character studio® 4

Welcome to the **character studio 4** Feature Highlights guide. This provides an in-depth description of the features in **character studio 4**, and is split into the following functional areas:

- **Keyframe Animation**
- **Non-Linear Animation**
- **Footstep Animation**
- **Motion Capture**
- **Crowd Simulation**
- **Skinning/Rigging**
- **Software Development Kit**

For more information about how **character studio 4** can help you build a more productive animation pipeline, contact your local Authorized Reseller or Discreet Regional Manager – you can find a local representative by visiting http://www.discreet.com/resellers

Please note: new features in **character studio 4** are highlighted **in red.**

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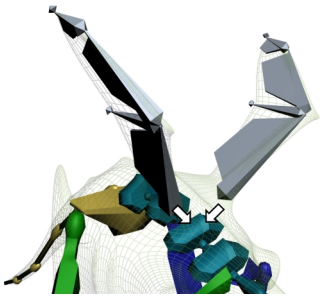
QUATERNION BASED FUNCTION CURVES: **character studio 4** is the first system to provide function curves that internally use quaternion interpolation (***see also*** Animation Workbench).

- there is no gimbal lock, leaving artists to work with intuitive, accurate function curves without the usual caveats of Euler rotations
- the interpolation is "geodesic" (most direct spline in rotational space) and therefore free of "extraneous swing" motion artifacts
- the rotations are order independent
- "best of both worlds" – the most advanced animation system commercially available.

3DS MAX BONES SUPPORT: Now you can load and save any **3ds max** IK & animations that are associated with the Biped character

- Animation and linking data from all attached **3ds max** IK data (bone chains, linked objects, the Biped Head-Target Object, etc) are saved with the .bip file
- **3ds max** bones can be used in conjunction with other components of **character studio 4** including the Animation Mixer, Analyser, Crowd System *et al*.



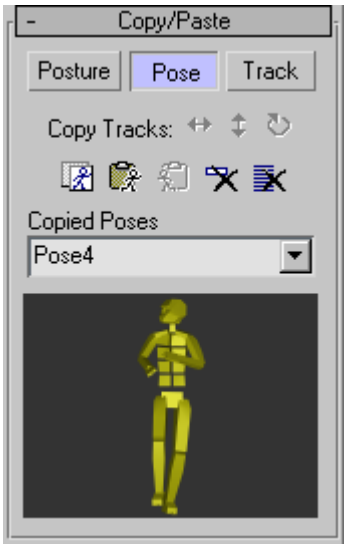
BIPED IK

- Animate characters in a realistic & precise manner with both IK and Forward Kinematics (FK) – allowing you to create whatever you desire with the approach you're most comfortable with
- Integrates seamlessly with **3ds max**'s suite of powerful keyframing tools (including Keyframe Reduction Tools and Weighted Controllers)
- IK Blend tools allow for hands and feet to have weighted attachments to scene objects – this makes throwing and catching a ball, rowing a boat, or dancing with another character easier than ever
- Use identical hand and foot IK pivots for fluid animation of quadrupeds
- Change hand/feet pivot-points over time, within the same timeline
- Multiple pivot points per location (hands and feet) give maximum control whilst integrating with internal Biped dynamics & other operations
- Pivot Point animation is saved into the .bip file

- Expand or collapse animation tracks for Biped arms, legs, spine, neck, and tail – giving power to animate at the digit, joint, or limb level as needed
- New **Clear Tracks** function gives animators ability to remove animation and constraint data from entire Bipeds or selected objects with a single click
- New **Forearm Twist** segmentation gives Biped animators more control over achieving realistic motion and skinning with the character's forearm
- New **Head Target** object gives the biped head a target to look at during the animation – this is a weighted target, so the Biped can be told to seek out the object over time, and then look away accordingly with a minimum of effort
- Bipeds remain parametric, with advanced figure parameters including Balance Factor, Ballistic Tension, and key-based prop coordinate space

TRACK OPERATIONS

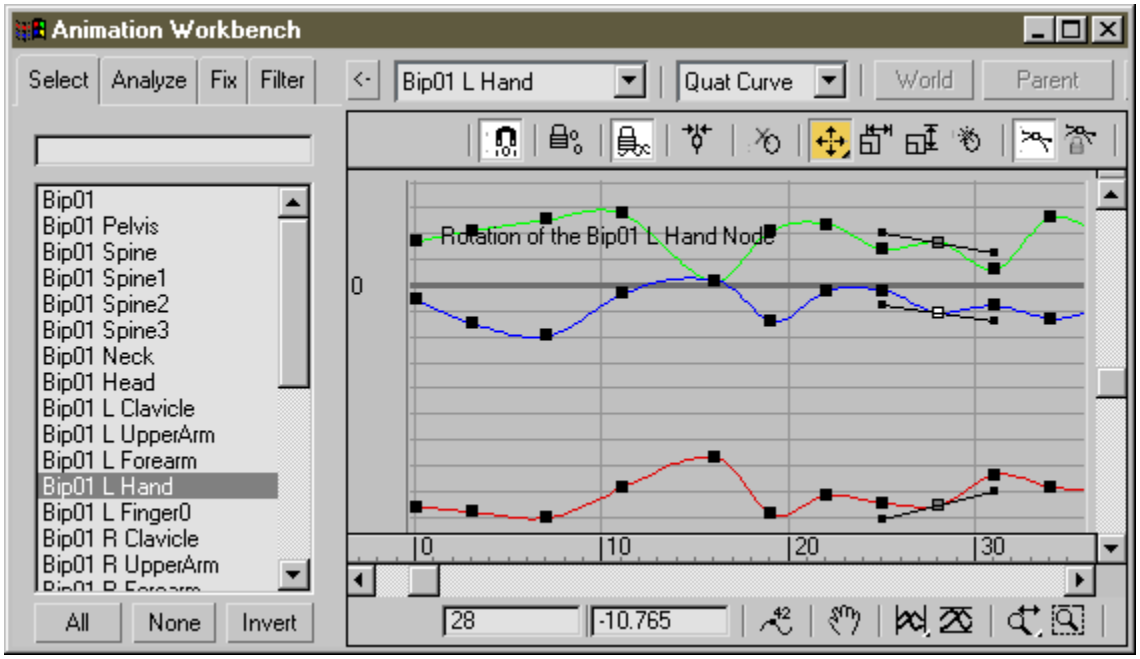
- Copy/Paste track enhancements Allows the entire motion from any Biped track to be easily reflected or pasted to any other biped part for more efficiency
- Tracks can also be copied and pasted between different biped characters - with motion mapping adaptation automatically applied. More efficiency and intuitive operation
- Existing copy/paste capabilities allow the posture of a limb or a character's pose to be instantly reflected across the body, or pasted onto a different Biped at any frame.
- A simple, yet powerful, extension to Biped's existing track operations opens new capabilities for transferring entire tracks of motion between Biped body parts, separate Bipeds, and even between stacked layers of Biped motion.
- Copy/Paste animation track/posture/pose has an improved UI, making it easier to re-apply animation tracks with a new **Visual Clipboard** – copied poses can also be saved and used in other scene files.



WORKBENCH – MOTION PROPERTY ANALYSIS & VISUALIZATION

A biped-specific keyframe editing, analysis, and motion fixing tool, designed for focusing on editing character-animation properties (***see also*** Quaternion Function Curves)

- Integrates seamlessly with **3ds max**'s suite of powerful keyframing tools (including Keyframe Reduction Tools and Weighted Controllers)
- Shows Biped Animations with revolutionary, useable **Quaternion Function Curves**
- Visualize higher-order motion properties such as **acceleration**, **speed**, and **jerk**
- View function curves for Animation Layers
- View sub-frame animation data for advanced motion analysis
- Position Curves can be displayed relative to ***world space***, the ***biped root***, or ***any scene object***



- Use multiple approaches to identify animation/motion capture anomalies
- Fix regular and higher-order motion problems with a range of tools, including motion blurring/smoothing, key removal, and advanced angle smoothing – **character studio 4** helps you identify the best solution for the task
- Analyze entire crowds, single characters or limbs/digits by time segment or entire animation

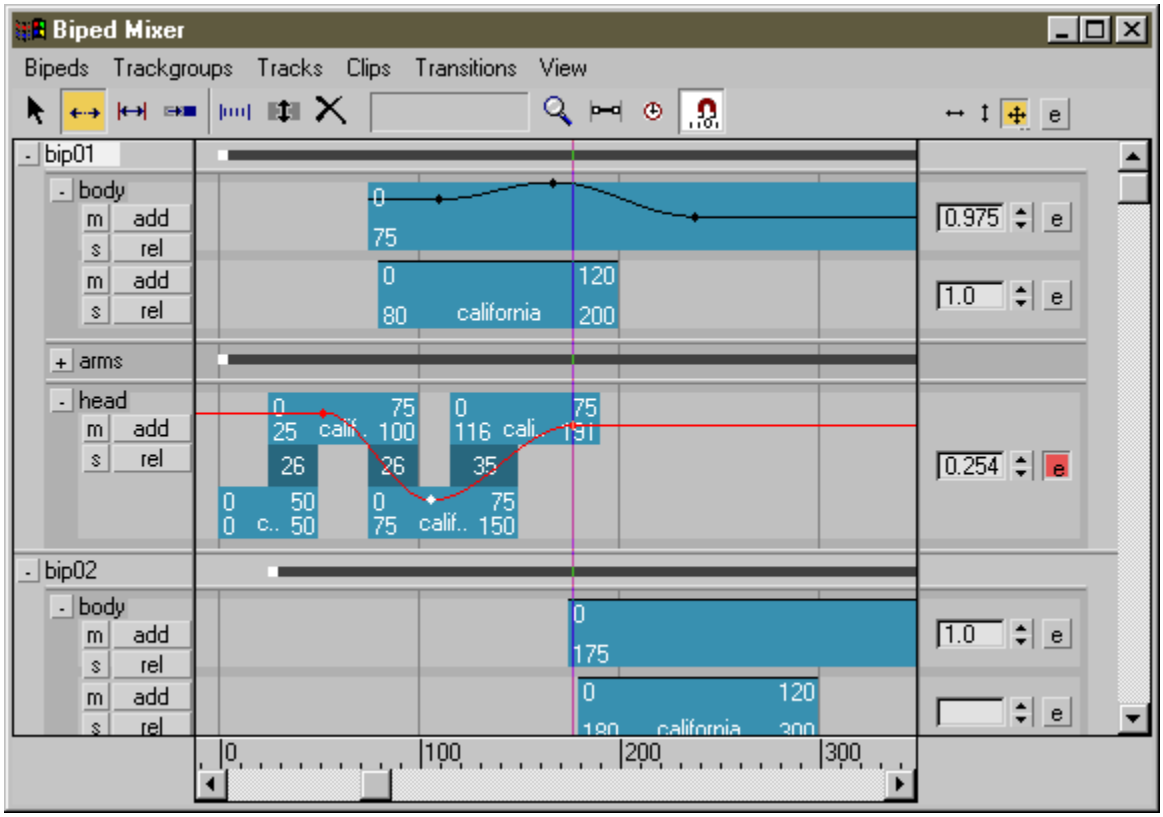
NON-LINEAR ANIMATION

character studio 4 is the most progressive commercially available Non-Linear Animation system on the market, using the latest research from our advanced-animation team and bringing you a production-ready suite of tools for maximizing your productivity on a daily basis.

ANIMATION MIXER

A new approach to Non-Linear Animation (NLA), the Animation Mixer provides artists with a fluid, comprehensive constraint-based NLA system which not only allows for solid, useable mixing of unrelated animation clips – it also contains tools for ensuring that the resulting motion looks inherently natural.

- True timeline editing/management (a la Non-Linear Editing systems) such as Time warps (for the Matrix effect), Clip movement, Clip Scaling, turning tracks/layers on and off, and trimming
- Multiple viewing options including Local/Global Clip start/end times, transition length, Weight Curves, and Time Warps
- All standard keyframe and view management tools from **3ds max** have been integrated into the Animation Mixer
- Weighting controls lets you set which clip or transition track will be considered when blending with other clips/tracks



- Intuitive trackgroup filter makes it easy to decide which clips to work on in the Animation Mixer
- Loads files from multiple sources including saved files, existing Bipeds, the clipboard, and the reservoir (***see also*** reservoir)
- Animation Mixer data can easily be sent out to any Biped
- Supports prop, keyframe, and motion capture information
- Automatically rebalances characters during a Mix, to retain natural bipedal body motion accordingly

3DS MAX CONTROLLERS

Until this release, **character studio** has been a closed system, unable to use the powerful controller components available for **3ds max** driven animation. This has now been changed, and the Biped system is now open to far more possibilities with the addition of controller lists for position, rotation, and scale.

- Drive Biped animations with non-linear or customized algorithms such as Noise, Look-at Controllers, Scripts, Expressions, etc
- Results from **3ds max** controller results can be collapsed and included in the Animation Mixer
- Scale controller gives full capability for Biped to have "stretchy" bones

ANIMATION MIXDOWN

Traditional NLA systems are not able to completely blend vastly different animation tracks together whilst taking foot location/knee joint angle into account to ensure a smooth, realistic looking result. **character studio 4** is the first system to mix down non-linear mixes into a single clip while satisfying feet IK and knee joint motion constraints.

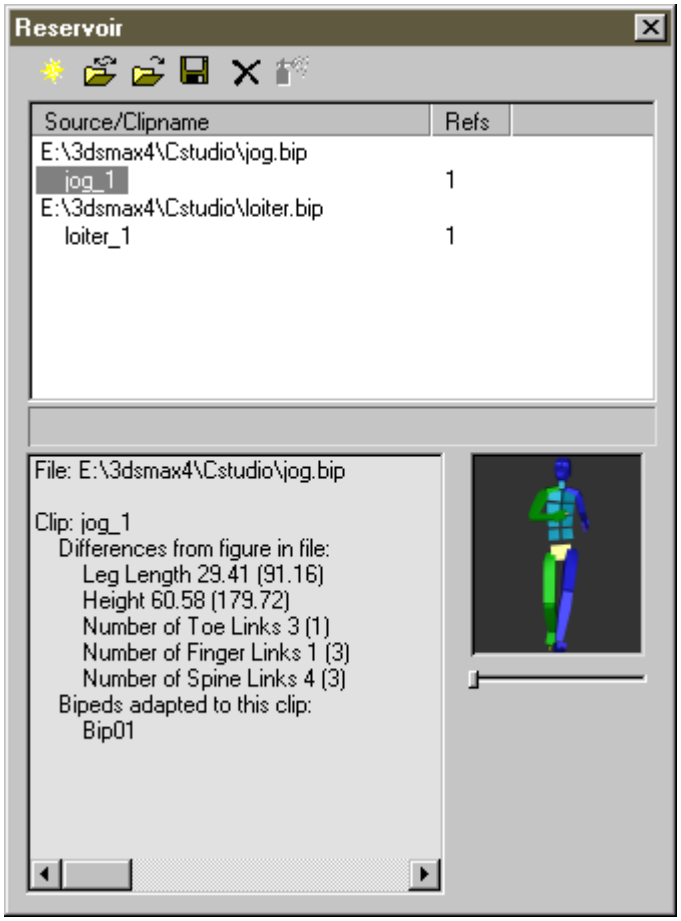
- Determines optimal locations ok IK footholds during clip-interpolation through a sophisticated analysis of foot motion
- Takes knee hyper-extension into account & solves to moves knee "popping" during a transition

- Resulting mixes don't violate crucial physical and kinematic constraints

RESERVOIR

The Reservoir is a scene management tool for organizing and viewing data that the Animation Mixer is currently using.

- View entire list of files being used in the Animation Mix
- An easy to navigate view of how many times each clip is being referenced by the mixer,
- Contains data about the difference in the motion file and the character setup, and how the file is being adapted to accommodate these differences
- Organize, resave, and readapt any combination of files as needed

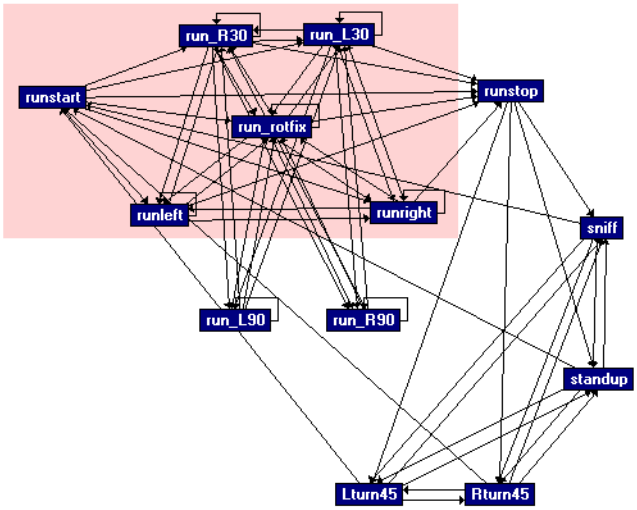


ANIMATION LAYERS

- Change character motion using layers of animation on top of initial data, and either collapse animation into single set of key frames or keep animation layers active
- Able to directorially change animation data of any complexity, from hand-done animation to full key-per-frame mocap data

MOTION FLOW EDITOR

- Accelerated layout, tuning, and sharing of large-scale non-linear animation systems between characters
- Automatically assemble hundreds of clips into a large motion flow graph showing every possible transition
- Select blend points for each transition using cost-analysis to rapidly deliver best-case results
- Cycle character animation autonomously based on per-transition probability
- Share motion flow networks between large numbers of characters to minimize memory usage, and yield unique but predictable results for each character
- Create random scripts to simulate autonomous movement, and assign random start probability per clip in a motion flow network
- Click once to unify motion flow scripts into a standard Biped animation



3D CHARACTER MOTION MAPPING AND SPLICING

- Apply footsteps and animation of one Biped character to any other Biped regardless of height, proportion, or physical differences
- Create motion sequences once and reuse them with any other character
- Use dimensional scaling to adapt footstep placement for different leg and pelvis size
- Adapt gravity to the relative stance of each Biped character
- Splice motions together by copying and inserting sequences of footsteps and associated upper body movements
- Generate seamless motion cycles by copying and reinserting selected sequences

CLIP FEATURES

- Clip tools enable you to set up and control arbitrary 3d studio max objects with states including speed, acceleration, pitch, pitch rate, and heading rate.

- Clip Controller provides realistic animation of flocks of birds, schools of fish, or any collection of non-terrestrial creatures

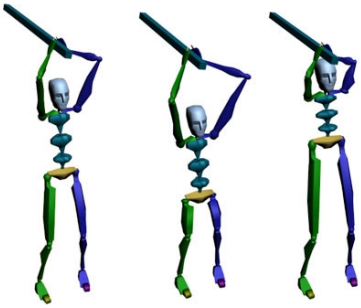
FOOTSTEP-DRIVEN ANIMATION

- BIPED has the industry's most intuitive approach to roughing out a scene for pre-visualization purposes – footsteps enable studios of all sizes to quickly build animatic sequences. These in turn can then be used as the basis of the final animation, a truly productive, effective workflow for building large amounts of animation data quickly.
- Easily create bipedal motion patterns with pre-defined Footstep "types" – running, walking, jumping.
- Place footprints to control timing and position of two-legged character motion
- Preserve nuances by adapting key frames to match changes in footstep timing or placement
- Characters move, rotate, and balance about their center of mass
- Bipedal mechanics help characters walk with bio-mechanically correct relationships between ankle, leg, and pelvis
- Characters bank into turns by default as a function of speed and path curvature
- Convert Footsteps into "free-form" (i.e. no footsteps) animation, and back, at any point in the animation process
- Footsteps work with all systems of **character studio** including the Animation Mixer, Motion Clip Editor, Crowds, etc

PROP RETARGETING:

character studio 4 is the first and only commercially available system capable of instant prop retargeting to characters of vastly different dimensions without the need for manual editing - even when the motion involves props that are exchanged in complex ways between hands or held with both hands.

- Props are systemic objects in Biped 4.0 – treated as part of the inherent Biped system
- Each Biped can have up to three props as set upon Biped creation or in Figure Mode.
- Prop data will work seamlessly with other advanced features of CS4 (the Mixer, Motion Flow, Unification, and Layered edits)
- Props appear as "boxes" in the Biped hierarchy, can be stretched and scaled in figure mode as other biped parts can,
- Props can change linked parents & coordinate spaces (similar to the MAX link controller) at any keyframe.
- Controllers can be used to further influence Prop motion, with the result able to be baked back down to the CS4 controller.



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MOTION CAPTURE

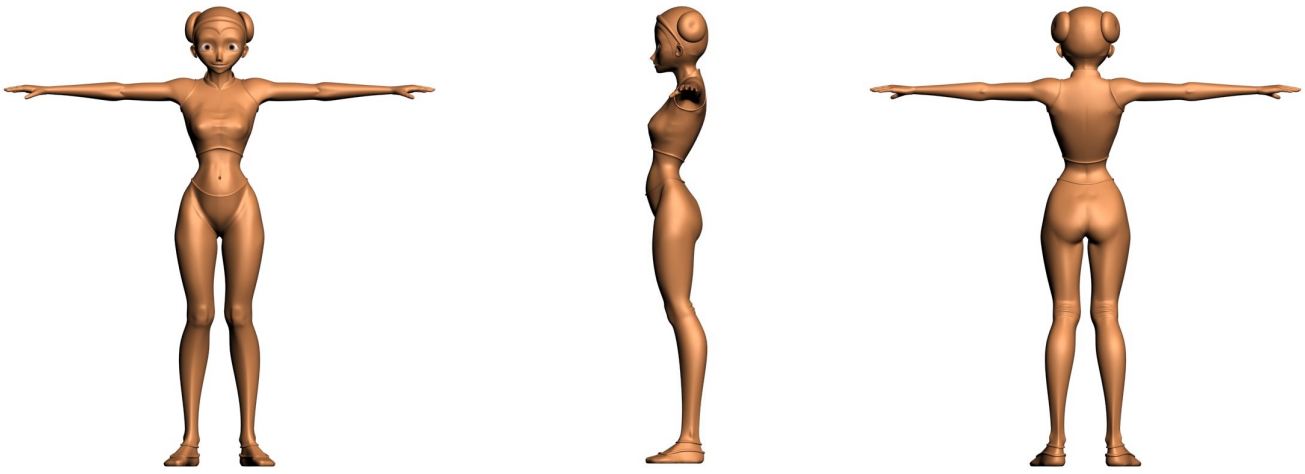
- Import data either from positional/optical markers in character studio's CSM format or from rotational hierarchies in Biovision's BVH format
- MoCap filtering tools give tolerance-based keyframe reduction to preserve the entire movement (key-per-frame) or general trends in the data.
- Either extract footsteps during import to lock character's feet to the ground (z-axis flattening) or create a fully free-form interpolation
- Progressively refine motion capture data by projecting it onto existing footsteps and free-form periods
- Convert hundreds of motion capture files into Biped format in one step using batch conversion
- Now supports toe MoCap data
- Marker Data White Paper is available on http://www.discreet.com to set-up and integrate your own MoCap data

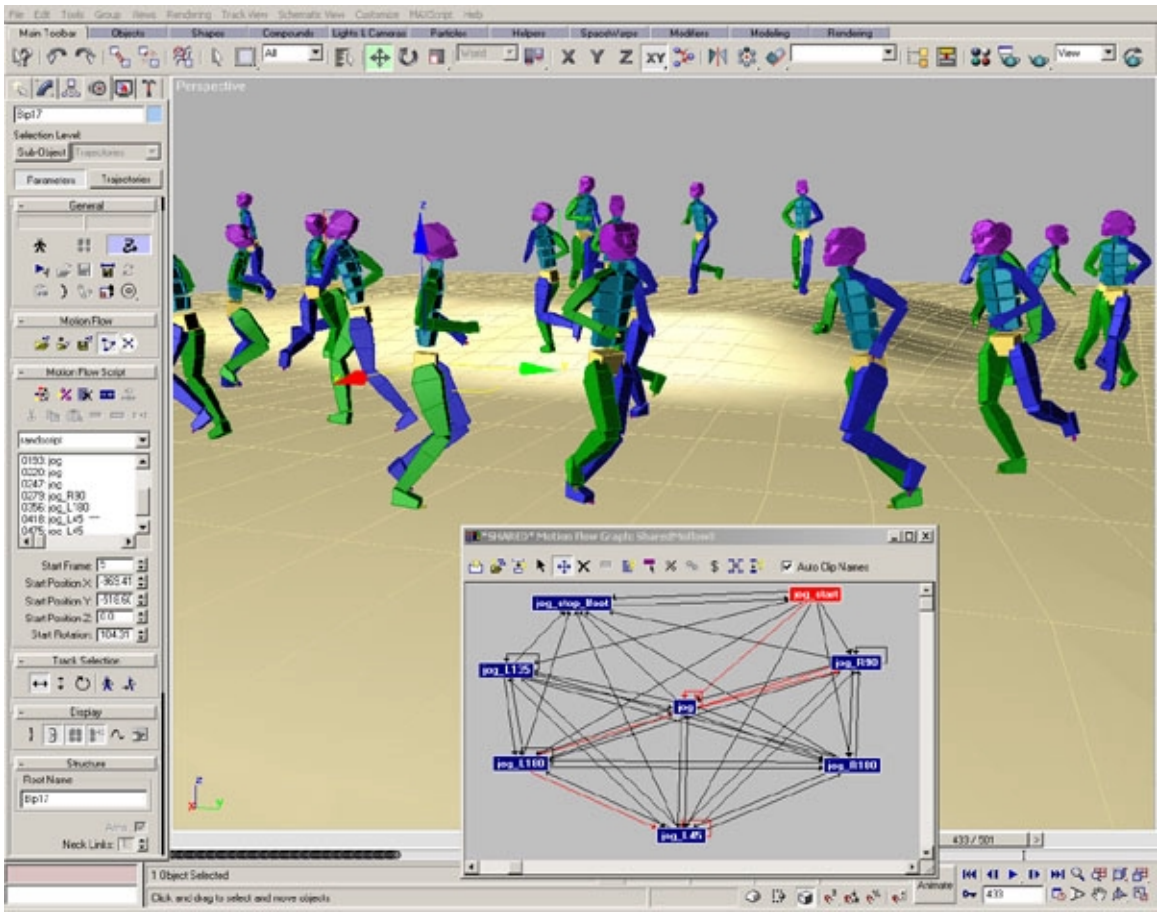
BEHAVIORAL CROWD ANIMATION

Groundbreaking research in the field of behavioral animation yields a rich set of tools and controls for intelligent, behavioral animation of large systems of arbitrary characters – **character studio 4** represents the world's most mature, commercially-available crowd solution today.

BEHAVIORAL ANIMATION

- Handles large systems of Biped characters, as well as non-terrestrial creatures designed with 3d studio max
- High-integrity crowd solver creates position, rotation, and scale keys for all delegates and manages collisions through weighted probability, turning, and speed variance
- Extensive set of modifiable attributes such as average speed, turning, and banking
- Scattering tool for cloning, distributing, and orienting delegates randomly across a surface or within a volume to set up initial conditions
- MAXScript access to set and get delegate attributes, create cognitive controller and clip controller logic, or create new behaviors
- Crowds: the industry's richest set of tools available for behavioral animation
- Intelligently control large groups of characters and creatures, such as schools of fish, flocks of birds, or groups of otherworldly creatures
- Animate crowds, program behaviors, yet retain total scripted control over every individual
- Mix behaviors for any character
- Crowd delegates are lightweight character proxies – they can be assigned any number of available stock or custom behaviors like seek, repel, or follow surface.
- Users can individually tune and name stock behaviors, or develop completely new ones using MAXScript – giving TD's and character animators full control
- Animate the intensity of a particular delegate or team behavior over time, with intuitive mixing control for delegates acting upon multiple behaviors
- Retarget entire crowd simulations to completely new sets of characters
- Combine numerous behaviors and triggering events into decision trees
- Any scene object can be used as a goal, or a barrier, for the crowd simulation





- Over 15 animatable attributes, affecting speed, turning, and banking.
- Values can also be randomized across 100s of delegates in a single selection Gives each delegate a unique personality and delivers efficient control of large populations
- Crowd delegates may be attached to Bipeds or to arbitrary **3ds max** objects, taking full advantage of Biped's non-linear motion flow features and motion mapping capabilities. Brings the full power of Biped to bear on large scale behavioral animations.
- Non-linear Motion Flow graphs of delegate-driven Bipeds deliver advance knowledge to the Crowd system for setting a delegate's path and speed, driving the character over terrain and through obstacles - synchronizing its motion with the ground at all times – an easier and faster way to create "intelligent" animation
- Shared Motion Flow graphs Allows hundreds of Bipeds to share identical graphs and assets - and yet move through a scene with completely unique results (***see also*** Motion Flow Editor)
- Global Motion Clips and Master Motion Clips can be used to apply "best fit" motion clips from an existing animation sequence to non-Biped objects linked to delegates, based on the trajectory of the delegates. This is ideally suited for realistically animating such phenomena as flocks of birds and schools of fish. (***see also*** Motion Clip Editor)

FIGURE CREATION / EDITING

Starting with **character studio** is as simple as drag and click! Your IK chain and constraints are handled for you automatically with this highly productive approach to quickly creating characters – and yet the system remains fully flexible so you can adjust almost any character parameter even after complex animations have been applied

- Instant creation of full Biped skeleton including real-world units for character height, full IK constraints, and is parametric for editing at any time
- Interactively edit bone length
- Add/remove spine/finger/toe segments
- Include extra forearm segments for more accurate wrist rotations
- Save Figure setups as a separate file, for sharing characters, calibrating motion capture data, and swapping out figures on which motion has been applied
- Copy/Paste character poses either symmetrically on the same character or between disparate characters (***see also*** TRACK OPERATIONS)

SKINNING/DEFORMATIONS

Physique is an envelope-based skinning system with full per-vertex weight controls, asymmetrical envelope assignment, intuitive bulge/tendon assignments, and the ability to save/share setups between characters and animators

SKIN ASSIGNMENT

- Attach skin with intuitive 3D deformation envelopes that show exactly how bones affect surrounding skin
- Stretch, shift, and shape each envelope independently
- Save time modifying or replacing skin by reusing envelope settings
- Highly optimized skinning algorithms for better viewport performance
- Intuitive Morph and Joint-based Deformations, intuitive Tendons, and Bulge controls for creating the exact looks you require when any joint is rotated
- Weighted Blending ensures that skin moves evenly and naturally

TENDONS

- Link muscle movement to bones
- Deform muscles across multiple links
- Selectively assign portions of skin to move with individual bones
- Pull skin to follow limb motion, using angular pull for effects such as chest rising as arms move up
- Pinch skin to follow limb bending, such as pectoral muscles protruding forward as shoulders shrug

- Stretch skin to follow limb motion, using radial stretch for effects such as tendons appearing when muscular characters lift weights

SKIN SLIDING

- Pinch and stretch skin to create creases or remove bunching around joints
- Fine-tune sliding on both inner and outer sides of each joint
- Skins biped and 3ds max bones (even "free-floating" bones) within the same modifier
- Fine tuning of Skin Sliding (inside and outside mesh control around the joint)
- Pinch and Stretch Skin to accommodate creases or remove bunching

WEIGHTED BLENDING

- Ensure that skin moves evenly and naturally around joints
- Automatically perform weighted blending with any number of overlapping deformation envelopes
- Fine-tune skin behavior by adjusting weight applied by each envelope
- Select basic blending to preview real-time video game characters

MUSCLES

- Generate muscle bulges based on skeleton joints and joint angles
- Define muscle profile at any point using cross-section editor
- Give model as much detail as desired for any position
- Define overall muscle movement through muscle cross-sections and joint angles
- Control influence, weight, and power of bulge as joints bend

FREE-FLOATING BONES

- Use free-floating bones not linked to a hierarchy for facial animation, muscle effects, and breathing
- Create spline-based bones
- Use all deformation envelopes and vertex-weighting tools with free-floating bones
- Now saved with the .bip file

ALL GEOMETRY TYPES SUPPORTED

- Choose best geometry type for each character
- Supports all 3d studio max surface types, including NURBS, surface patches, splines and polygons
- Change your mind without sacrificing initial set-up time, since deformation envelopes make it easy to change skin shape or structure

SOFTWARE DEVELOPMENT KIT

BIPED

- Allow comprehensive "set" and "get" functions for creation, editing, and export of all aspects of Biped character data.
- New areas of programmatic access include biped creation, forearm twist, loading and saving, setting and getting keys and all key attributes, footprints, Motion Capture import, and Motion Flow I/O
- Biped controller properties now exposed
- Figure Pose Editing (copy/paste functions)
- Get/Set transform data

CROWDS

- The Crowd system is exposed to MAXScript Primarily for setting and getting of delegate attributes, for creation of cognitive controller and clip controller logic, and for creation of entirely new behaviors.

SCRIPTING

- Develop scripts that seamlessly incorporate many Biped animation files
- Save scripts to remap to any Biped character
- Build motion library from saved scripts
- MAXscript reflects a 1:1 association with the **character studio 4** SDK
- Use MAXScript for access to all Biped character data, including creation, load, save, set and get keys and key attributes, footprints, motion capture data, and motion flow I/O

PHYSIQUE

- Includes direct export functionality for game developers wishing to import Physique Vertex Assignments into their game engines
- Supports Blended and non-Blended Rigid Types

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