

User's Manual

X-Muscle System 1.8.9c

Tissue System for Blender

k44dev Studio 2017

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Welcome

Thank you for purchasing the X-Muscle System add-on, the first complete muscular and tissue system for Blender.

The great effort has been performed in design and development to provide the best quality and functionality of this software. With X-Muscle System an artist is free to focus on the artwork and use effectively his time to create even more realistic, complex shapes and animations of characters and creatures. With its simplicity and integration with Blender's native tools, X-Muscle System is easy in use and ready to start straightaway.

What you get

With X-Muscle System add-on purchase some exclusive materials and services are provided:

- X-Muscle System Blender add-on download access
- Anatomy Bundle
- access to the documentation, examples and tutorials
- Support and Updates



With buying this add-on you support Blender Foundation through Development Fund Contribution program and at same time creation of better Software.

Introduction



X-Muscle System is designed for rapid muscular system, tissue and other organic object creation and their physical simulations. Its main purpose is to help visualize better skin surface deformations according to volume preservation of the body muscles, fat and even skeletal bones. Add-on lets you focus on the design, creativity and to significantly speed up the workflow with extremal learning curve.

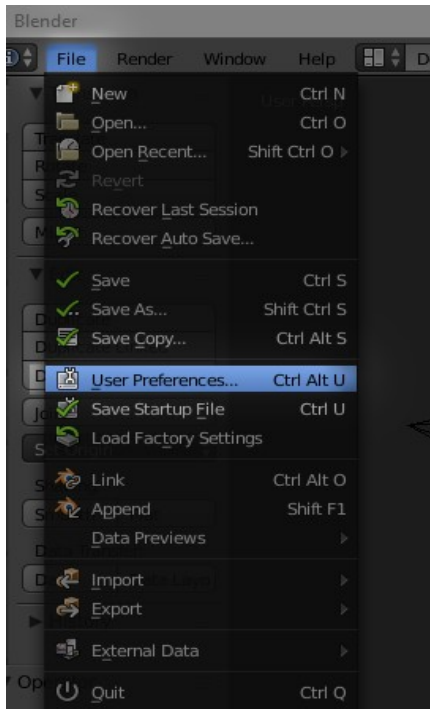
The User Manual contains all essential information for the user to make full use of the X-Muscle System. This manual includes a description of the system user interface, functions and capabilities. It also contains advanced techniques, tips and tricks to make the targeted model and animation look more realistic. However the anatomical aspect of body muscles will not be widely covered in this document but some basics are essential to achieve neat and satisfying results.

At the end, the documentation describes the list of system known limitations, blind alleys and explains how to proceed in case of troubleshooting and provides support instructions.

Main features and goals:

- animatable muscle parameters like size, shape, properties settings and controllers
- body auto-weight painting function for muscles and controllers with scope control
- auto-naming and auto Vertex Groups management
- flexor and extensor muscle type changing with one, single click
- supports multiple armature instances sharing the single scene within the system
- dedicated display manager
- “Smart Update” for fast and easy muscle dynamic's cache updates
- allows easy muscle mirroring with intelligent X-Mirror feature, what guarantees perfect character symmetry
- vast support for variety types of armatures and custom rigs Blenrig5, Rigify, Pitchipoy Auto-Rig Pro and etc.
- multiple muscles properties adjustment at same time with real-time execution
- integrated naming system with powerful renaming feature
- three muscle types available including custom shape muscles, all with Shape Keys support
- automatic muscles to body assignment with Auto-Aim feature
- freedom of sharing work with artists without having the add-on.
- Body meshes with Shape Keys are supported
- Body meshes with mirror modifier are supported.
- designed to work with Soft Body collisions (experimental)
- physically based tissue simulation - jiggling muscles can simulate fat, or particular parts of the body like breast, buttocks, cheeks or skin folds or rigid body like bones
- real-time dynamic's preview
- multiple muscles assignment for single bone
- micro skin Controllers for the best quality
- at last but not least, can be used as an extra tools for facial expressions or in making special effects for cartoonish stylized characters

Installation



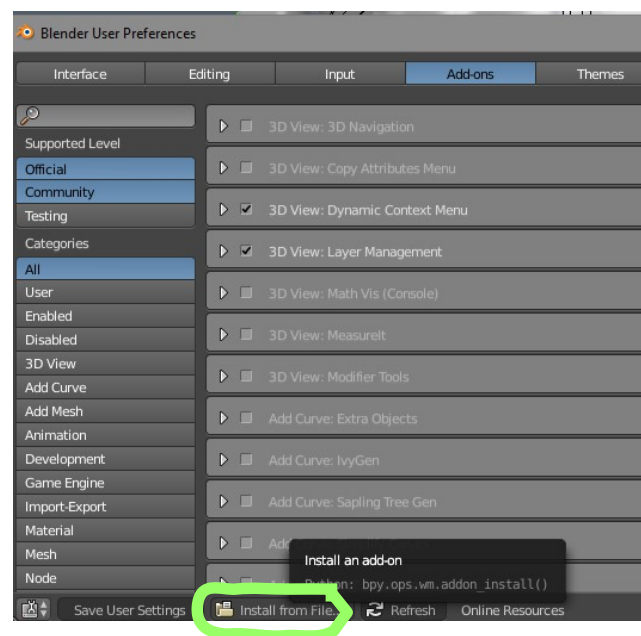
The Installation of the add-on is very simple. Make sure you have the latest Blender version available. Currently it is 2.78c. If you want to use the add-on with Blender versions lower than 2.78 please contact the k44dev Support for details.

First of all download the **xmusclesystem.zip** file. Do not extract the file, just remember its download location. Start the Blender program and find the File menu which in the default view is located at the top left corner of the screen. Select **User Preferences**.

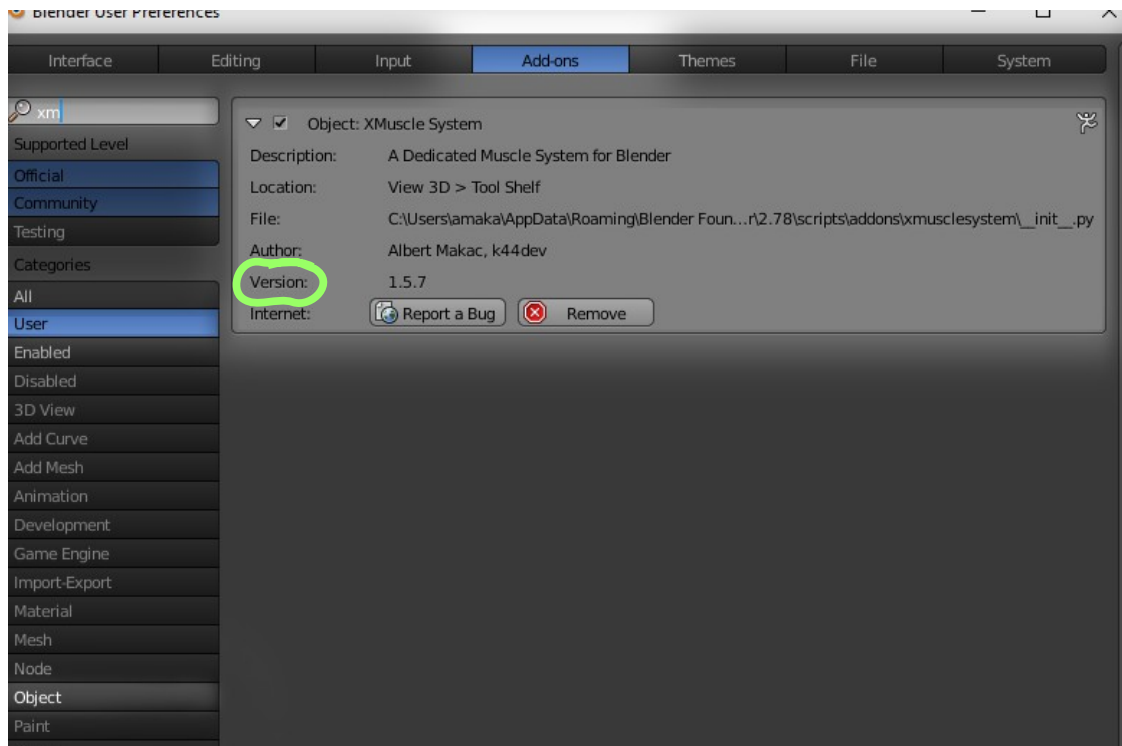
The another way to get there is by pressing **CTRL+ALT+U**

Next click the **Add-ons** tab and choose "Install from File..." button from the bottom of the Preferences Window.

Navigate inside the file browser window and find .zip add-on file. Enable it, and unfold the region to get more information about the add-on's **current version**.



It is possible to check the add-on's status under the User and Object **categories** or by typing "xmuscle" inside the **finding field**. By the default add-on should be enabled after installation. Finally, at the end press **Save User Settings**, otherwise add-on will be enabled only on the current session.



Updating the add-on:

Every X-Muscle System update is ready for download from the BlenderMarket after information is announced directly on the product page **Changelog**. Only bigger updates are notified with an e-mail. In case of troubles with updating your add-on, please uninstall and remove old add-on from the Blender before installing new one. For more help please contact k44dev Software support.

X-Muscle System is now installed and you're ready to go!

Recommendations

Good organization is the key to success if you want your work to look perfect. This is why before you start you may want to **install two add-ons**. They're not obligatory but can help you organize the scene and make your navigation life easier.

Bone Layer Manager 0.6

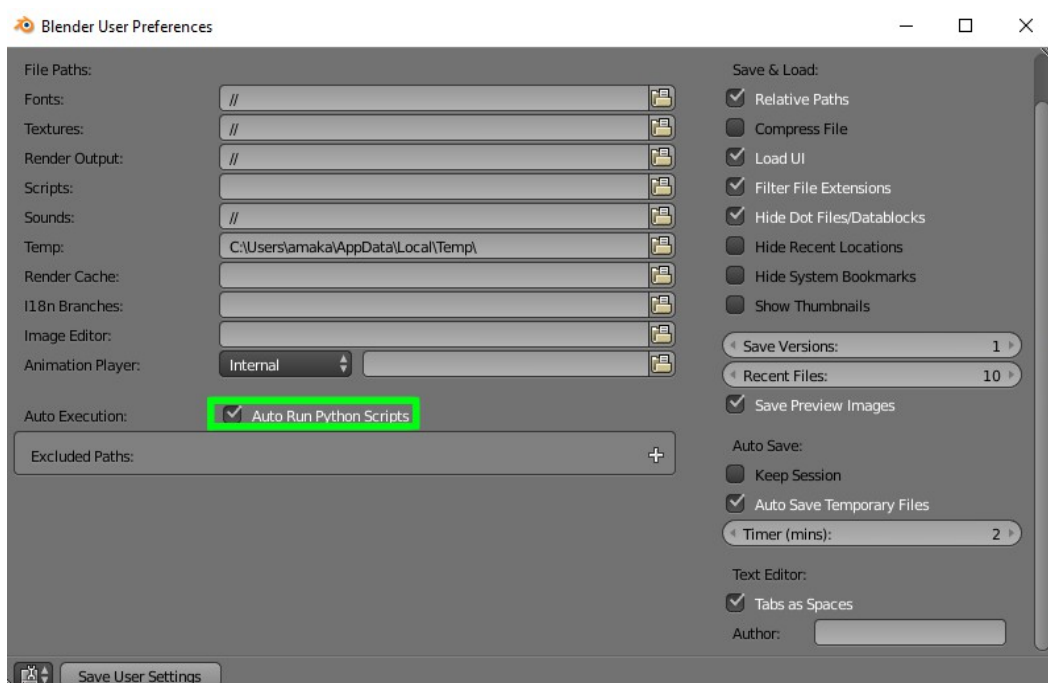
Add-on helps to work with armature's bone layers in the systematic way. Advanced rigs like Rigify, Blenrig5, Pitchipoy or Auto-Rig Pro organizes bones on layers by separating deformation bones from mechanism and control bones, and by the way, they're all supported by X-Muscle System. Bone Layer Manager is located on the 3D View **Properties Panel**. Enable it by pressing the **N** key.

Layer Manager

This add-on allows to name, navigate through and manage Scene Layers properties. It is accessible via tab in 3D View **Tool Shelf Panel**.

Both add-ons are free.

Since the X-Muscle System add-on is designed to not requiring the loading scripts at startup Rigify and some other add-ons needs reload trusted or permanently enable this function what is common practice enable the Load Trusted at Startup with **Autorun Python Scripts** checkbox under File tab in **User Preferences** Window.

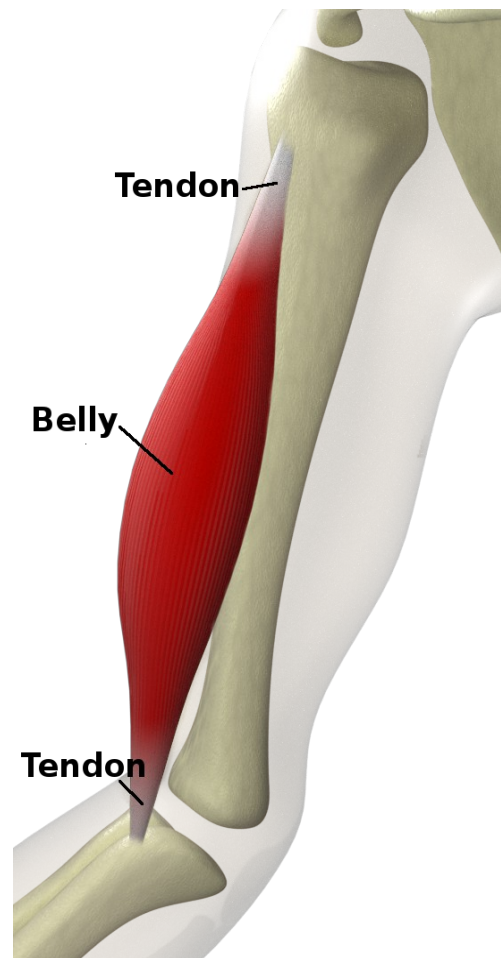


How do muscles work

A human body is very complex mechanism. It consists of more than 200 bones and even more muscles attached in the number of around 650. These connected muscles, which are called skeletal muscles are one of three types of the human body muscles. Because of their special properties their main purpose is the responsibility for the body movement.

Each specific muscle is connected to the bone with so called tendon. Muscles contract or relax causing bones to flex and extend. Depending on caused action there are skeletal muscles like biceps that contract on bone flex and muscles like triceps that contracts on bone extends. In example - to bend elbow joints biceps belly (**flexor**) contracts and triceps belly relaxes (**extensor**). For unbending the elbow joints muscles work reversely – biceps muscle relaxes and triceps contracts.

There are also some other muscles that take action to make the elbow bend but they will not be discussed here.

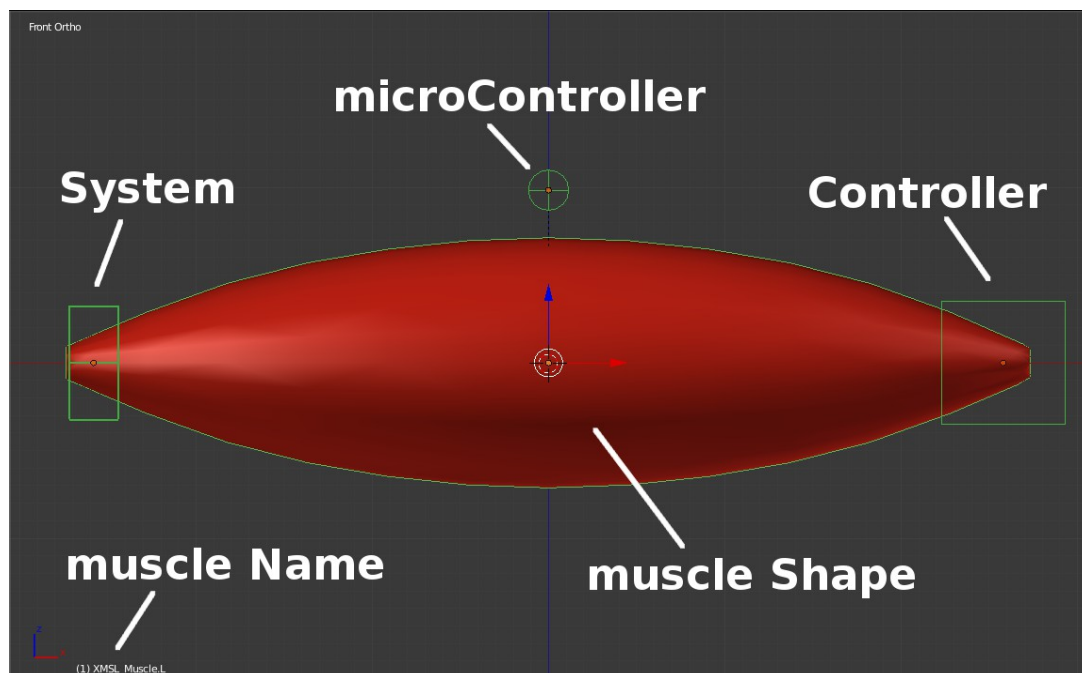


X-Muscle System

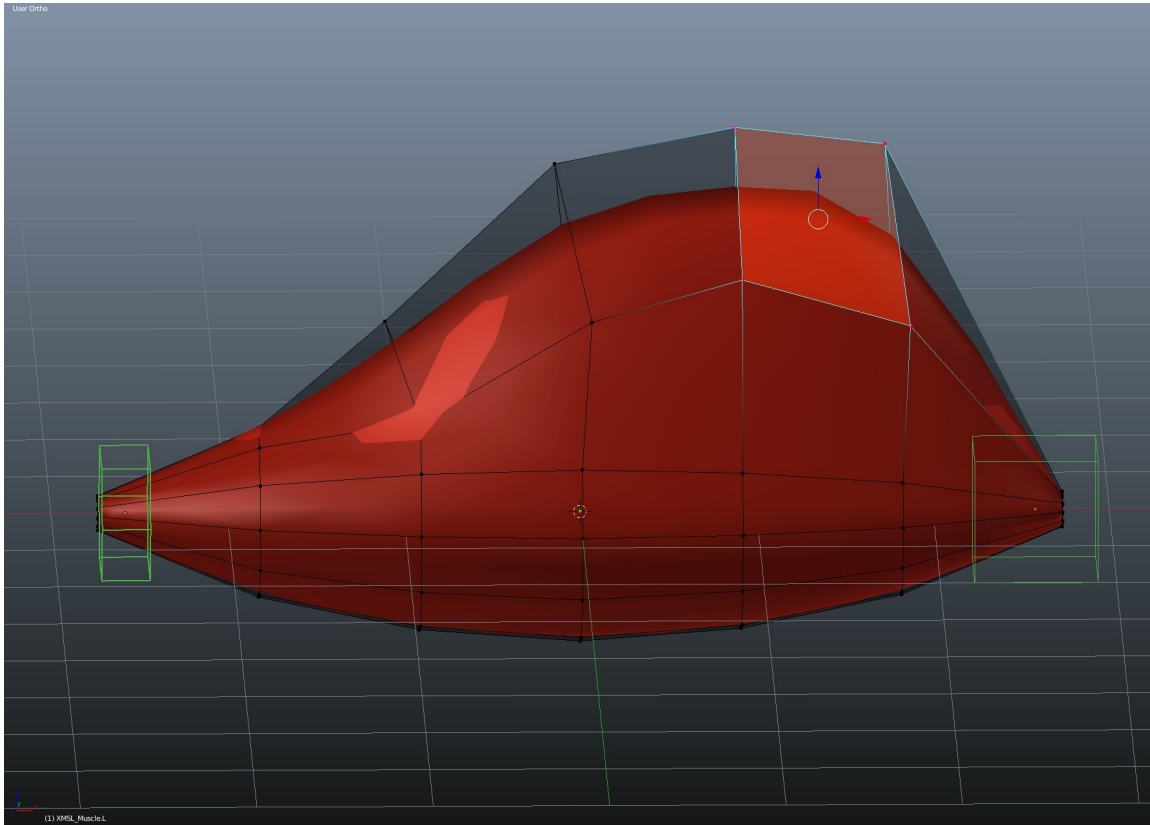
The purpose of the X-Muscle System is to create a mechanics which will visually imitate the character's tissue along with its skin deformation.

As in the case of real muscles, X-Muscles basically have two attachment points – **System** and **Controller**, which represents tendons - that after parenting to the bones will follow their movement and mimic real muscles behavior.

A single muscle unit consists of Muscle **System**, **Controller**, **muscle Shape** and optionally **microController**.

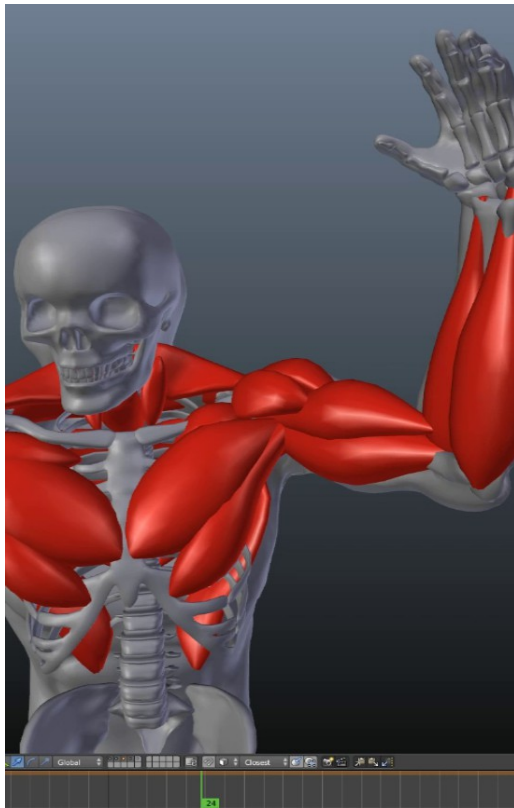


The **muscle Shape** (sometimes called belly, head or muscle mesh) is the visual representation of the muscle. It has properties that defines how it looks and reacts. Properties can be set or changed when the particular muscle Shape is selected. Muscle Shape itself can be scaled, moved and rotated as in Object Mode as in Edit Mode.



The **System** is first of the attachment points and is also responsible for all the muscle mechanics. It may be transformed by scaling and moving what will result different muscle Shape appearance and properties. Adding Constraints to the „System” is allowed.

The **Controller** is the second of the standard attachment points and is also responsible for placing muscle in correct position on the armature. Changing the distance between the System and the Controller will stretch or shorten the muscle Shape. It can be parented to the armature bones just like the System element.

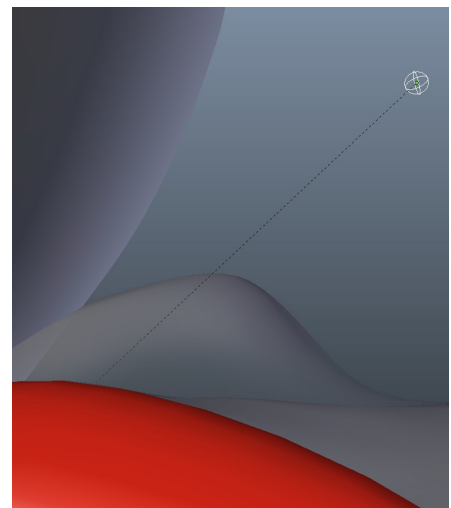


To make the muscle work correctly, the Controller and System should be **parented to the bones** and their position adjusted slightly for the best results. The real life anatomy can be often the best reference here.

The **microControllers** is what will have influence only on the object's skin but not the muscle itself.

MicroControllers are free floating handles that can be used for multiple applications like - setting skin surface properties (skin fraction, etc), but also for non-destructive model shape correction, animating primary and secondary motion, special effects or even facial expression.

Depending on effect scale and strength it may simulate skin friction, may be used to compress the skin closer to the muscles or skeletal to expose their presence or create bigger model deformations. All general microController transformations can be animated (rotation, location, scale).



User Interface

X-Muscle System Panel can be found under “x-muscle Sys” tab in the 3D View, **Tool Shelf Panel**. To make the Tool Shelf visible press this “**plus**” sign” or just use the **T key** shortcut.



The **User Interface** is divided into four general parts: Create, Muscle, Display and Musculature. They contain options and properties. Each part's functionality is context dependent. For example - **Convert button** in Create Panel **appears** only if the mesh object is selected in the scene, or the Muscle Panel expands with new options if the **microController** is **enabled** and so on.

To regulate muscle properties **select the muscle Shape**, otherwise properties won't be available on the panel.

Properties can be set for single object or for multi-selection. For **multi-selection** adjustment press and hold **ALT key** before performing an action. It will result adjustment with real-time execution. For more **precise value control** hold **SHIFT key** when moving the sliders.

It is possible to **Reset the single Property** to its defaults. To do that click the right Mouse Button on selected Property and choose **Reset to Default Value** from the context menu or press **Backspace** when the mouse cursor is over the property field.

CREATE

There are three types of muscles available:

Basic, Stylized and Custom Shape. The first, **Basic Muscle** option is the most generic and universal and probably will be used for most of the time.

The **Stylized Muscle** by default has its shape modeled for quick appliance and prototyping such regions like biceps, triceps or chest with just few mesh adjustments. Stylized muscle has also Shape Keys applied by default which can be changed with **Shape Property**. Shape Keys can be added to all three muscle types.

The third option, for the **Custom Shape Muscle** will appear only when the mesh object is selected in the scene. Custom shape muscle can perform great as a bones like rigs, clavicle or scapula, in places where skin is interacting directly with skeletal bones.

Note:

keep in mind the muscle created by conversion from the mesh to custom shape method will not support the microController by default.

All created muscle shapes are adjustable in position, scale, rotation and transformations can be done as well as in Object as on vertex level in Edit Mode.

Edit Limitations:

User is allowed to edit created muscle shape by modeling free shapes from the mesh in Edit Mode **under condition of preserving existing vertex indices**. Any interference with the mesh by deleting or adding vertices, faces, edges or edge loops to the existing muscle mesh may violate it's structure and cause serious defects in quality. Modify muscle mesh wisely.

There are also three ways of **targeting** and adding muscles to the armature available under **Targeting Method** section. They all differs in the level of automation.

The first one is **Manual** which is the most basic option. When using Manual, the muscle will always be created at the center of the scene with object's World's coordinates set to 0 XYZ.



Manual option has its purpose, when you want to have the full control over the process of placing and attaching muscle to the armature. It may be used in case when tissue will be attached with both attachment points (System and Controller) to the same, single bone. Use it also if you want attach the tissue to non-armature objects like meshes, curves or empties.

Attaching muscles to the objects is achieved by **parenting**. To attach the muscle, select the armature and enter the **Pose Mode**. Next, select first attachment point (System) and then, with holding the **SHIFT** for multi-selection, the bone you wish muscle to be attached to. Press **CTRL+P**, then choose “**parent to bone**” from the context menu. Repeat it for the second attachment point (Controller). This way of attaching muscles to the armature applies for the **Manual** and the **at Cursor**. The Auto-Aim Targeting Method will make parenting automatically for you.

Tip:

Just in case, the good manner is to create and parent a “dummy” bone to any other object type different than Armature, you wish muscle will be parented to, instead of parenting muscle attachment points directly to that object.

at Cursor:

This option allows you to create muscle at cursor's position. It is useful when further manual position adjustment is needed. Just like in case of Manual, this method will not neither do any muscle auto attachment with an armature.

Tip:

at Cursor works fine with *armature in Pose Mode*. To use it at its full potential set the **pivot point** to “*3D Cursor*” and press **SHIFT + S** for snapping “*cursor to selected*” on active pose bone. New Muscle will be created with the “*System*” part pointed at the cursor. Turn on **Proportional Editing** Tool with smooth falloff for shape edition.



Muscle Scale applies for newly created muscle only. To create muscle size equals 1 unit long use scale value approx of 0.18. Muscle's orientation created with “Manual” and “at Cursor” are **sensitive** to the **Suffix**.

Auto Aim:

This is the most advanced method of all three. It works with armatures set in **Pose Mode** only. To create a muscle using Auto-Aim, show X-Muscle System Panel if it's hidden, choose Auto-Aim option, **select at least two bones** and click one of two available muscle types. This will create a muscle with adjusted muscle scale and size, attached to the first and last bones in the selection.

Proper bone selection and selection order is important in case where muscle is planned to be longer than single deformation bone. **Selecting multiple bones** with Auto-Aim results in **extension of muscle Vertex Weights** on the region that selected bones cover. This will be widely discussed and explained in the Musculature section.

Notes:

- When using Auto Aim, Custom Shape Muscle from mesh can not be created directly.
- For the correct work of Auto Aim function, X-Muscle System Panel (**T key**) must be enabled in 3D View before making bone selection.

Naming

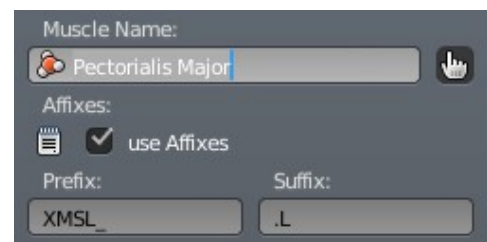
Naming convention helps to organize things in the systematic manner but also tells a lot about the objects themselves. Naming defines the way muscles are created and to which **X-Musculature** they belong. Every muscle in the scene has unique naming. To prevent naming repetition X-Muscle System uses its own, internal, intelligent **autonumbering** system. Taking care of good and proper naming in the scene will prosper with ease of management and extra bonuses.

Muscle Name:

Muscle Name gives name to muscle that will be created. Type the name and press **ENTER**.

To **rename** an existing muscle, select muscle Belly of the muscle and press the **icon** of pointing finger next to name field. This will rename active muscle in the scene. This will also change its Prefix, Suffix and all the Vertex Groups, Modifiers and Drivers related to the muscle.

Renaming applies to **multi-selection** when holding the **ALT key** at the time the rename button is pressed.



use Affixes:

Using affixes allows to manage the groups of muscles that belong to the same **X-Musculature** (contain the same Prefix) or to mirror them along the X axis with **X-Mirror** feature and other automation mechanisms, like common **Material Set**. Disabling this option will exclude newly created muscle or currently renamed from the ability of using these features, so it is recommended to keeping this enabled.

Prefix:

Prefix defines the muscular system to which muscle belongs. This muscular system is called **X-Musculature**. Default is: **XMSL_**

When multiple armatures are sharing the same scene, set unique **X-Musculatures** for each of their muscle systems.

Supported Suffix: L LEFT r right Right

Suffix defines the Symmetry Group to which muscle belongs. **Leaving Suffix field empty** will tell the system to **exclude** the muscle from **X-Mirroring**. Also the muscle will not be X-Mirrored when the Suffix is invalid. Affixes are valid only when used with correct **separators**: **. _**

All these Properties are applied to the muscle at the time of the creation.

Examples of correct names: ABCD_Biceps Brachii.R
XYZ.Triceps Brachii_Left
QMUSCLE_Pectorialis_Major_L

MUSCLE

Muscle object can be generally considered as any organic tissue. It can be a muscle, fat or skeletal bone, depending on the properties set.

All settings in this panel can be applied for multi-selection as well for the checkboxes as for the sliders.

The only exception is the **Reset Properties** button which will always apply to an active muscle only. Also muscle parameters like **size**, **shape**, other settings and **controllers** are **animatable**.

Muscle Mesh:

In Muscle Mesh section user is able to control how muscles look and behave.

Render, View3D:

Enables or disables character's mesh deformation in the render output and 3D Viewport.

Resolution:

Render, View3D:

Increases or decreases muscle mesh resolution in the render output and 3D Viewport.

Flexor to Extensor:

X-Muscle System by default creates **flexor** type of muscles. Enabling **Extensor** option inverts general muscle behavior. In result muscles will stretch and shrink in opposite to Controller's direction. It helps to create an simulate muscles similar to **Triceps Brachii**.

Base Length:

Defines the resting length of the muscle. It can be combined together with **Volume** and **Size** parameters.

Shape:

This will change Shape Keys if they're available. Basically only Stylized muscle type has the Shape Keys ready by default but they can be added for two other types as well.

Volume:

This factor is responsible for the muscle volume to enlarge when it contracts and shrink when it extends (for flexor muscle). It can be combined together with Base Length and Size parameters.

Size:

Scales mesh shape around local YZ axis resulting the thinner or thicker muscle.



Muscle Dynamics:

Muscle Dynamics is for physically based tissue dynamics simulation like muscles jiggling, fat, or particular parts of the body like breast, buttocks, cheeks or skin folds. Muscle dynamics are visible on **timeline playback** (**ALT+ A** to start and stop). Keep dynamics disabled for rigid body like skeletal bones.

Render, View3D:

Enables or disables muscle jiggle deformation in the render output and 3D Viewport.

Note:

When the animation cache is baked, disable dynamics 3D Viewport at the time the muscles are modified or the character is positioned.

Jiggle Settings:

Springiness, Stiffness, Mass:

Defines how much tissue will bounce before it loses all its energy, how much mesh will hold its original shape. If both **Stiffness** and **Springiness** are set to maximum no jiggle will occur at all. The mass will make tissue heavier and more influenced by the gravity if increased.

Damping:

Will reduce the bounciness.

Vertex Group:

The active **Jiggle Vertex Group**. If there are more Jiggle Vertex Groups than one, active Jiggle Vertex Group can be selected here.

Note:

Do not remove default Jiggle Vertex Group.

Tip:

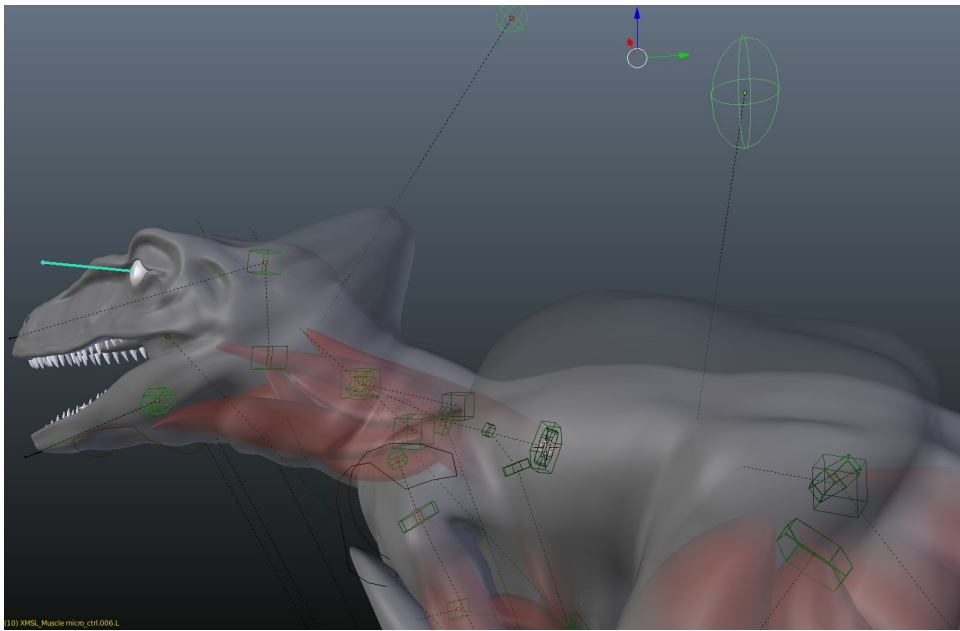
If muscle mesh topology has been extruded, divided or changed, instead of editing default **Jiggle Vertex Group**, add new one and select it as active from the muscle **Jiggle Vertex Group** list.

Smart Update:

When **tuning up** is finished use the **Smart Update** for fast and easy muscle dynamic's cache update. It will recreate all the X-Muscle System cache in the scene according to the animation length.

microControllers:

microControllers are small but powerful handles that basically cause the skin naturally follows muscle movement. You decide how and what skin region microControllers will influence by scaling them in any axis, moving, rotating and combining together with **Setup** parameters. microControllers use their own, dedicated weight-painting method and can be used straight away as soon as **muscles are applied to the skin**. They can be used as a support for basic deformation methods or can be used alone.



Keep microController close to its muscle, just above the surface of the skin to control its sliding gently according to tissue movement. For the best results rotate the whole muscle to set microController's position. Do it before you edit the muscle Shape. Enable **relationship lines** if you want help in finding out which microController belongs to which muscle (Property Panel **N key**).

Setup:

Distance, Influence and Radius:

These settings tuned together with microController's position and scale will result in sharper, stronger or smoother skin deformation. The effect of single microController can be really subtle or extremely big affecting the whole model's mesh depending on needs.

Set:

Applies the skin settings to active microController. Like most settings and parameters, **Set** will apply settings to multiple selected muscles with the **ALT key** pressed.

To **reset** the microController **re-enable** it.

Render, View3D:

Enables or disables mesh deformation caused by microControllers in the render and viewport output.

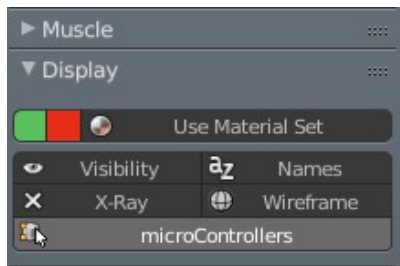
Skin Tension:

Defines how much the skin will follow microController.

Reset Properties:

Resets all the Properties of the active muscle including the Auto-Aim's extended Vertex Weights region information and microController's influence. This option can be applied for the active muscle only. Use it carefully.

DISPLAY



Display Panel is where the Viewport display tools are placed. This panel gathers all the tools that are helpful in the creation process and the later inspection.

Colors:

first

This field sets the outline, wireframe and name display color.

Note:

Color setting is the same as used for the blender's theme and will overwrite it. Saving **User Settings** will **preserve** this change in Blender's settings.

second

Second color field is responsible for Viewport muscle color as well as tissue **material's diffuse**. Can help with better overview in the scene by dividing visually muscles on groups.

Use Material Set:

By defaults all created tissue use the same, generic material which is shared across the particular X-Musculature (name space defined by the Prefix). **Use Material Set** option will make selected muscles to use individual material. That allows to visually separate these muscles from the rest. However all newly created muscles will keep using the master, default material according to their X-Musculature. Muscles without affixes will by default use their individual materials.

Tip:

To easily transfer materials between muscles press **CTRL + L** for link materials from active one to selected. It is compatible with the standard as long as selected muscles share the same X-Musculature as active.

Visibility:

Hide and unhide muscles toggle. Hides only selected muscles but unhides all. This button is always available.

Names:

Toggles displaying muscle names in 3D Viewport

X-Ray:

Toggles displaying muscle x-ray in 3D Viewport.

Wireframe:

Toggles displaying muscle wireframe in 3D Viewport. There are two types of wireframe mode available.

Skin microControllers:

Global display skin microControllers switch. Shows or hides all microControllers in 3D Viewport.

X-MUSCULATURE

X-Musculature (defined by Prefix) can be considered as single muscular system or depending on personal scheme of work, can be divided on smaller groups of muscles if the muscular model is more complex.

Note:

If there are more than one character in the scene, it is good practice to work with unique X-Musculature for each of the characters.



Select X- Muscle:

Selects the single muscle with all its elements. You can add multiple muscles to the selection with **SHIFT** key pressed.

Select X- Musculature:

Selects all muscles that belong to the same X-Musculature as the active muscle.

X-Mirror Muscles:

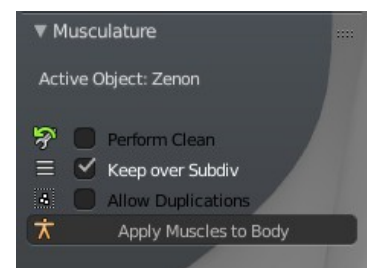
X-Mirror Muscles is powerful and intelligent feature for mirroring muscles along X axis. Muscles mirroring is done according to **Prefix** and **Suffix** of selected muscles. Only selected muscles that belong to **the same X-Musculature as the active muscle** will be mirrored. From all pattern matching muscles only one with the existing **Suffix** will be mirrored, regardless the symmetry Suffix of the armature to which they are bound (will work even if tissue is attached to the spine or other bones without Suffix). Mirrored muscles will inherit all the properties and weight influence information including microControllers and Auto-Aim's extended Vertex Weights region information. All new tissue will be also automatically attached to the opposite side of the character's armature. Already existing mirrored muscles will be prevented from **duplication** by default. It is also possible to mirror free-floating muscles and attach them to the armature bones or other objects manually later on.

Note:

Having **Suffix** for muscles located **centrally** on the symmetry axis which you don't want to be X-Mirrored (like belly fat), will result **unnecessary duplication**. Use **rename** function with **Suffix field empty** before X-Mirroring. This will in consequence prevent the duplication.

Apply Muscles to Body:

For model's skin deformation, muscles have to be bound with the body. To do that, first **select muscles** for binding (can be a single muscle or whole X-Musculature), and next **add** the body to selection with holding **SHIFT**. Body's name has to appear as **Active object**. Both, **muscles** and **Body** have to be selected at the time.



This feature works in two modes - additive, what means you can safely add more muscles to the current body deformation, if you decide it's necessary. However all that changes will be preserved in the model, even if some Tissues were previously deleted. To clean that up, use second mode - **perform Clean** checkbox.

perform Clean:

This will refresh the X-Muscle System Vertex Groups, modifier stack data. Works like **reset mode**, removing settings like custom Weight-Paints. Use it carefully.

keep over Subdiv:

Will keep all the currently added muscle modifiers above the Subdivision Surface in the skin modifier stack. **Keep it enabled** for the **best performance**.

allow duplications:

By defaults X-Muscle System prevents you from creating duplications on common operations and assists you to work in more systematic way. Enabling this option will allow to apply the single muscle multiple times to the skin, each time creating new, additional set of modifiers, drivers and new Vertex Groups. It will also allow tissue duplications on X-Mirror. Both operations are normally very unwanted but sometimes may be needed. Feature for advanced users only. Keep it Disabled.

Applying muscles to body takes time, especially when microControllers are present, so take your time to relax.

Besides all of that, X-Musculature also supports:

- Body meshes with **Shape Keys**
- Body meshes with **Mirror** modifier
- Auto-**Naming** and Auto-**Vertex Groups** management

Apply Muscles to Body and targeting methods

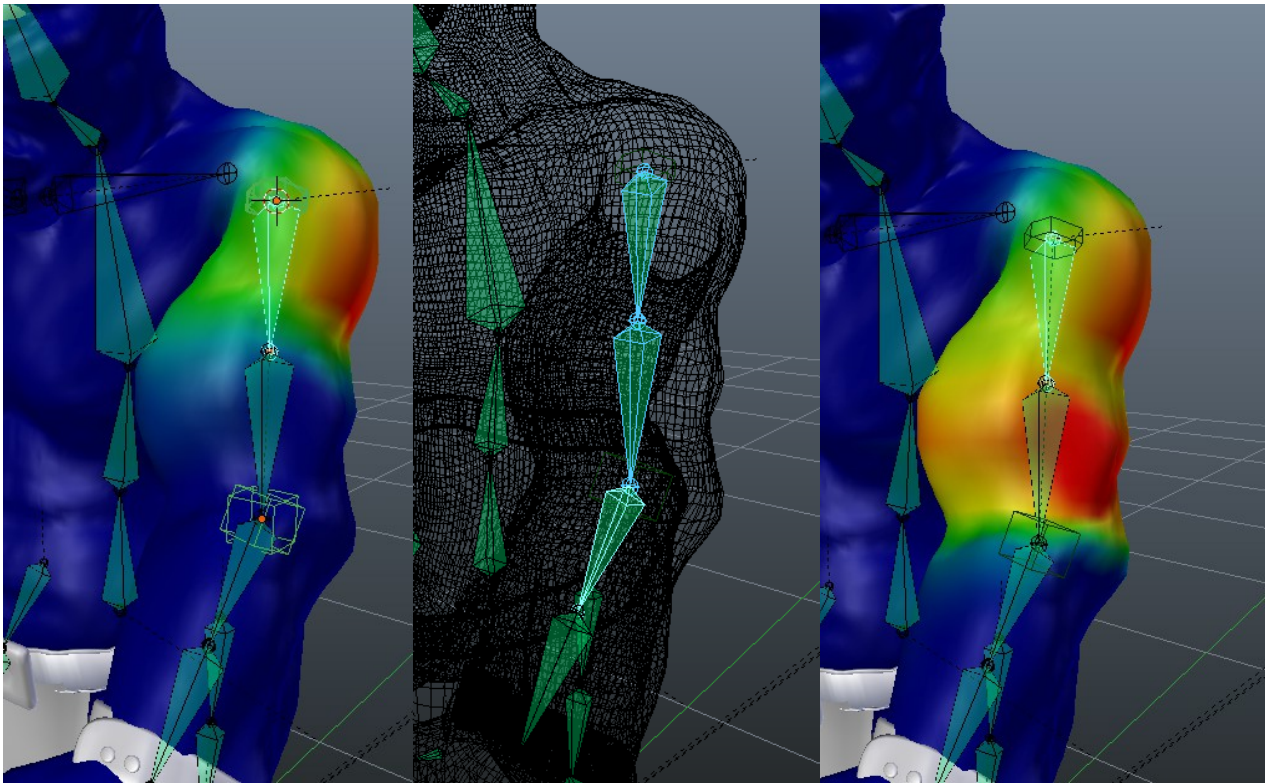
“Manual” and **“at Cursor”** vs **Auto-Aim** Weight-Paint.

Weights for Manual and at Cursor Targeting Methods are calculated only at the first bone range, to which System is attached. They will inherit **Weight-Paint** from that bone and store it in the new Vertex Group. In case when there is more than one bone in the chain, when using these methods, manual Weight-Painting is required.

Auto-Aim Weight-Paint

Auto-Aim Vertex-Weights will be extended and transferred from all selected bones except the last one.

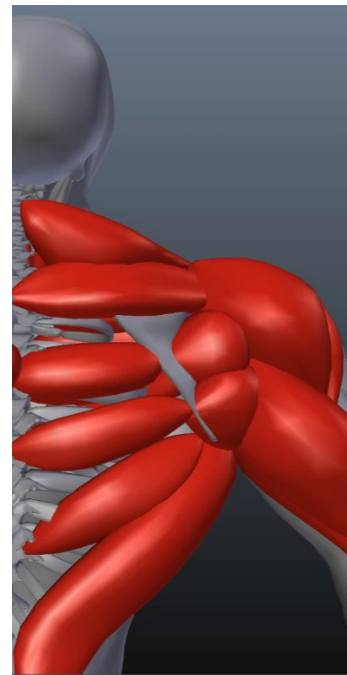
Picture below shows the difference between Manual and Auto-Aim (with multiple bones selected) auto-weights.



Workflow

General workflow in order:

- can be applied individually:
 - Set name
 - choose Targeting Method
 - create muscle
 - enable microController (optionally)
 - attach muscle to armature (Manual/at Cursor)
 - set position
 - edit shape
- can be applied for multi-selection or X-Musculature:
 - set properties
 - Apply to Body
 - enable or disable microControllers
 - fine tune muscle position and Shapes (optionally)
 - fine tune microControllers
 - fine tune Weight-Painting
 - enable and set Dynamics
 - animation preview



Note:

Display Tools can be used for **individual muscle** as well as for **multi-selection**.

Adding the muscles to the armature is just the next step in character's **creation pipeline**. As always, for the best quality and effect you have to plan your work from the very beginning. Keep in mind that tissue will deform your model, so you may want to simplify your model's musculature details and model them always in relaxed state, otherwise you may need to use microControllers for the counter effect to make some pressure on the skin. Keep your **model's mesh simplified**, add as much geometry as needed to make tissue deform skin surface nicely.

X-Muscle System is designed to give you that freestyle experience on workflow, but for the best precision you may want to follow these recommendations:

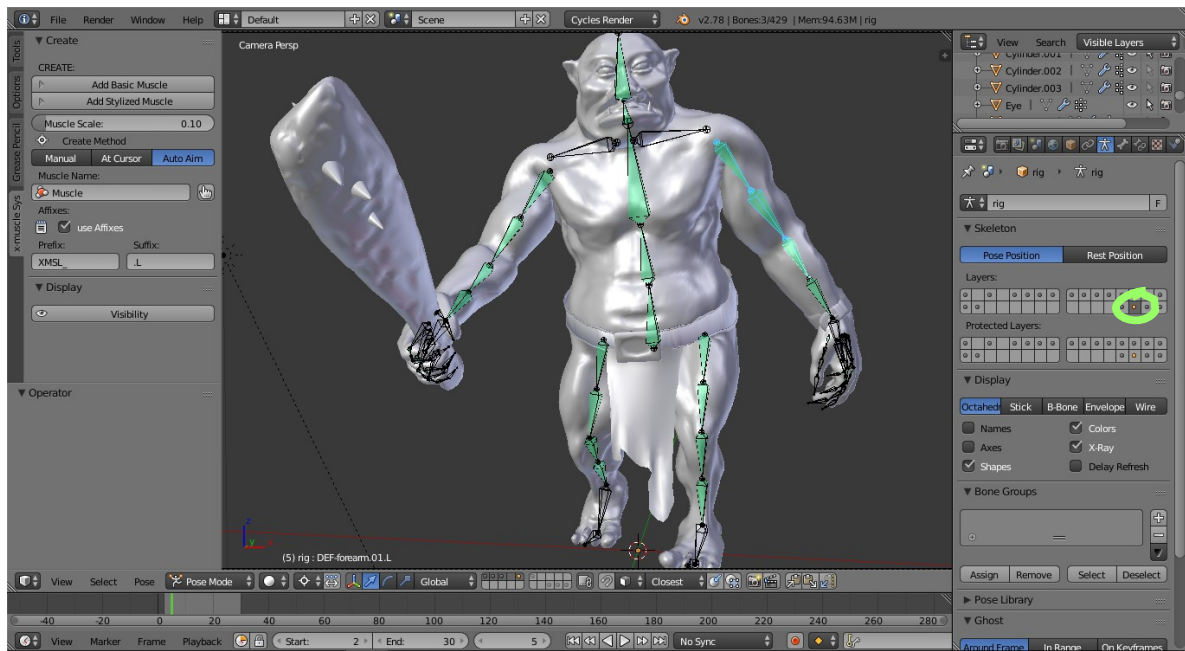
Press 1 on the Numpad to switch to **Front view**. Press 5 for **Orthographic view**. Correctly placed Armature's **origin** should be set to global 0 XYZ. If it's not, **reset armature's transformations** (**ALT+R**, **ALT+G**, **ALT+S**) in **Object Mode**. Check the **coordinates** in the Property Panel.

In this example we will start with **at Cursor** Targeting Method so it's good to consider taking some additional settings into account before you start adding a tissue:

- set 3D Cursor as **Pivot Point**
- **select** unique **scene layer** and name it correctly, something like "muscles"
- **lock** the character's mesh layer
- Select the Armature and set it in **Rest Position** (just for convenience)
- enter the **Pose Mode** with **CTRL+TAB**
- optionally enable Preserve Volume in character's Armature Modifier

If you want to make use of **Auto-Weight-Paint** feature, find deformation bones which are usually named with **DEF-** Prefix. In most cases deformation bones are located on one of armature's bone layers somewhere at the end. You can check are they really deforming the mesh by clicking the **Object Property** function button and find is the **deform checkbox** enabled. Sometime happens that control or mechanism bones have "deform" enabled. If you're not sure you can always check bone's deform influence in the Weight-Paint Mode and also inspect the Vertex Group of that bone.

The Rigify with deformation bones (layer index 29) visible:



Now, choose your symmetry side and make sure the **Suffix** is set, give it proper **Name** and add the muscle.

Note:

You can attach multiple muscles to single bone.

Tips:

In case of muscle selection problems try to select muscle Belly or other muscle part while holding **CTRL key**, it may increase selection precision in some cases. Also clicking Right Mouse Button when holding **ALT** will expand selection menu. The other way is to select the single muscle with all its elements with **Select X- Muscle** button.

For the muscles like Triceps, use **Flexor to Extensor**.

Use **Snap Cursor to Selected (SHIFT+S)**. It will place the cursor at active bone's head.

Created muscles can be nicely adjusted with **local rotation** by pressing **(R, X, X)** or **(R, Y, Y)**, **(R, Z, Z)** **keys** before or after it's attached to bones.

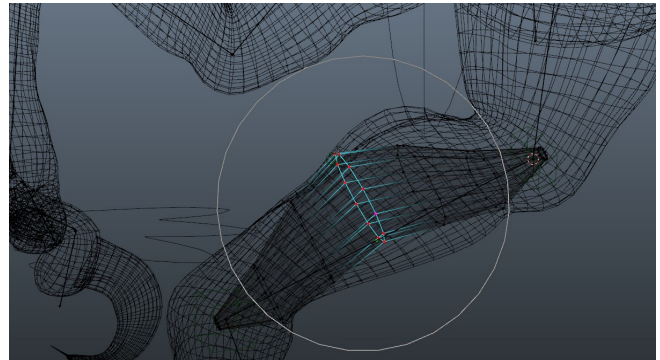
Toggle muscle **X-Ray** display and **Wireframe**.

For **Manual** and at **Cursor** parent the System and Controller with appropriate bones by pressing **CTRL+P** parent to bone.

When using **Auto Aim** no parenting is needed. Additionally **selecting bone chains** will profit with Auto-Weight-Painting. X-Muscle System always automatically generates uniquely named Vertex Groups for the skin and when Auto Aim is used muscle will inherit Weights from all selected bones (except the active one).

Adjust the **position** of the Controller just a little bit after the joint to cause muscle stretching and compressing on the leverage.

Enable **Proportional Editing**. Edit muscle shape by moving, rotating and scaling the edge loops; select edge loop with **ALT+Click**.



Set Base Length, Shape, Volume, if needed:

Base Length can be combined together with **Volume** and **Size** parameters. **Shape** will change muscle Shape Keys if they're available.

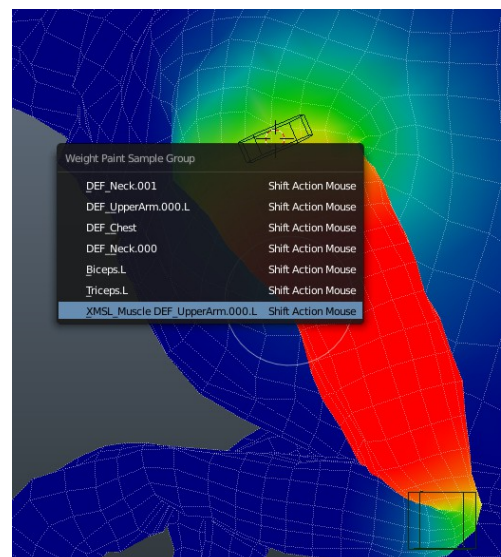
Continue your work. Add more muscles, choose the method that suits best for you...

When it's done it's time to **Apply Muscles to Body**:

First **select muscles** for binding, and next add the body to selection with holding **SHIFT**. Press **Apply Muscles to Body**.

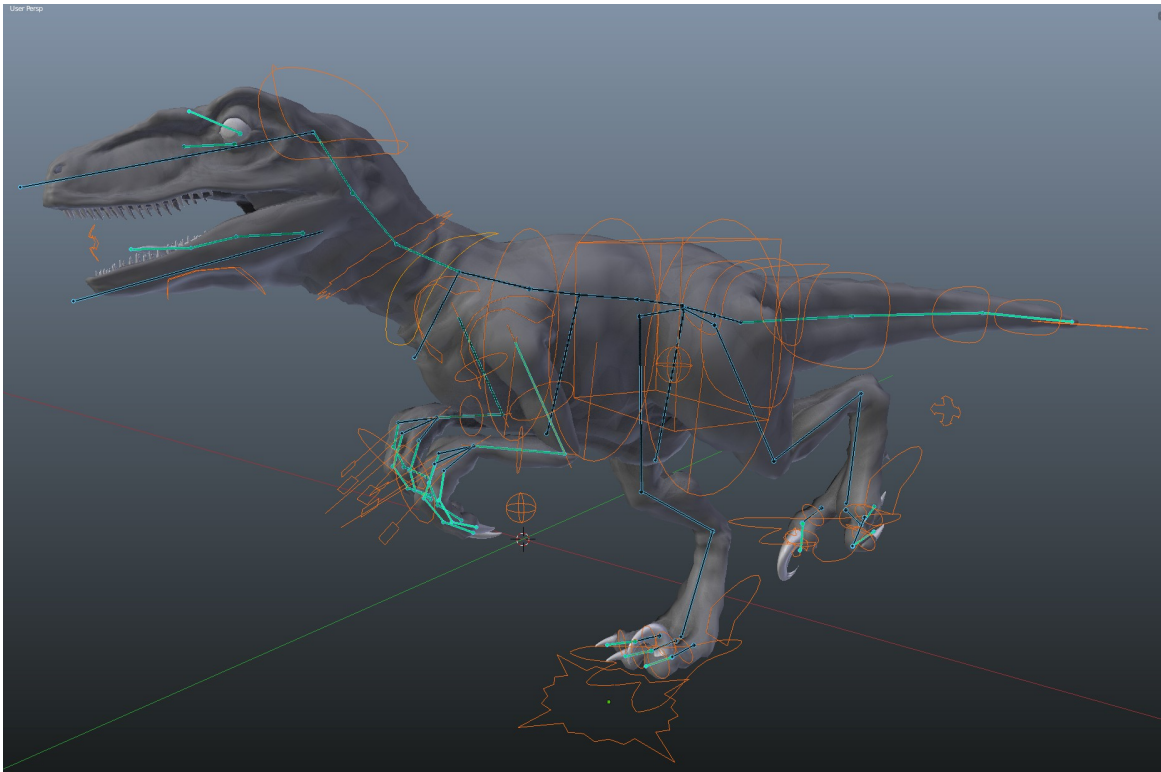
Now all you have to do is to fine tune microControllers, weights and enable and tune muscle Dynamics if needed.

When **Weight-Paint inspection** is needed, set the Weight-Paint Mode for the model and with **SHIFT+Left Click** check the place where particular muscle is expected to have influence. The other way is to find proper name on the Vertex Group list.

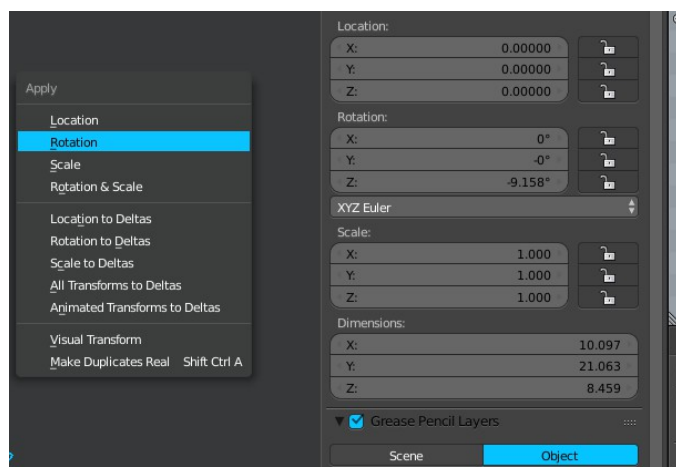


Custom Armature requirements:

- Deformation bones are required for auto-Weight Paint to work.
- Origin point at 0 XYZ
- good if does not contain dependency loops
- auto-run scripts at startup enabled
- **Supported armature suffix format:** .suffix #.suffix ##.suffix ###.suffix or suffix.###
stands for **numeration**, where **#** represents the **cipher**. These are formats for the armature bone naming supported by the system automated tools like X-Mirror reparenting.



The Rig must be placed at World's 0,0,0 coordinates and facing towards along Y axis. This is always the default orientation for all rigs when they're created in Blender and X-Muscle System works according to that standards. Depending on needs **reset rotation** and **location** press **ALT+R** and **ALT+G** accordingly or **apply it** pressing **CTRL+A** and choose **location** and repeat for **rotation**. Proceed these steps in **Object Mode**. You can check armature's location and rotation in the Properties Panel **N** key.



And that's it! You're now ready to start working with your custom armature.

What's next

Compromise between realism and performance

Note that average human body has approximately 650 skeletal muscles. Together with bones they create complex system of around 900 movable parts. When designing a model you must consider what will have the most impact on its visual presence and the goal you want to achieve. There are some other techniques which you may be interesting in, like **displacement** caused by textures, **normal maps** or **Shape Keys** which can be used instead in particular scenarios. Some of them also complement great each others. Always take into consideration taken effort, the render time, performance, complexity of technique, quality, versatility in use. It's all the matter of the ease of adjustment, ease of mixing together and feedback speed.

Animation Inspection

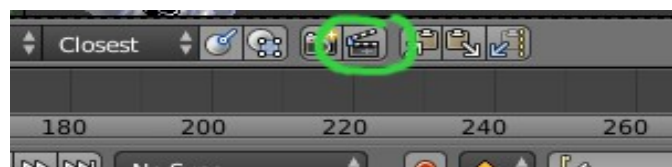
Enable **OpenSubdiv** for the model body Subdivision Surface modifier if it's available. For better Viewport performance, move Subsurf at the bottom of model's modifier stack. To make **OpenSubdiv** work enable it in **User Preferences> System**. In case of Viewport selection problems (lag) switch selection mode to **OpenGL Occlusion Queries** in **User Preferences> System**.

Tip:

It is possible to Apply the Subdivision Surface modifier for every muscles if you decide it's necessary or reduce the number of tissue geometry resolution (3D View). Most heavy load part is the dynamic deformation. You may want to inspect particular model region by disabling deformation and dynamics for the rest of the muscles. These operations should decrease significantly CPU load on playback. Save your work before proceeding this step.

Tip:

Use **OpenGL rendering** to the image sequences or video file. Before the start use **Select X-Musculature** and change muscles Display to **Wireframe**, next open Property Panel Display **N** key. Select **only render**. This allows for high quality, smooth animation Viewport preview. Check rendering output settings and hit Render OpenGL.

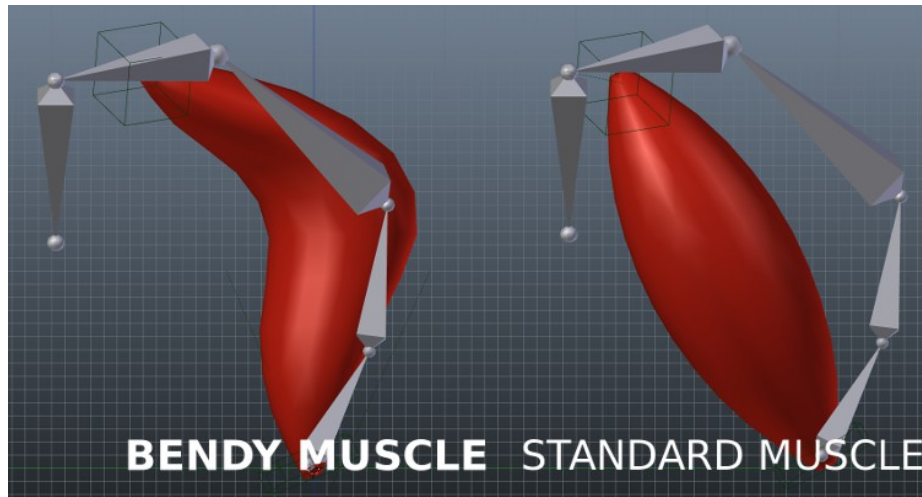


Advanced techniques

creating bending muscles

applies to:

neck, tail, spine, shoulders etc.



This technique allows to create more quasi attachment points that will result more natural muscle bending shapes and behavior in those cases, where single muscle runs through multiple joints.

Create an **Empty**, name it in the systematic fashion, set Empty's location in the center of the muscle's belly. Select the muscle, add **hook modifier**, moving it on modifier stack higher than existing Subdivision Surface modifier will result different appearance. Make copy of jiggle Vertex Group selected and adjust the weights if needed. With muscle selected, enter **Edit Mode** and press **reset** on the **hook** modifier. Exit Edit Mode and move the Empty to the place it will be attached.

Parent the Empty to the desired armature's bone (or other muscle or object) and adjust its location giving the muscle appropriate shape. The muscle shape will now obey armature's skeleton bending, allowing manual adjustment while preserving it's original physical properties. Experiment with the stack order to get the result you want.

This technique allows you to create additional quasi attachment point instead of basic two. This way muscle takes shapes more accurate and flexible to according rig's skeletal position.

Note:

Bendy muscle can be supported by **X-Mirroring** only if the Empty name contains correct **suffix**.

Muscle pinning

Muscle pinning is advanced technique that allows to create realistic, based on anatomical reference muscle attachments. With proper pinning, muscles are able to mimic the real life tissue the same way when responding to skeleton's motion. Pinning affects as well tissue shape as physical based jiggling. X-Muscle System by default creates muscles with two tendons what can be a limitation in some cases. Muscle pinning technique is essential to create complex, high quality structures like deltoid shoulder muscles, forearm muscles, proper deformation of chest pectorial muscles and so on increasing the realism to the maximum.

Pinning muscles to bones is achieved in very similar way as bendy muscles.

To pin the tissue, **create an Empty**, name it correctly and **parent it** to the armature's particular bone. Select the muscle, add the **hook** modifier and **create new Vertex Group** for the muscle. Paint vertex weights, where value of 1.0 will pin the region in place.

You can use **multiple pin points** for single muscle. To do this simply add more Hook modifiers to the muscle. For best results make sure weight-paints for each of pin points does not overlap on the muscle.



Notes:

- Working with body anatomy atlas is recommended for the best results when using this technique.
- The technique is fully **supported** by the add-on starting from **version 1.8.9c**
- For now, only name.XXX.suffix format for Empty name is supported where XXX means numeration. This applies for both Bendy and pinning techniques.

Rigging

Muscles are supplements of the rig and basic rigging rules and methods applies to them. It is very welcome if you have some skills in rigging, know about constraints, parenting and how armature works. This will help you solve some problems you can face during the “body-building”. Don't hesitate to modify and change System's and Controller's properties and treat them like a part of the armature. If the muscle spins, just add **Limit Rotation** constraint to the System muscle part if you want it to stop, and so on. However remember, all these constraints targets will not be handled by X-Mirror and have to be changed manually at the moment.

Going step further with realism

Contracted muscles are more stiff than relaxed. Animate muscle properties or create a driver to control the muscles stiffness value depending on when they're stressed or relaxed.

Collisions

Soft Body collisions are possible with assigned Collision Group. This is experimental feature within X-Muscle System and Save your project before use. Must be done manually. CPU killer

Reusing the existing muscle mesh shapes

There are three ways of reusing existing shapes. **CTRL+ L** to link object data, conversion mesh to muscle and duplication. Each of them has its advantages and disadvantages. You can generally use mesh conversion to create bone mesh. It will create new mesh (muscle) based on any active mesh shape. It is great way to create elements like bones.

Be aware that direct muscle **duplication** with **Shift+D** may result unpredictable behavior. But if you decide to do this step make sure you use **Rename** function for the duplicated muscle what is mandatory to keep naming convention solid in the system. After duplication you may also wish to check the parenting which is always inherited from the original object.

Removing the muscle

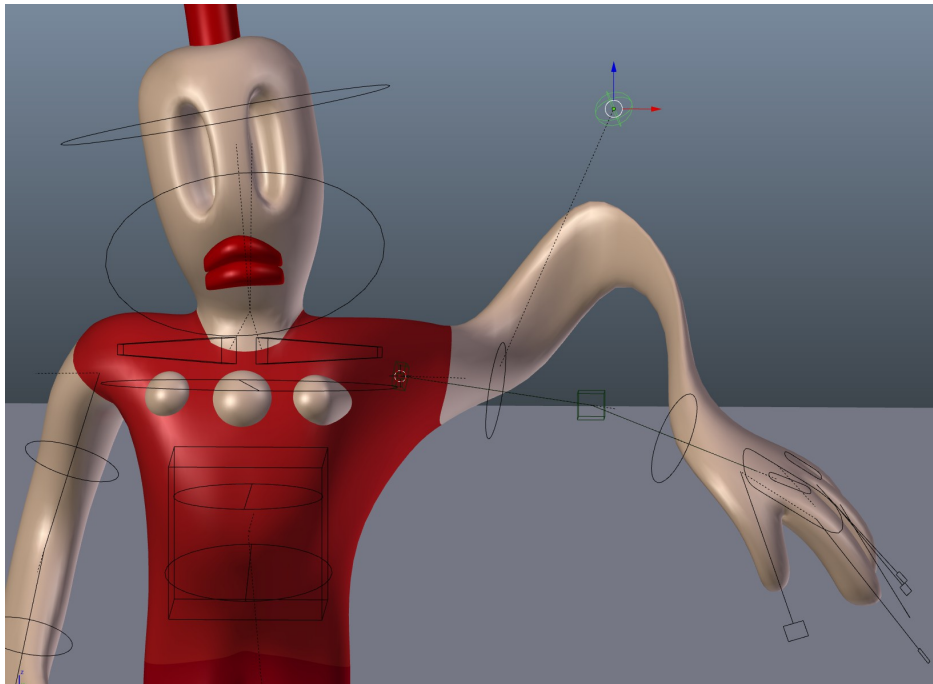
To safely remove a muscle select it with available selection tool from X-Musculature Panel and disable microController. After that you can remove all selected muscle parts with the **X key**. If the unwanted muscle is bound to the skin already, run the “Apply Muscles to Body” first with **Perform Clean** for all the muscles selected, keeping this unwanted muscle deselected. Excluding it from the binding will allow safe removal as described at the beginning of the section.

Warning:

Detaching muscle from body this way will in result in resetting all your X-Muscle Vertex Groups progress.

Using microControllers for cartoon stylized shapes and motion

Using microControllers can have many purposes - like shaping and animating cartoon stylized characters. Do it really fast! Disable muscle mesh **3D View** and **Render** deformation, enable microController and tune up the radius, distance and influence settings to find the results that will cause limbs bend like they're made of rubber.



Exporting

There's no need to export project when used on other machines within Blender but sometimes you may want to consider exporting muscles to external applications. In this case there are currently two options supported.

Converting muscles to shape-keys

X-Muscle System supports conversion muscles to shape-keys. This technique can be very useful when exporting characters to external game engines (Unity, Unreal Engine) or general scene optimization. It is possible with Corrective Shape-keys add-on, which is available within Blender but by default requires enabling in User Preferences. To create a shape-key from the muscle use **slow mode for all modifiers**. Make sure your character's mesh has Subsurf disabled when creating duplicate for editing. Visit Corrective Shape-keys add-on documentation website for more information and visit official X-Muscle System YT Channel for **video tutorials**.

Bake and export animations

X-Muscle System result can be exported as key-framed animation. It is possible to export the animation as a .mdd file, which first requires enabling the Import-Export Newtek MDD file add-on (in User Prefs/Add Ons). Once the add-on is active, use File>Export>Lightwave Point Cache to export a designated series of frames as a cache (file) of vertex (point) locations.

The data exported (the point cache) can then be applied to the existing mesh or a duplicate (recommended) by importing the .mdd file (File>Import>Lightwave Point Cache .mdd) as shape keys on the active mesh, which needs to be identical to the mesh from which the point cache was exported.

Note that the point cache export will include all mesh-level modifiers on the exported mesh, including such modifiers as Cloth, Soft Body, Edge Split, and even those such as Solidify and Subdivision Surface, anything that alters the base topology/vertex count and/or the morphology (shape) of the selected mesh, so keep in mind to disable any modifiers that you do not want to export.

Also note that the shape keys will also reflect all Transforms on the exported mesh, even Object-level transforms, so adjustment to the target mesh will be needed to compensate once the Shape Keys are invoked. In other words it simply copies location, rotation and scale of the model's each vertex of the mesh from every single frame and pastes these attributes accordingly to vertices of active model.

Troubleshooting

Blender 2.77 has a known bug that requires manual drivers updating. In case of issue contact Support for help. You will receive dedicated version with the workaround.

For solving symmetry issues with X-Mirror try setting the model in the REST POSITION before applying X-Mirror.

In case of rendering artifacts - set exactly the same muscle mesh resolution for 3D View and Render

There is known issue with displaying 3D Viewport muscles if dynamics is enabled and Blender started with new dependency graph.

Start with blender console, look for python errors.

Find out are there any Modifiers or Shape Keys that could negatively impact and interfere with muscles. Check the drivers, muscle item properties are available in Properties Panel for debugging.

Prepare simple scene, reproduce and define an error. Collect logs, contact Support, write error description with blend file and specification details provided.

Limitations:

default scene is supported at the moment

Support

In case of software issues, feedback, feature request or licensing questions please contact k44dev Software developer at karab44@wp.pl or via website:

<https://blendermarket.com/creators/k44devsoftware>

or have a lifechat on IRC freenode.net #blender channel.

Reference links

<https://blendermarket.com/creators/k44devsoftware>

<https://www.youtube.com/c/k44devStudio>

<https://blenderartists.org/>

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