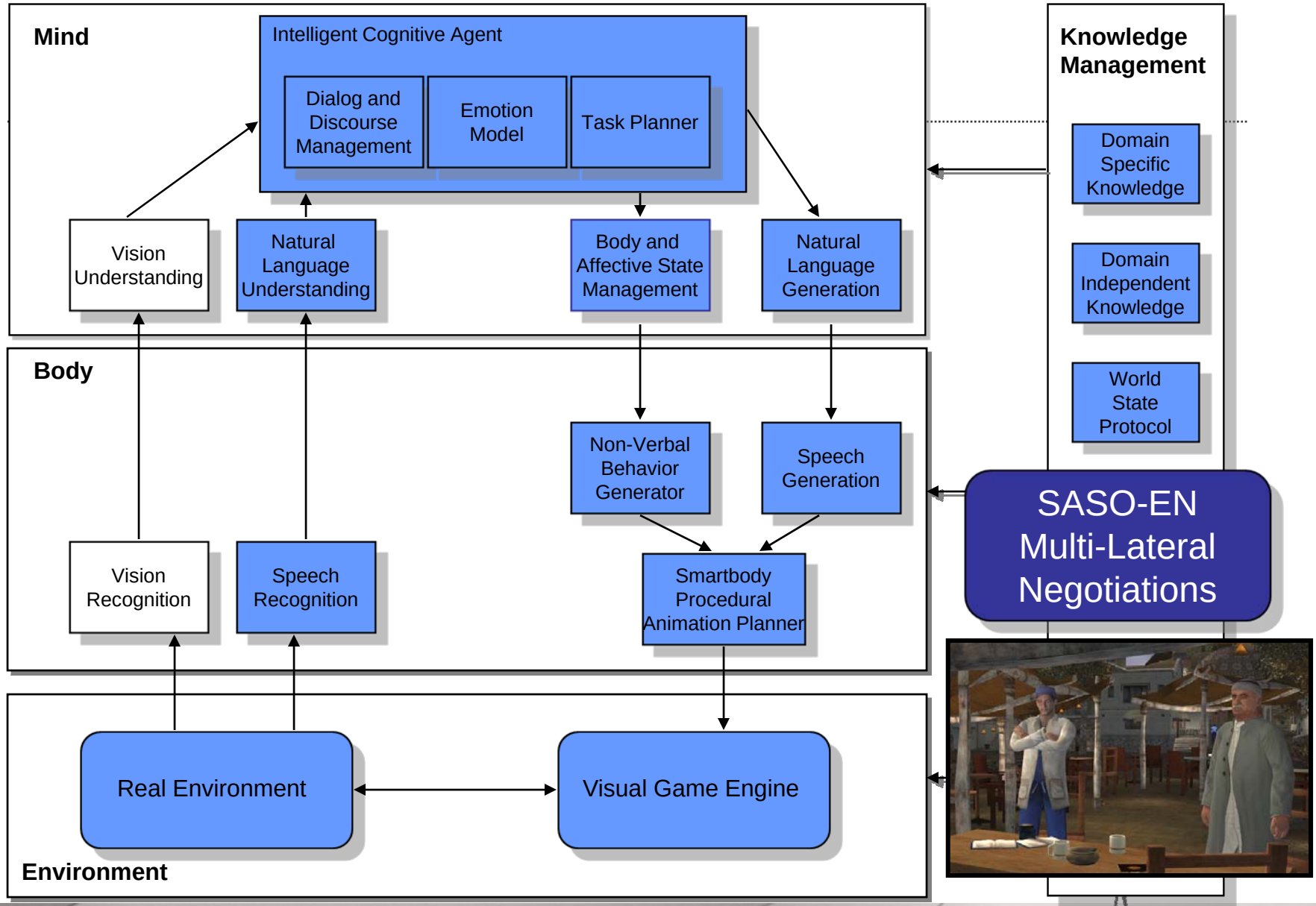


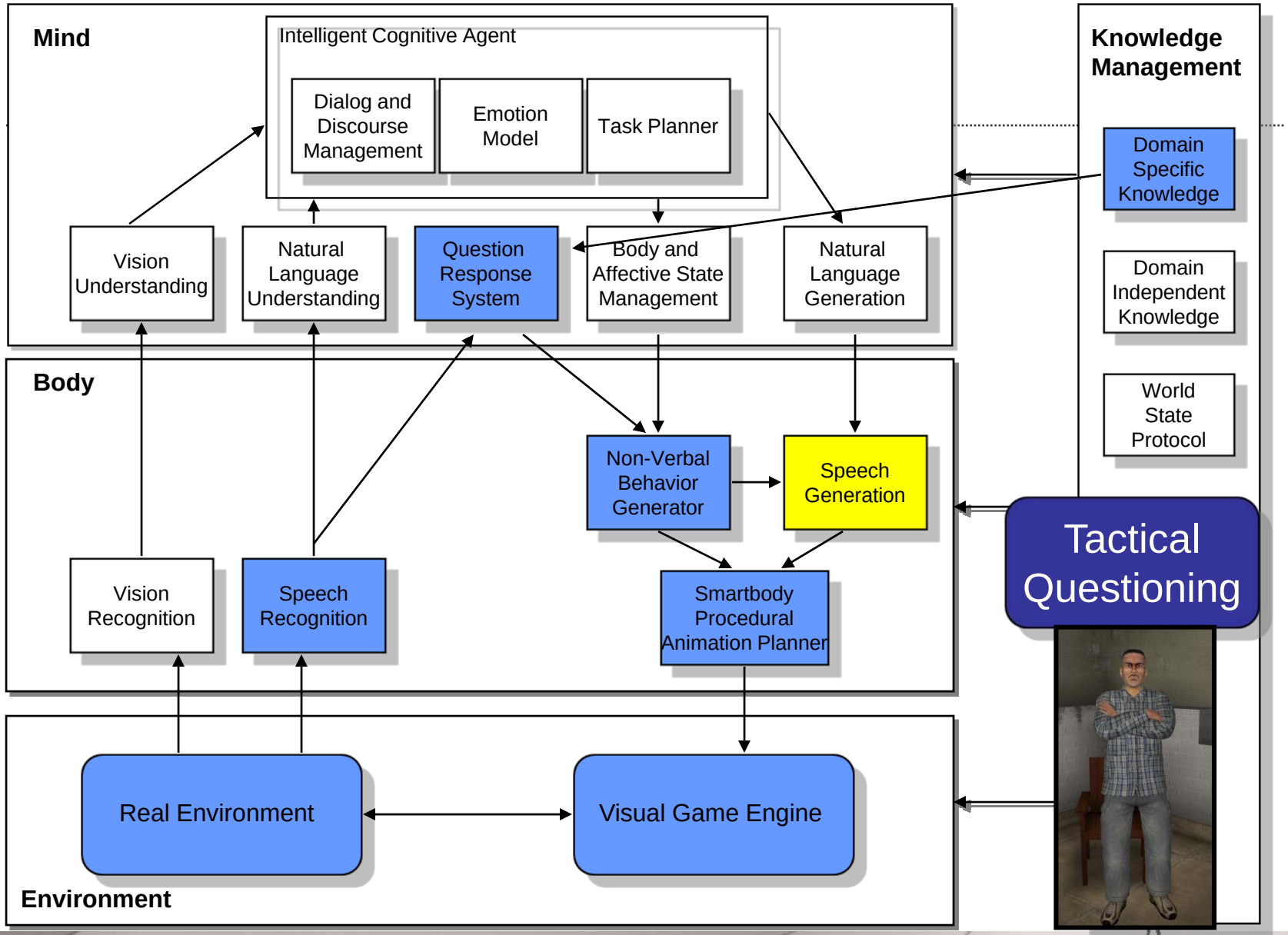
Levels of Agents

- **Cognitive Soar Based**

- **Question / Answering**

- **Uses different components in the system as needed**


Mind
Intelligent Cognitive Agent
Dialog and Discourse Management
Emotion Model
Task Planner
Vision Understanding
Natural Language Understanding
Body and Affective State Management
Natural Language Generation
Knowledge Management
Domain Specific Knowledge
Domain Independent Knowledge
World State Protocol
Body
Non-Verbal Behavior Generator
Speech Generation
Vision Recognition
Speech Recognition
Smartbody Procedural Animation Planner
SASO-EN Multi-Lateral Negotiations
Real Environment
Visual Game Engine
Environment


Mind
Intelligent Cognitive Agent
Dialog and Discourse Management
Emotion Model
Task Planner
Vision Understanding
Natural Language Understanding
Question Response System
Body and Affective State Management
Natural Language Generation
Knowledge Management
Domain Specific Knowledge
Domain Independent Knowledge
World State Protocol
Body
Non-Verbal Behavior Generator
Speech Generation
Vision Recognition
Speech Recognition
Smartbody Procedural Animation Planner
Tactical Questioning
Real Environment
Visual Game Engine
Environment

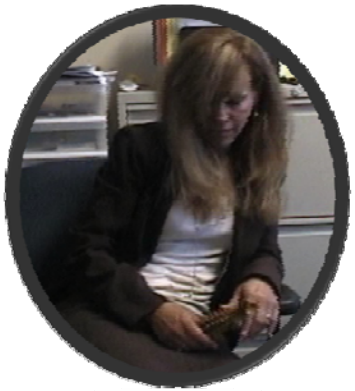
Technical Details

- **Communications System**
  - Active MQ – Java based Messaging System (Open Source)
- **Message Protocol**
  - Virtual Human Messaging System (VHMS)
  - BoneBus – Send Animation Bone data to Game Engine
  - BML – Behavior Markup Language
  - FML – Functional Markup Language
- **Languages in System**
  - Java, C++, C#, tcl/tk, python, perl, Microsoft Windows Based

Creating the Justina Virtual Patient

Concept

DSM IV TR
PTSD
Role Play
Expert opinion



Establish Character

Design

History and background
Artwork
Character
Environment

Application / Experimental Requirements

Develop

Knowledge
Language
Behaviors
Gestures

Choose Technological Components

Apply

Training
Research
Education

Collect Data
Assess System
Measure Value

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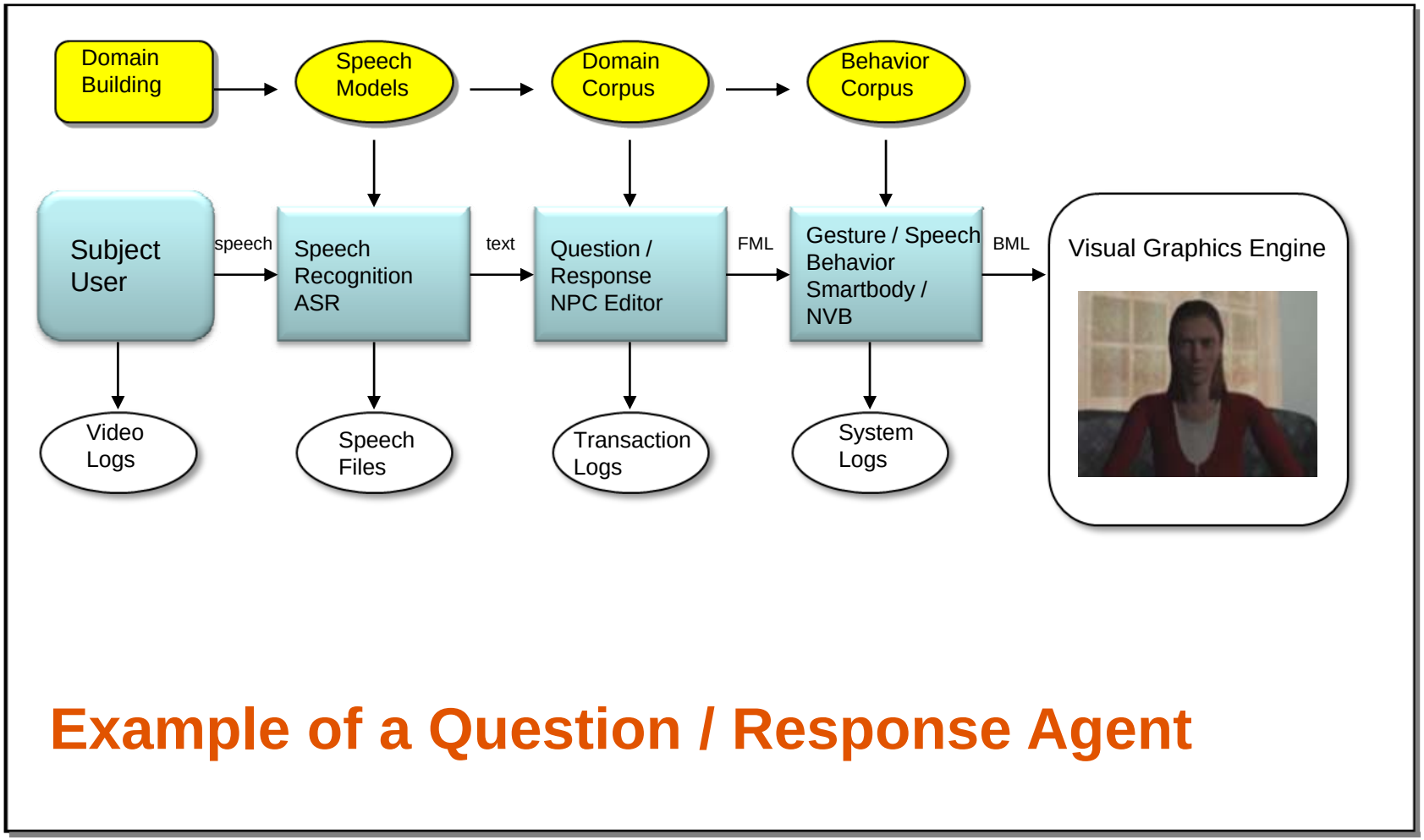
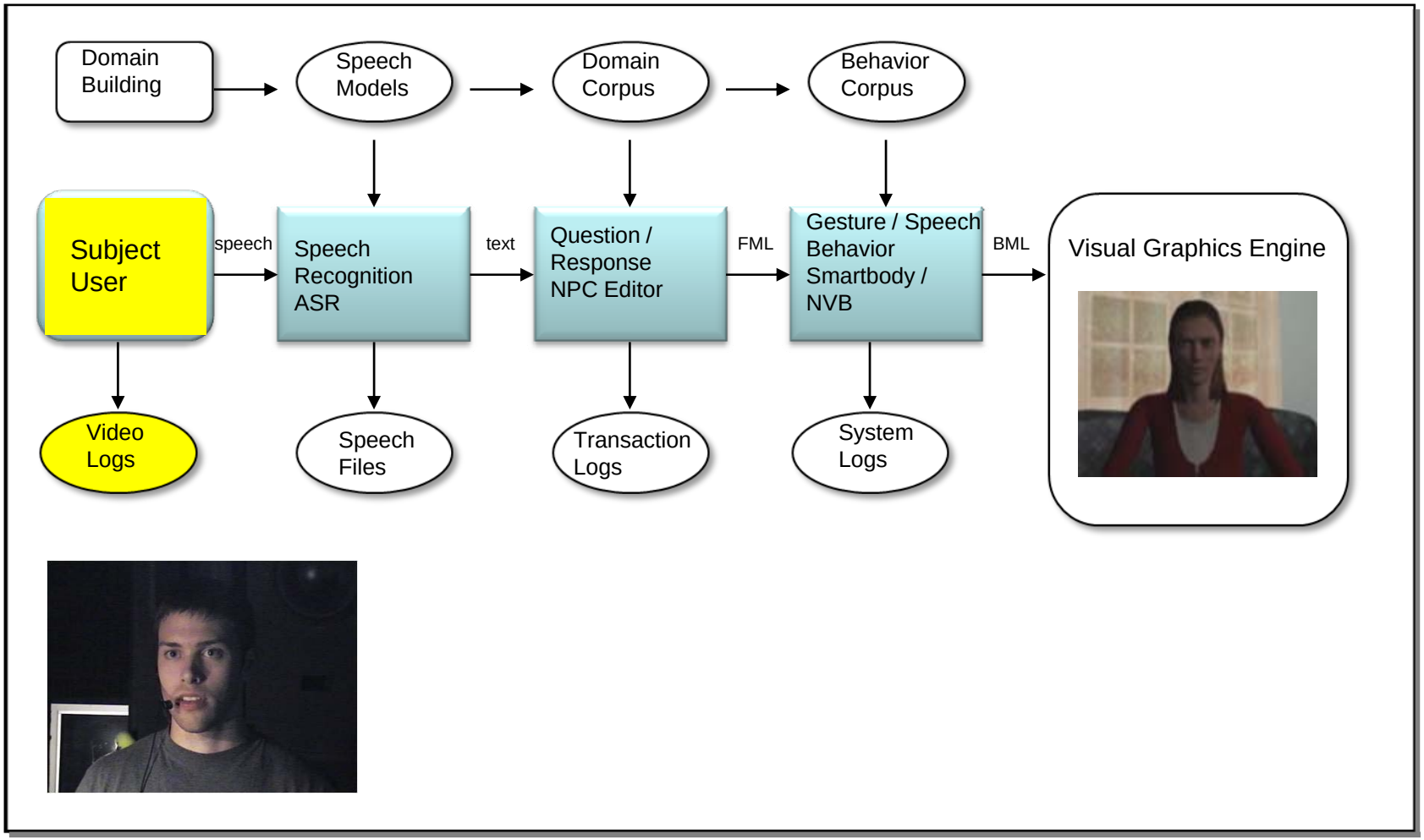
System Interaction – Domain Building



Example of a Question / Response Agent

System Interaction – User Talks to System



Wave Form

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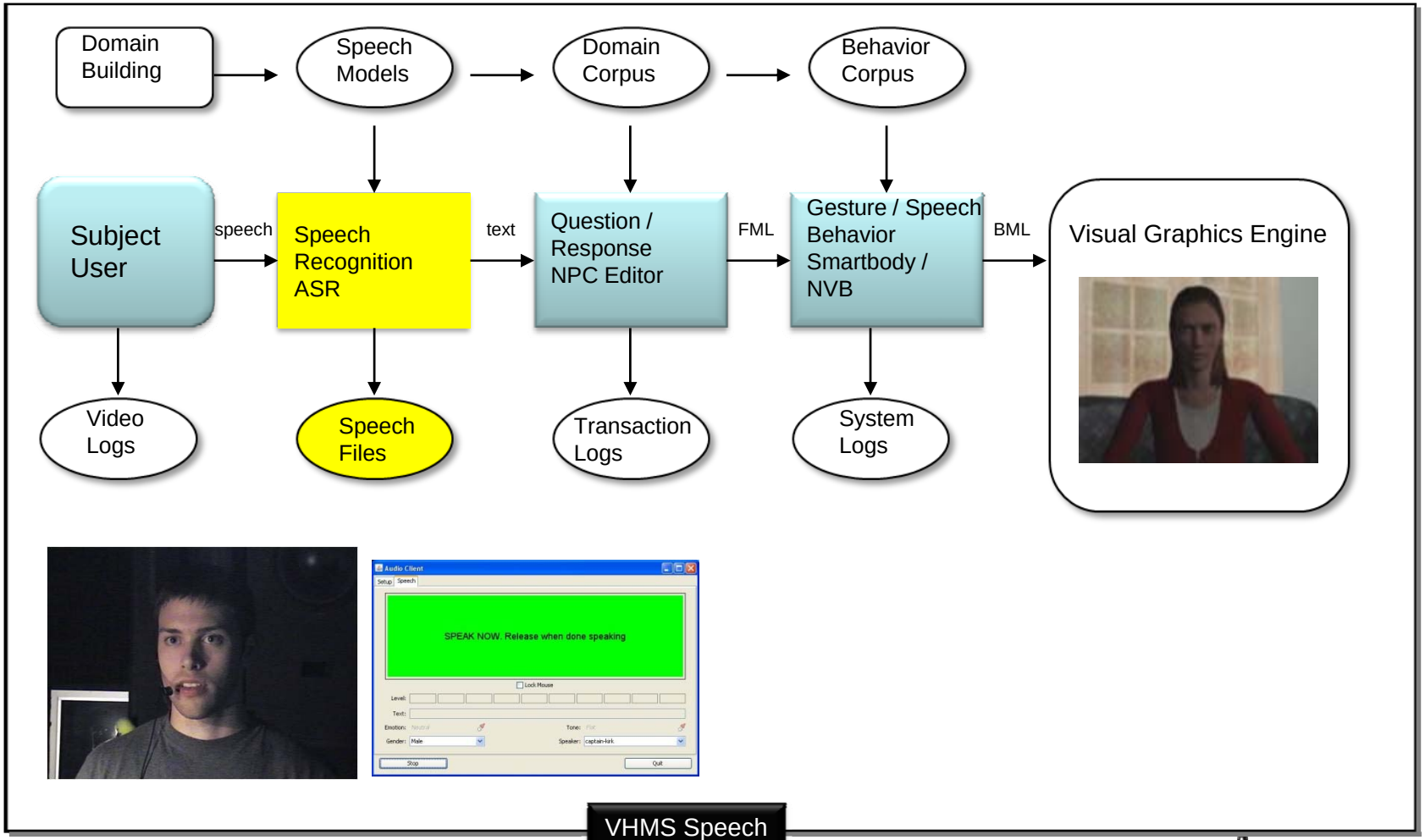
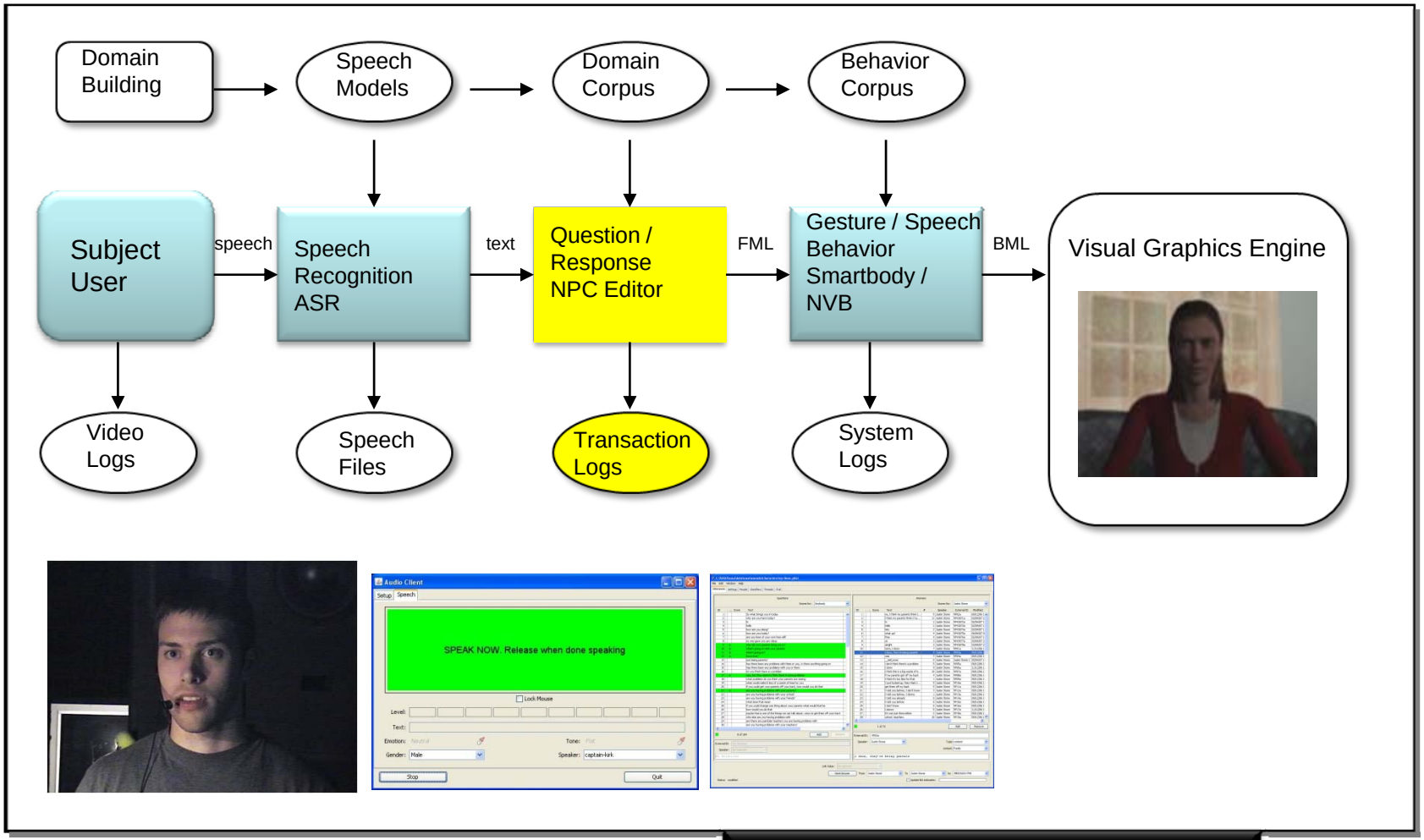
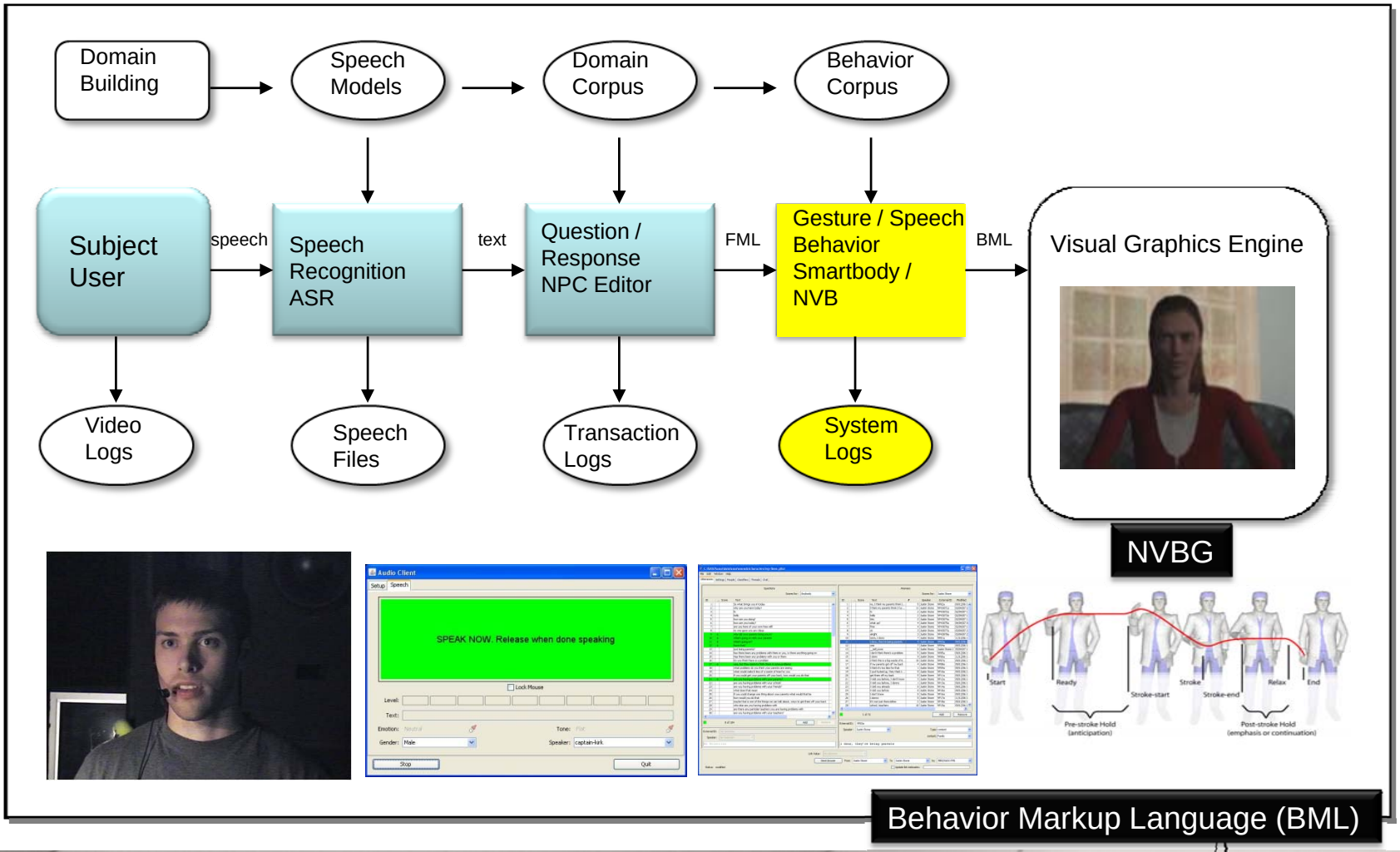
System Interaction – Speech recognition



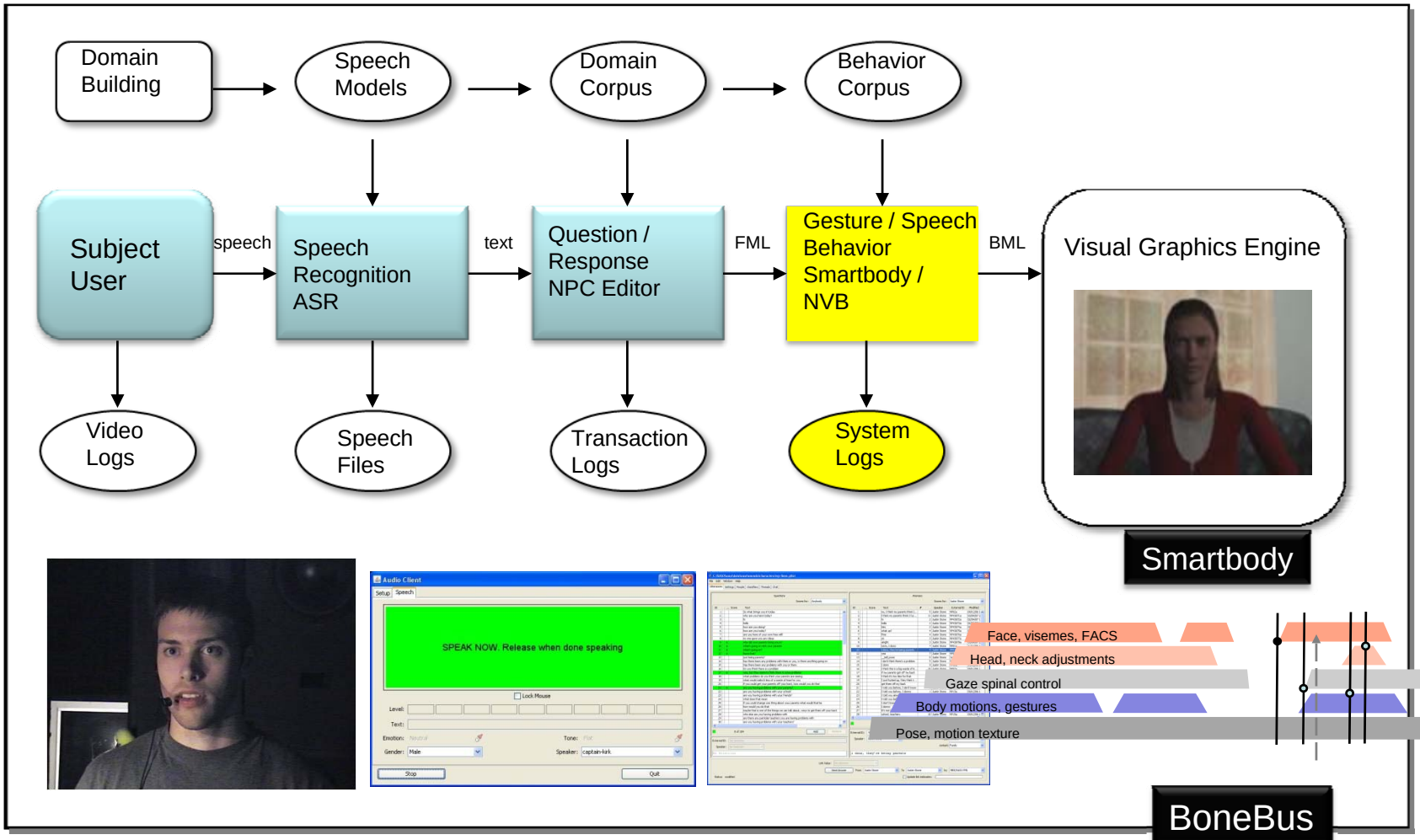
System Interaction – Question / Response



System Interaction – Non-Verbal Behavior Applied



System Interaction – Non-Verbal Behavior Applied



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Demo of SASO-ST

- **Later today we will show the more advanced Cognitive Agents**
- **Tutorials tomorrow go into more detail on the question/response agents**

ICT Virtual Human Independent Research Projects

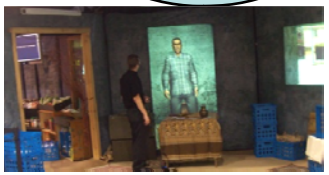
Dr. Perez
SASO-ST
SASO-EN

Elder-Al-Hassan
SASO-EN

Minor Characters

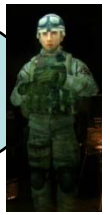
CAB / DUPE Characters

Flatworld
C3IT
Cultural training



ELECT
Bi-Lat

Sgt. Blackwell



Training

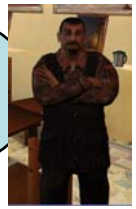
Research

Virtual Human System

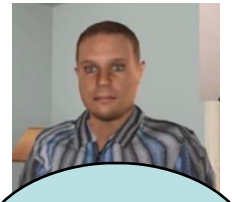
Marketing

Sgt. Star

Hassan
Emotional Dialog Modeling



Science



Raed
Tactical Questioning

Rapport
Agent Study

Gun Slinger

Museum Docent

Clinical Diagnosis

Justina
Virtual Patient

Justin
Virtual Patient

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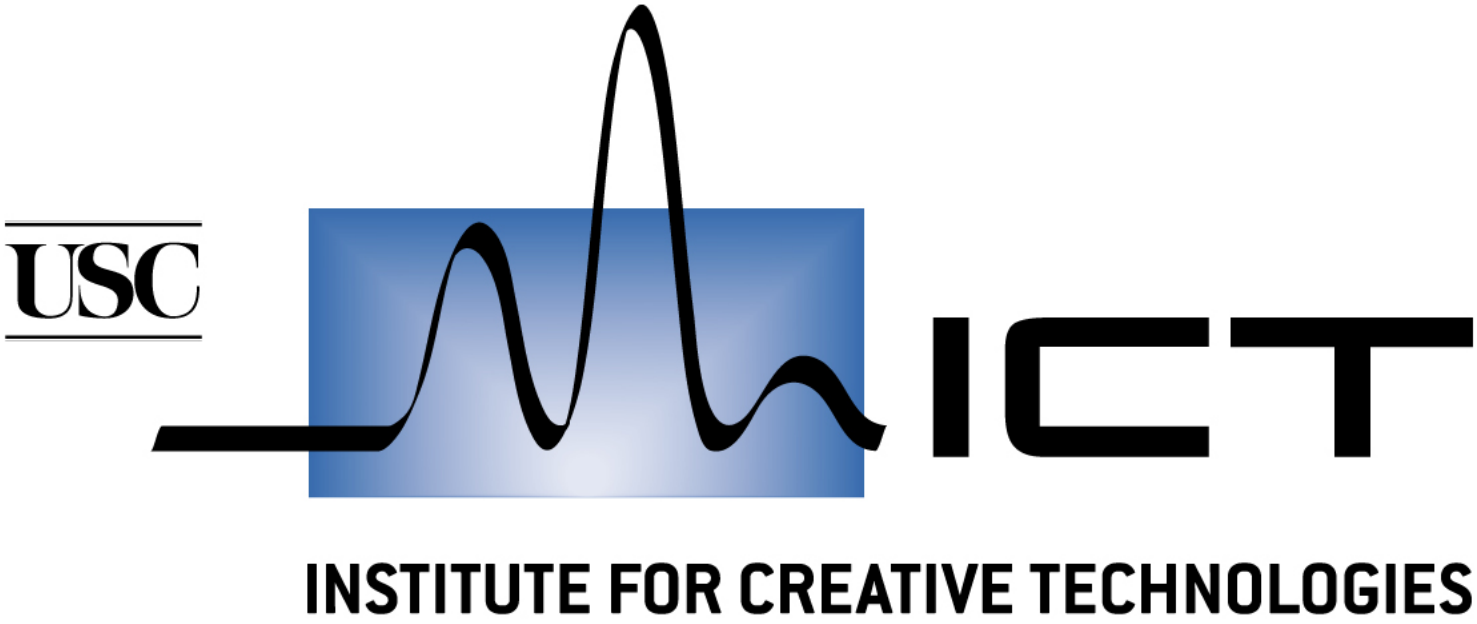
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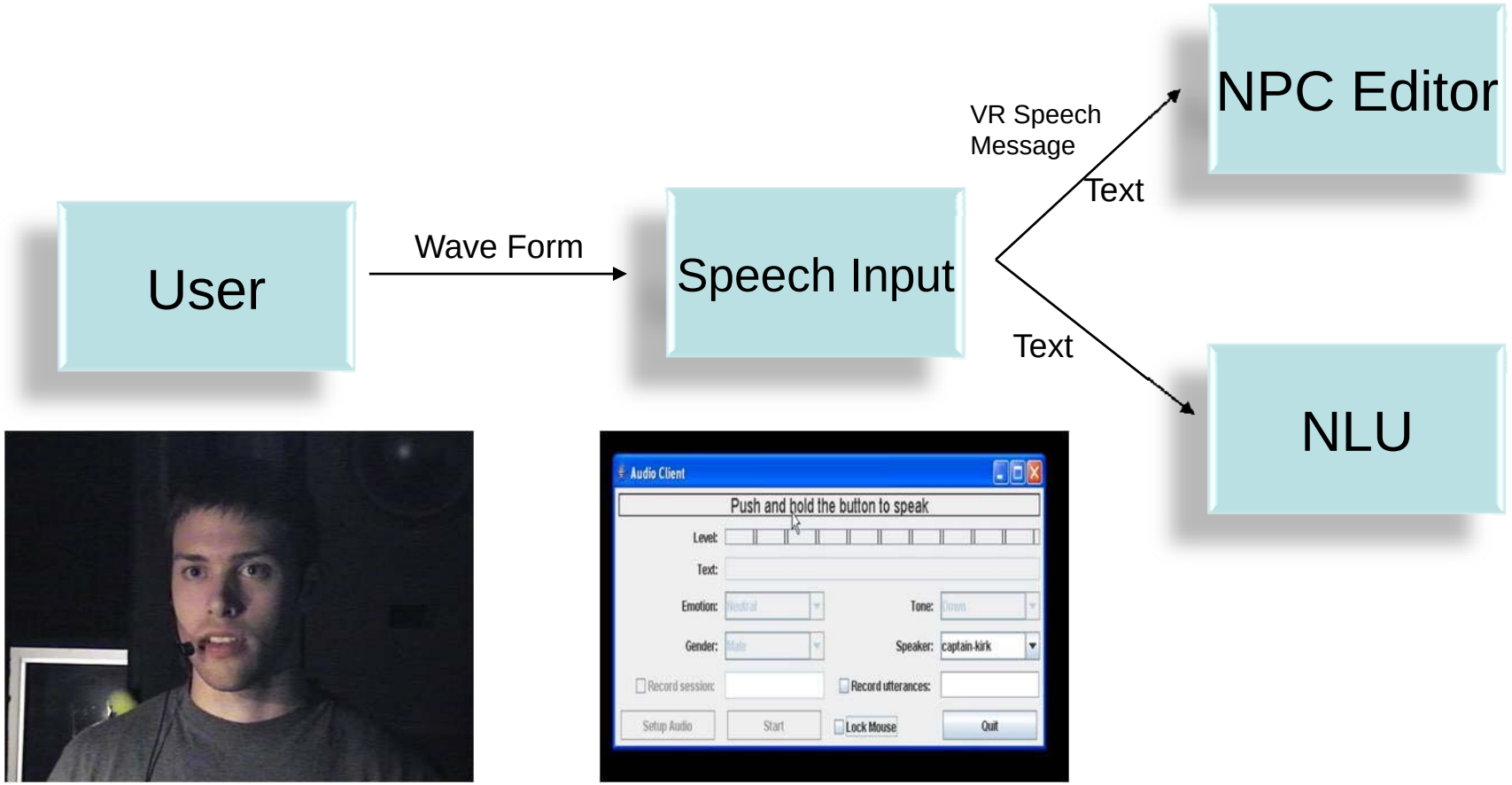
Virtual Human Pipeline

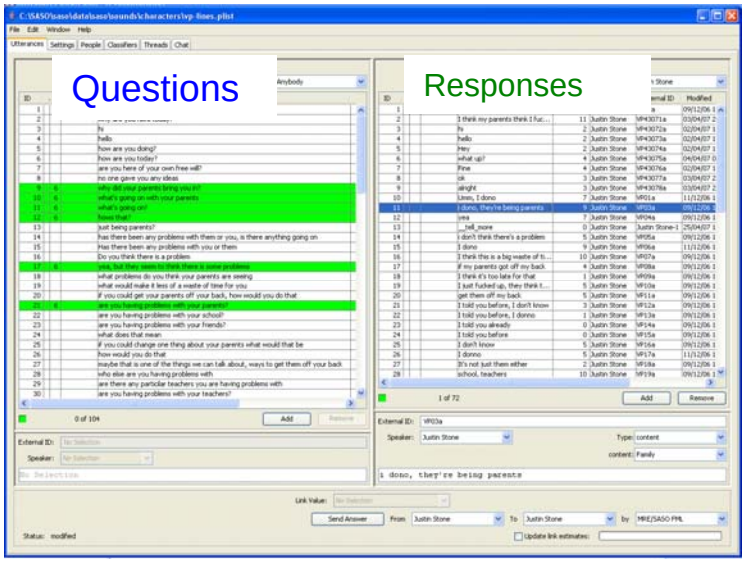


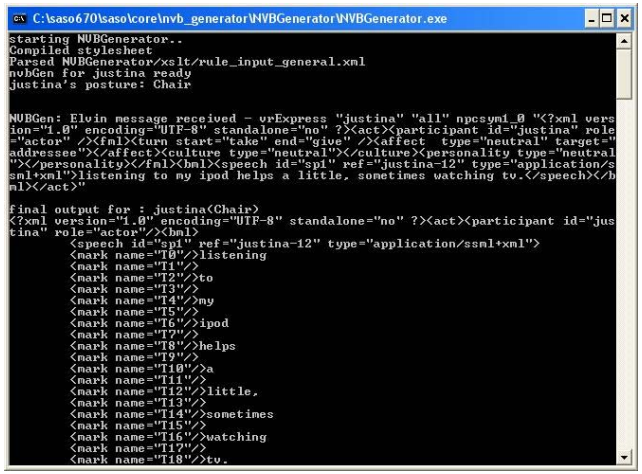
NPC Editor

vrExpress {"justina" "all" npcsym2_0 "<?xml version="1.0" encoding="UTF-8" standalone="no" ?><act><participant id="justina" role="actor" /><fml><turn start="take" end="give" /><affect type="neutral" target="addressee"></affect><culture type="neutral"></culture><personality type="neutral"></personality></fml><bml><speech id="sp1" ref="justina-12" type="application/ssml+xml">listening to my ipod helps a little, sometimes watching tv.</speech></bml></act>"}

Functional Markup Language (FML)

NVB





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NLU

Frames

Agent

Task & Emotion Reasoning

Manage Dialogue

Human Speech

gsym29

CAPTAIN: ill see to it personally

gsym30

CAPTAIN: thank you doctor

gsym31

CAPTAIN: goodbye

human nlu

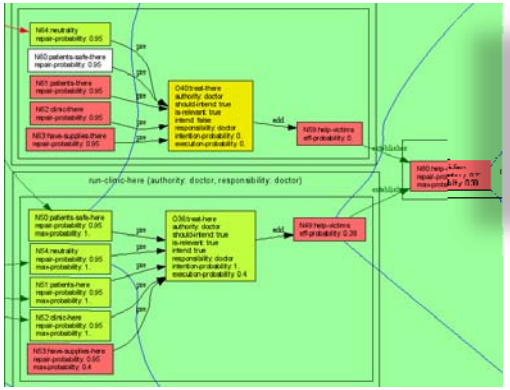
s.sem.modality problematic

gsym30

s.addressee doctor
s.sem.theme you
s.sem.type thank

gsym31

s.sem.type goodbye



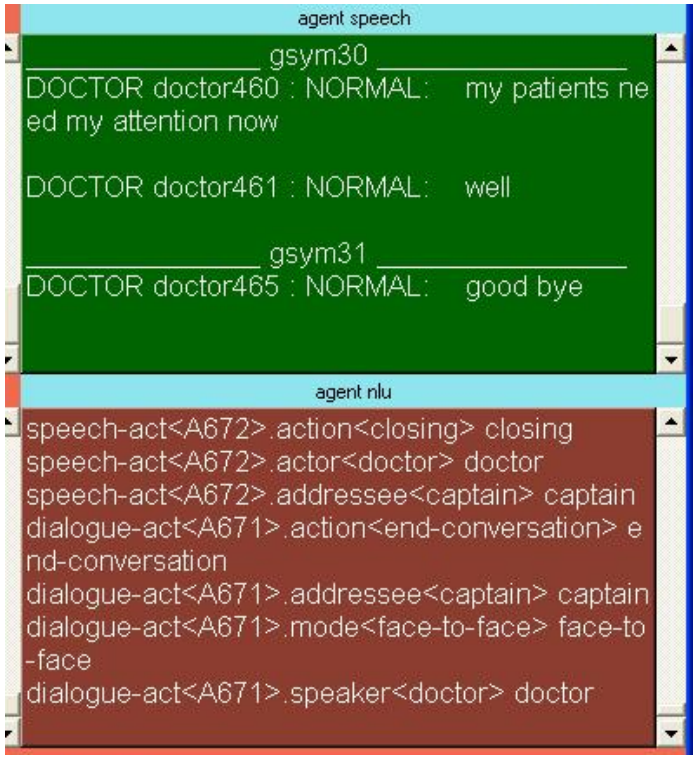
Action Planning

Agent

Functional Markup Language (FML)

NVB

NLG



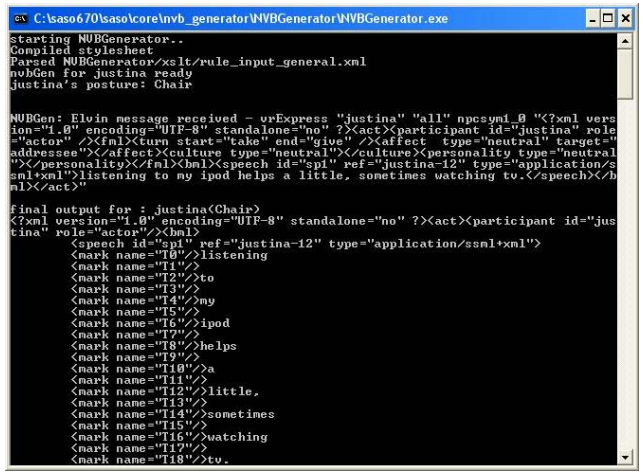
Rules

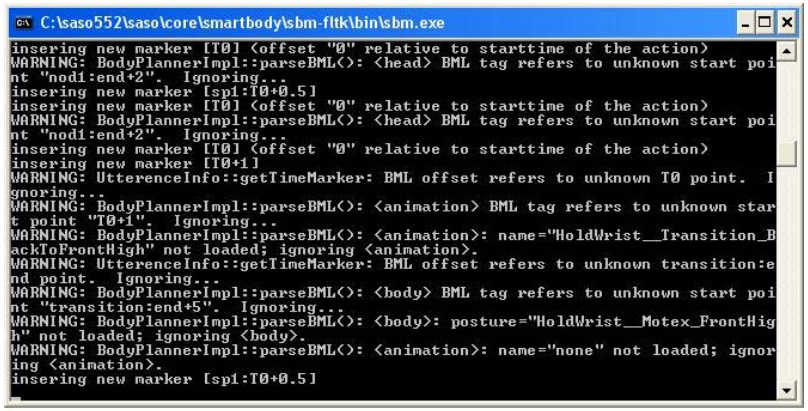
NVB

Smartbody

vrSpeak {justina all npcsym2_0 <?xml version="1.0" encoding="UTF-8" standalone="no" ?><act><participant id="justina" role="actor"/><bml>
<speech id="sp1" ref="justina-12" type="application/ssml+xml">
<mark name="T0"/>listening
<mark name="T1"/>
<mark name="T2"/>to
<mark name="T3"/>
<mark name="T4"/>my
<mark name="T5"/>
<mark name="T6"/>ipod
<mark name="T7"/>
<mark name="T8"/>helps
<mark name="T9"/>
<mark name="T10"/>a
<mark name="T11"/>
<mark name="T12"/>little,
<mark name="T13"/>
<mark name="T14"/>sometimes
<mark name="T15"/>
<mark name="T16"/>watching
<mark name="T17"/>
<mark name="T18"/>tv.
<mark name="T19"/>
</speech>
<event message="vrSpoke justina all npcsym2_0 listening to my ipod helps a little, sometimes watching tv." stroke="sp1:relax"/><gaze angle="0" direction="POLAR 0" target="all"/>

Behavior Markup Language (BML)





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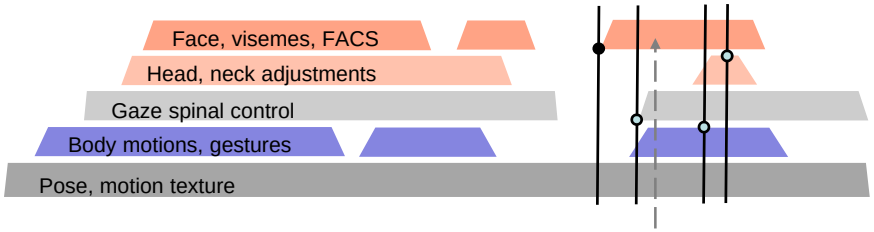
Pre –recorded
Or Generated
Voice



Smartbody

Game Engine

Bone Bus Targets