**SmartBody (SB)**

* <http://smartbody.ict.usc.edu/>
* It is a Behavioral Markup Language (BML) realization engine that transforms BML behavior descriptions intoreal time animations.
* Written in C++
* Can be controlled using Python
* Can run as a standalone system (has own viewer and 3D renderer)
* Or incorporate into Unity, …
* Can be built for Windows, Linux, OSx
* Also Android, iOS

**BML behaviors relevant for the deep-virtual-rapport-agent project  
[**See example .py scripts from SmartBody**]**

* Idling motion
  + Repeatable whole-body animation
  + <body posture=”idlemotion1” start= ready=/>
* Gesture
  + [N/A] Only if using hands
  + Compatible with idle motion
* Gaze
  + Done with 4 body areas: EYES, NECK, CHEST, BACK (simult. or individually)
  + Or direct position / angle
* Head movements
  + NOD, SHAKE, TOSS, WIGGLE, WAGGLE
  + Set:
    - number of repeats
    - Velocity
    - Magnitude
    - WI/AGGLE warp, acceleration, pitch, decay
* Face
  + Set “amount=continuous float 0-1” for each AU
  + AUs: 1,2,4,5,6,7,10,12,25,26,45 **(11 AUs)**
* Speech
  + From prerecorded audio (wav) - requires speech timings with visemes as XML
  + From text - TTS engine
* Eye saccade (rapid movements of eyes)
  + Ref to paper used is in the BML docs
  + listen / talk / think

**Virtual Human Toolkit**

* <https://vhtoolkit.ict.usc.edu/>
* MultiSense
  + MultiSense is a multimodal sensing framework which is created as a platform to integrate and fuse sensor technologies and develop probabilistic models for human behavior recognition. MultiSense tracks and analyzes users’ facial expressions, body posture, acoustic features, linguistic patterns and higher-level behavior descriptors (e.g. attention, fidgeting). It uses the Perception Markup Language (PML).
* NPCEditor
  + At the core of the NPCEditor is a statistical text classification algorithm that selects the character’s responses based on the user’s utterances. A character designer specifies a set of responses and a set of sample utterances that should produce each response through a provided authoring tool. The NPCEditor also contains a dialogue manager that specifies how to use the classifier results.
* Nonverbal Behavior Generator (NVBG)
  + The NVBG is a rule-based system that analyzes character text and functional markup to propose nonverbal behaviors. The resulting schedule is Behavior Markup Language (BML).
* SmartBody
  + SmartBody is a character animation library that provides synchronized locomotion, steering, object manipulation, lip syncing, gazing and nonverbal behavior in real-time. It uses Behavior Markup Language (BML) to transforms behavior descriptions into real-time animations.
* vhtoolkitUnity
  + The Toolkit uses Unity as its main game engine, which has been extended to include a tight integration with SmartBody, a messaging protocol, debug and authoring tools, and a graphical timeline editor for creating cut-scenes.