# Repository 7.0 release notes:

This repository version runs with AnyBody ver. 3.0.1 or later.

The new repository 7.0 contains important improvements compared to repository 6.1 which it replaces. Several new body parts have been added including a new neck model. Also some restructuring of the models has been done to facilitate the use of the body models. The basic idea behind this has been that the body models should bring calibration and initial position settings with them when they are included into a model. This makes it easier to set up new models and reduces a common source or errors.

## *New repository structure:*

The file structure of the repository has been unchanged since it was first launched in 2003, but this update includes a slight restructuring of the file tree. The basic idea of separating body models from the applications remains the same, but new folders and more descriptive folder names have been introduced to make the file structure of the repository easier to navigate and to expand.

Figure 1 displays the old file structure and Figure 2 shows the new structure. BRep has changed to Body and ARep has changed to Application. In the Body folder the subfolder names now also contain information about the model, whether it is a cow or human etc. A new folder named Beta has also been introduced; currently it contains a model of a hind leg of a cow. The idea behind the Beta folder is that it may contain models that are not tested fully or do not comply with the normal structure of the repository. The Beta folder allows inclusion of these models without "corrupting" the other models and thus enables faster publication for the benefit of the users.

The Application directory now holds an Example folder; this folder contains all the examples that are based on the non-beta Body models. There Application directory also contains a Beta with applications based on Beta body models. Finally the Application directory now contains a validation holding models from various validation studies. Typically these models replicate experiments and compare calculated results with measured.

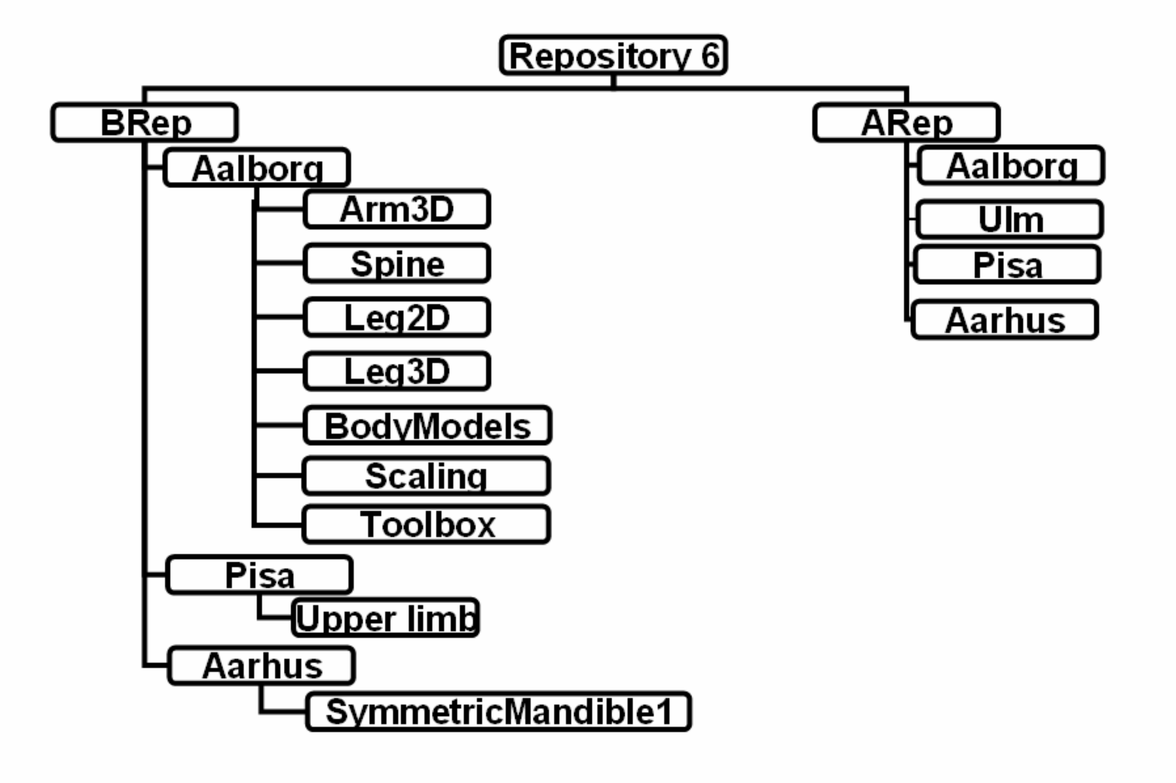


Figure 1 Repository 6.1 structure

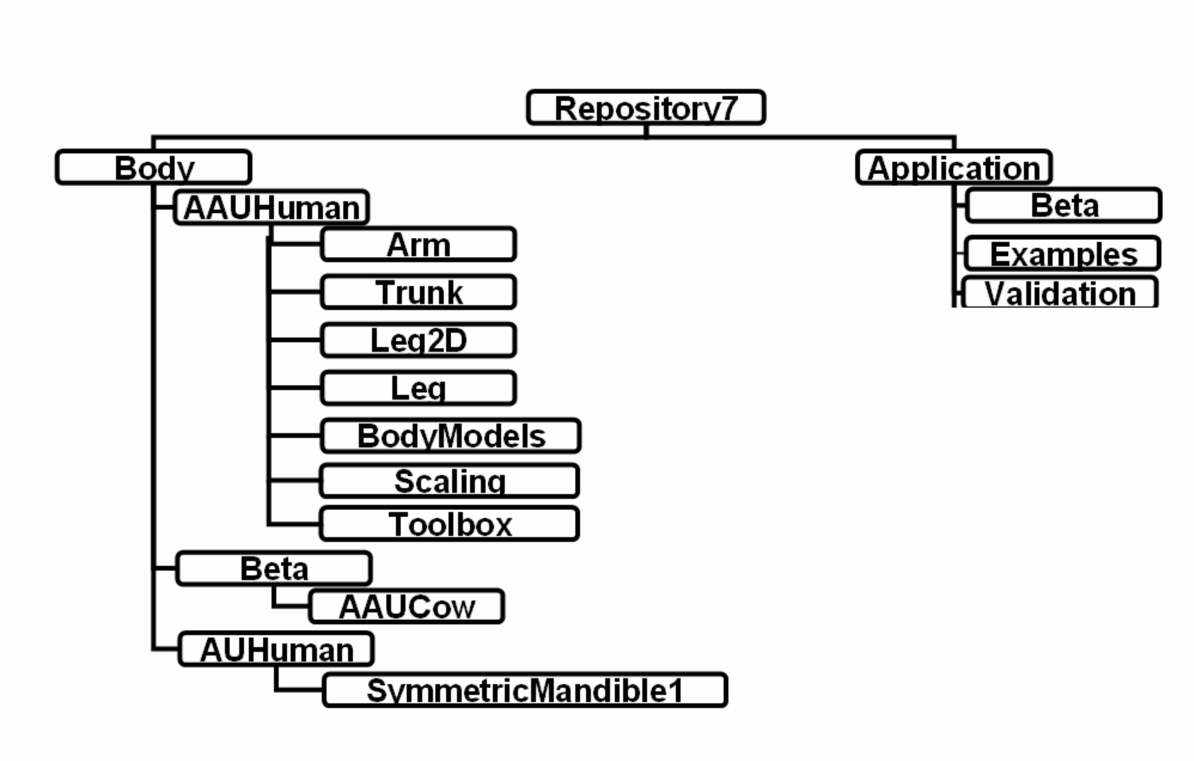


Figure 2 Repository 7.0 structure

## *Calibration and initial positions*

As mentioned above, the body model collections found in the AAUHuman/BodyModels folder now come with the appropriate calibration studies built. This makes it easier to change between body models. Previously if for example you where running a BodyModel_Mus3e.any model and had manually included a calibration study in the main file, then if the body model was changed to BodyModel_NoMuscles.any this calibration study would have to be excluded manually to be able to load the model. With the new structure this will happen automatically. Each body models now knows how to calibrate itself, and a new folder named Main.HumanModel.Calibration.CalibrationSequence will appear automatically in the OperationTree when the body model is included.

The way the load-time positions are imposed on the models has changed similarly. Now each body part contains its own InitialPositions.any file capable of positioning the body part reasonably and in accordance with the joint angle settings in the mannequin.any file, which therefore must exist in the application folder.  The nice thing about this setup is again that it is easy to shift between the bodymodels without having to think about making changes in the InitialPosition.any file of the application.

## *Arm*

Multiple muscles spanning the wrist joint have been added. These replace the previous artificial joint torque providers in the wrist and they add to the pronation and supination strength of the model.

## *Leg*

The new version has minor updates of muscle attachment points on selected muscles spanning the knee joint, in particular the hamstrings.

## *TrunkNeck*

A newly developed model of the neck has been included. Some important features are:
- The model is only partially validated.
- The model does not include facet joints.
- The muscles do not include the force-length-velocity relations (i.e. it uses the so-called simple muscle model). The only input parameter in the muscle model is the cross-sectional area multiplied by a nominal tissue tensional strength.
- Ligaments are not included because it has not been possible to find the necessary mechanical properties.

Most of the data for this model is derived from:

van der Horst, M. J. Human head neck response in frontal, lateral and rear end impact loading - modelling and validation. 2002. Technische Universteit Eindhoven, Eindhoven, The Netherlands.(Ph.D. thesis) which can be downloaded from: http://alexandria.tue.nl/extra2/200211336.pdf

## *Applications*

Several new applications have been included:

### AAUCow

The model is developed by the two students Daniel Johansen and Christian Gammelgaard Olesen, and it is motivated in a desire to improve the animal welfare in the dairy industry. Modern production systems have been known to cause injuries in the limbs of cows, and the project was initiated by the Danish Institute of Agricultural Sciences in cooperation with Health Science and Technology at Aalborg University to investigate this phenomenon and eventually be able to design healthier environments for the animals. Motion capture experiments and force plate measurements were conducted, and dissections were performed to obtain anthropometrical data.

### GaitUniMiami

The data in this model, optical marker trajectories as well as ground reaction forces, was kindly provided by Dr. Shihab Asfour and Moataz Eltoukhy, Department of Industrial Engineering, University of Miami.

Subsequently the motion in this application has been created using an external application created by Michael Skipper. In short, Skipper's application performs an optimization of segment scaling, marker positioning and joint angles to best fit measured data from optical markers.

This model takes you through the steps of converting a C3D file with measured mocap marker trajectories to an equivalent AnyBody model of the experiment allowing you to calculate muscles forces joint reactions ect. by means of Skipper’s stand-alone application, GaitApplication2.exe. This application reads marker trajectories from a gait experiment and processes them to joint angle variations that can subsequently be imposed on the AnyBody gait model. It also performs a scaling of the segments and local positioning of the markers on the bones to comply optimally with the recorded data. In time this technology will be built directly into AnyBody.

## Runner

This is a model of a sprint runner. The motion has been optimized using Michael Skipper's gait application as described above. The data was kindly provided by Prof. Y. Liu of the Shanghai University of Sports.

## AirlinePassenger

This is a model of a coach class airline passenger seat characterized by the following:
- No arm rests (you always lose the battle for the armrest to the person next to you)
- Horizontal seat pan
- Limited ability to incline the backrest due to the lack of clearance to the person behind

The model allows computation of discomfort criteria such as muscle activity (i.e. failure to relax) and seat shear forces as a function of backrest and seat pan inclinations.

## Benchpress

Model of a bench press exercise developed from the free posture model. The bench is simulated by reaction forces between the head, thorax, pelvis, feet and the ground.

## Lunge

Forward lunge is a motion used for testing the function of ACL (Anterior Cruciate Ligament) patients. There is experimental evidence that ACL-deficient patients divide into two distinct groups: Copers and non-copers. The former distinguish themselves by being able to perform a forward lunge movement as quickly as individuals that have an intact ACL, whereas the latter take more time to do the movement.
The motion data for this example is kindly provided by Tine Alkjaer of the University of Copenhagen. The motion data is subsequently processed by Michael Skipper's application as described above.

## MaxForceNeckModel

This application comprises an isolated cervical spine model. The model is equipped with the so called simple muscle model.

The goal of this application is to find the force-generating capacity of the neck in all directions. An external force of 50 N is defined which rotates around the center of the skull. The strength of the model in different directions can subsequently be evaluated from the simulated muscle activity level.

### SeatedHumanFullWithNeck

This is a application comprising the full body model including the neck, a chair and an interface between them. The interface makes the posture of the body conform to the settings if the chair. The support between the body and the chair is made with contact elements that also provide Coulomb friction.

### ShoulderBag

This is a posture prediction demonstrator based on the standing model. It simulates a person carrying a bag on the shoulder and tries to predict the postural changes due to this by means of optimization.