

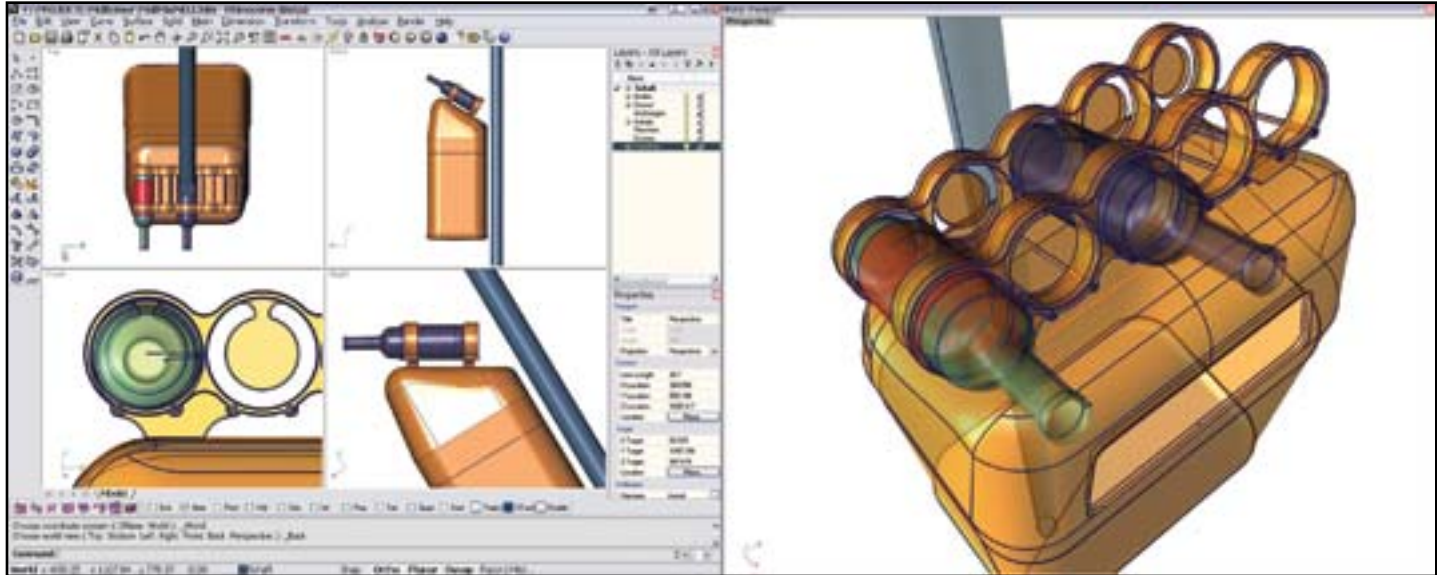
Rhinoceros 4



Written by Al Dean

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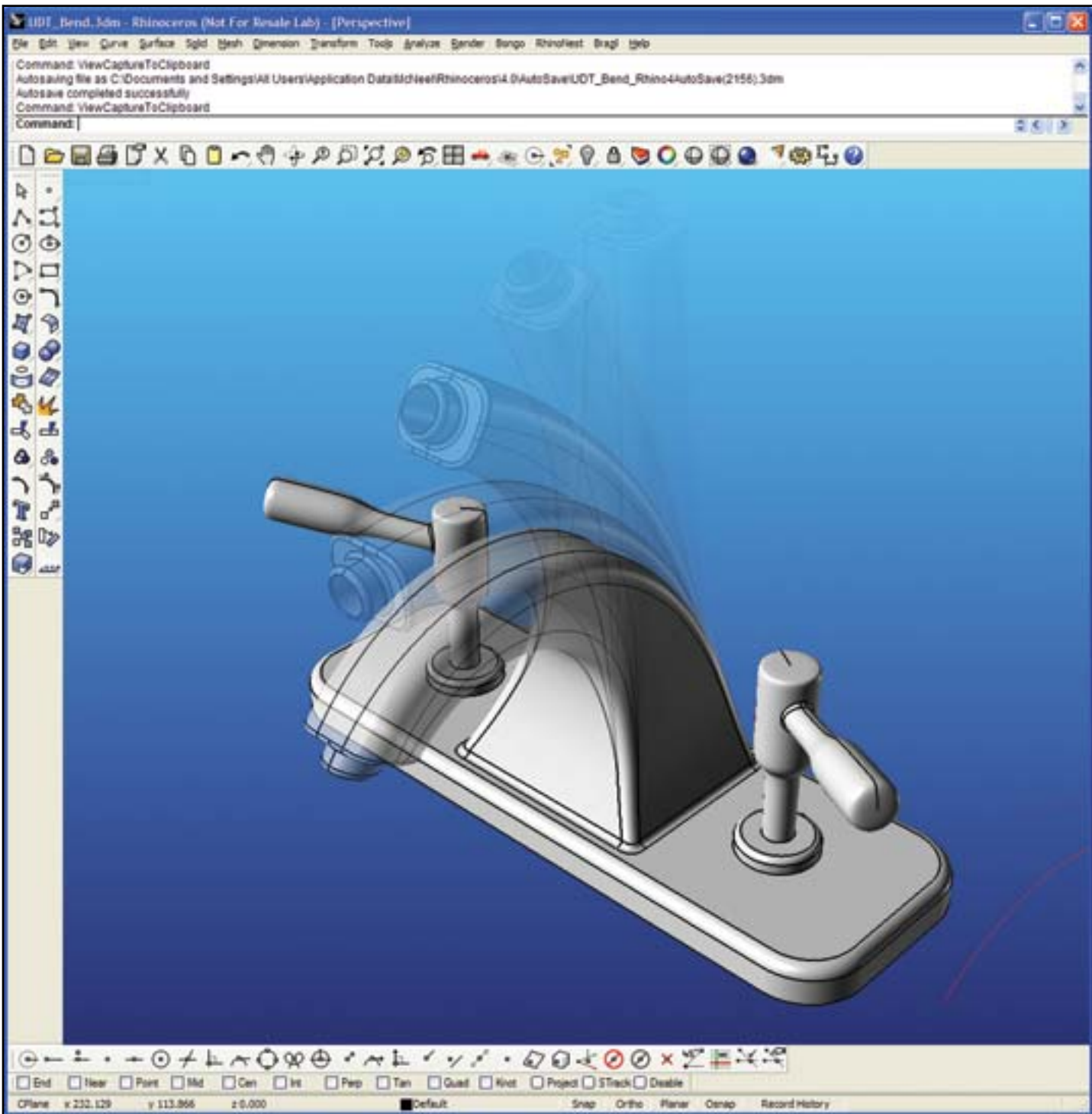
Al Dean takes a long overdue look at Rhino 4, the legendary software application from Robert McNeel & Associates for the creation and modification of complex forms and shapes.



You can now use Rhino across dual monitors and with the new floating viewports, you can have a large scale view on one monitor and the regular interface on another. For design work this will prove invaluable, but it really sings for design presentation and client review (you could have the second monitor output to a projector).

Of the wide and disparate applications that have been released over the past decade, few have gained a cult following like Rhino from McNeel and Associates. Rhino is a low-cost, high functionality system developed for the creation and modification of complex forms and shapes. It's widely used in almost every industry sector, from traditional industrial and product design, and into other niche sectors, such as jewellery, medical etc.

Whether Rhino's cult status is driven by price, the focus of the development team, the fact that's it's owned by an independent company, or just plain good value or money, the fact is that there are a lot of Rhino users out there and that always means one thing – development. The latest release of Rhino has been out for some time (since January), but having sat and had a look at what's new, what's been added and what's been changed, I thought it was well worth the time to dig a little deeper.



The new Bend command allows you to deform a geometry set around an axis to create very sculpted forms with ease.

Those that have experience with Rhino will know several things. Firstly, it's a system developed to assist with the definition of complex shapes and the entire application, whilst supporting solid-type entities (primitives etc), is tuned for surface modelling. Over the past few releases, the level of sophistication of those surface modelling and, perhaps just as importantly, editing tools has increased, reaching a pinnacle with this release. What Rhino 4 has seen is the introduction of a raft

Rhino and automotive design

If you believe its competition, Rhino is often dismissed as a budget modelling tool, but the facts of the matter are that while the mainstream automotive industry is heavily invested in higher-end (read: more expensive) systems that fit in with their heavily process-based workflows, for the smaller automotive-based organisation, Rhino offers a powerful modelling tool that is affordable.

of new tools that make the modelling process, specifically editing and making design modifications much easier than is traditionally the case with any form of surfacing.

The first biggie for those used to working in a history-based system is that Rhino now supports history. As you would expect, this can be turned on and off as needs be, so 'history aware' objects can retain their inputs and the result of their operations if you need them to. History aware objects and commands include arrays/patterns, copy, divide, extrude (of surfaces, curves, along curves, tapered, to point etc), flow, Intersect, loft, mirrors, revolves, rotations, scales, as well as mirrors and symmetry. When you change the underlying geometry or conditions, the part geometry will update – saving you rework.

McNeel has also introduced what it is calling Universal Deformation Technology or UDT for short. This allows you to make modifications, through deformation to any curves, surfaces, meshes, and solids. What is clever is that you can do this while the system attempts to maintain the integrity of the object – so if you have tangency or curvature defined, the system will try to maintain it. The actual operations take the form of several key commands, so let's take a look at those. For me, the most interesting are the Cage Edit operations. These allow you to take either the whole or specific areas of a surface model and edit it using a boundary box. You use the control vertices to edit the boundary box and the part will deform as you move them – it's shown in the later stages of our workflow and the results that you can achieve, from even the most basic starting model, are incredible.

While the workflow on page 17 shows what can be done with the Cage Edit tools, the UDT technology has also been implemented in other commands that allow you to make more localised edits in specific ways. For example, you can now bend and twist components. One really cool new function is the Flow Along Surface operation. This allows you to take one set of geometry and morph it to a target while maintaining any geometric relationships you've built into the original.

What impresses me most with this release is the manner in which the development team has taken the core technology updates and created usable operations – alongside the UDT and cage editing tools, there has been a lot of work done to make commonly used functions such as the Blend Surface operation more powerful and flexible. You can see some of this in use in the workflow box out, but in general terms you can now create transitions

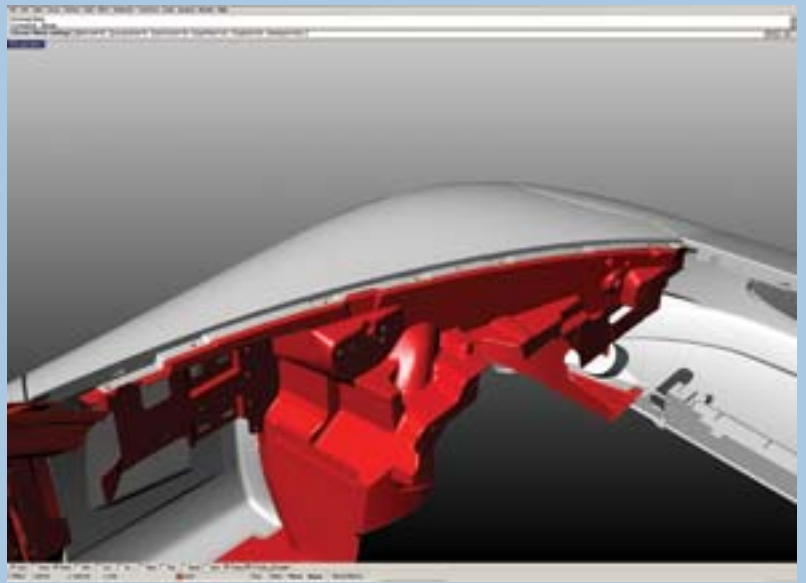
One example is the recent work done by Barcelona-based design firm Ingeenium (www.ingenium.com), on the 4 x 4 SCARTT 500cc you'll see on our front cover. This vehicle is the European answer to the host of familiar-looking All-Terrain Vehicles (ATVs) from North America and Asia. The Ingeenium design team gave the SCARTT (www.scartt.com) a contemporary look that borrows more from the world of automobiles than of motorcycles. "It eats any kind of terrain. The SCARTT is just incredibly agile," says lead Ingeenium designer Sergio de la Parra, whose team developed the concept for CSR Motorcycles (www.csrmoto.com). According to de la Parra, the most difficult aspect of bringing the SCARTT into reality was a very fast design schedule. While the product development was a year long process, most of the crucial design tasks for Ingeenium took place in six intensive weeks with de la Parra, mechanical engineer Sergi Sans, and product designer Cristián Hutinel all working full time on the project. Due to the brief design timetable, the team saw serious limitations in using a physical model. Hutinel, with vast model-making experience in different materials, had a good inkling of the ordeal it would have become if they formed the design in clay. Sans, a former engineer with SEAT, Spain's largest automaker, knew the potential of Rhino to perform the same sculptural constructions as the modellers used by big automakers, but costing a small fraction of the price. The three designers found 3D modelling the fastest way to prepare the design for prototyping. When they came to work on this project as a group, the choice was to work exclusively in Rhino. Another automotive example is the work done by BRIO innovation for Callaway Cars. Callaway is a specialty automobile manufacturer who enlisted BRIO's surfacing expertise to assist with the development of the Callaway C16, a sportscar built on the GM Corvette platform. The BRIO team did all the technical development from scanning the initial design up to production using Rhino. Using a clay 1:10 scale reference model of the new Callaway, a digital model was created to fit the GM Corvette platform.



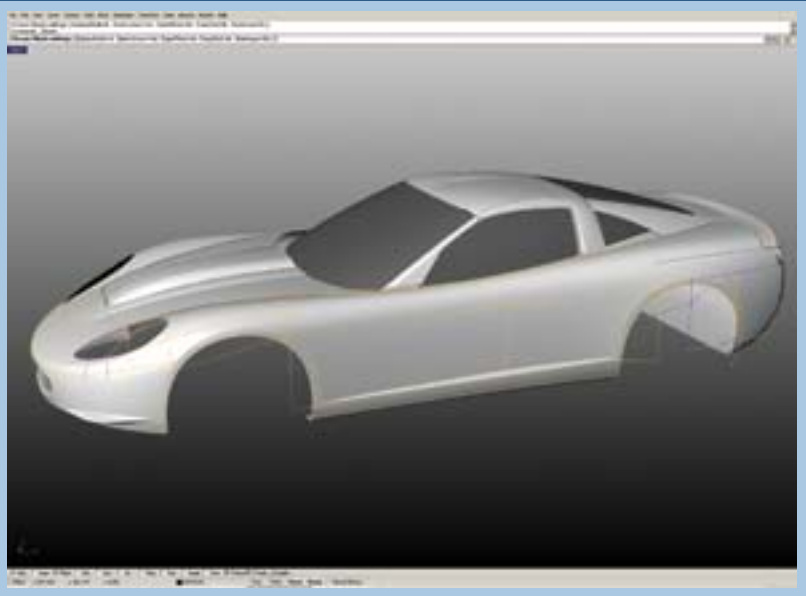
between geometry and fully control it in terms of curvature continuity but, at the same time, have a huge amount of control over how the geometry is constructed – with the end result being that you can achieve the form and aesthetic quality you're looking for and have the system handle the underlying maths.

To give a little more detail, whereas in some mainstream tools, a curvature continuous blend between two surfaces would give you a fixed shape in that blend, within Rhino you can control the continuity at each edge individually (between G0 and G4), click a toggle to symmetrically adjust blends or dive in and define multiple cross sections to precisely create the form you're looking for.

Callaway C16, a sportscar built on the GM Corvette platform



The silver-colored fender of the Callaway, with added flanges and points of attachment, was sculpted to fit tightly with the interior of the Corvette frame from GM, shown in red. Much of the 450 hours of modelling were spent not on the general form of the car, but on breaking Deutschman's design into the composite parts. A Microscribe 3D digitizer was used to scan the clay model and import the 3D points directly into Rhino as polylines. Corvette body parts were obtained from GM in IGES and STEP format and used as a starting point. Mounting points were derived from those so the team knew where all the points would be on the new car. From the scan, curves were recreated, forming a scaffolding on which the surfaces were built.



Couillard re-builds the surfaces in Rhino. The faint yellow lines represent the main outline derived from the scan. The rendered surfaces over the wireframes allowed the user to perfect the subtle highlights on the

Alongside the modelling and editing tools, this release has seen a fair amount of work done on the display pipeline which takes the existing tools for display, analysis and such and makes them much more efficient using today's hardware. In general user terms, the system now supports floating viewports, which when combined with the added ability to run Rhino across dual monitors and to run in full screen, makes for a very interesting presentation and design review potential (as well as giving you more modelling space).

The system has had the standard surface evaluation tools you'd expect from an industrial design-focussed tool (such as Zebra striping, curvature, draft and now thickness analysis), but with the pipeline updates, the system can now visualise design changes whilst maintaining the analysis and rendering modes – either by viewport or by object. Alongside this, you can also analyse and display topology problems including back-faces, holes, gaps, and open edges.

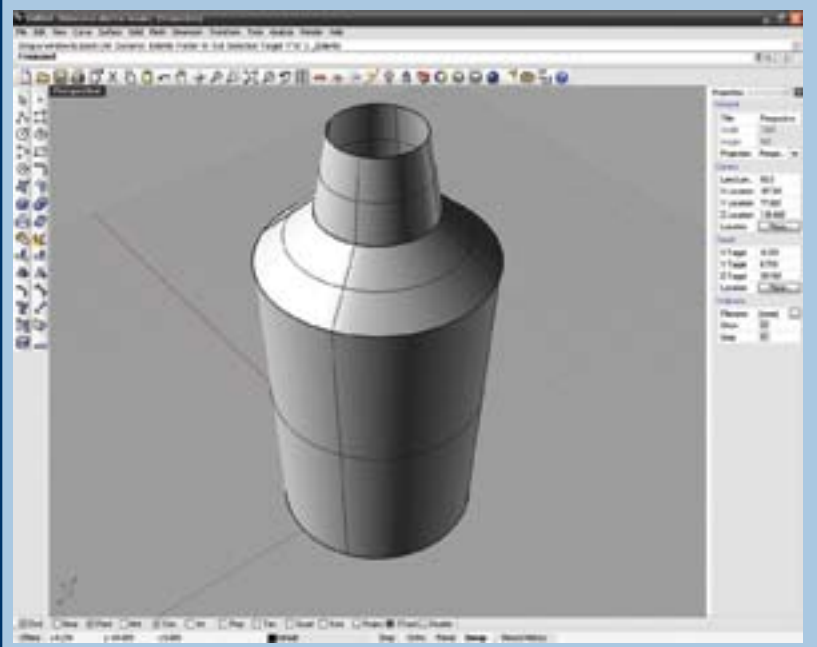
Conclusion

I recently spent some time with the founder of the company and his team in Mexico (see our coverage of the DIME (Design Industrial Mexico conference) event next month) and I left with the impression of a CAD developer that differs from the norm. Yes, McNeel & Associates is a commercial enterprise and as such is looking to make some money out of what it does – but not at a huge cost to the user. Rhino is popular across the globe with 150,000 plus licenses out there. It's priced globally at a cost that most commercial entities can stand. You acquire the license (for €995) and you get a lifetime of support – yup – no maintenance fees. Upgrades are available for each major release, and they're going to cost €395. This is the reason that Rhino has become popular. There are no tie-ins, you get support for the software you've acquired for its lifetime (or more specifically, yours) and, when all's said and done, it's an incredibly powerful modelling tool.

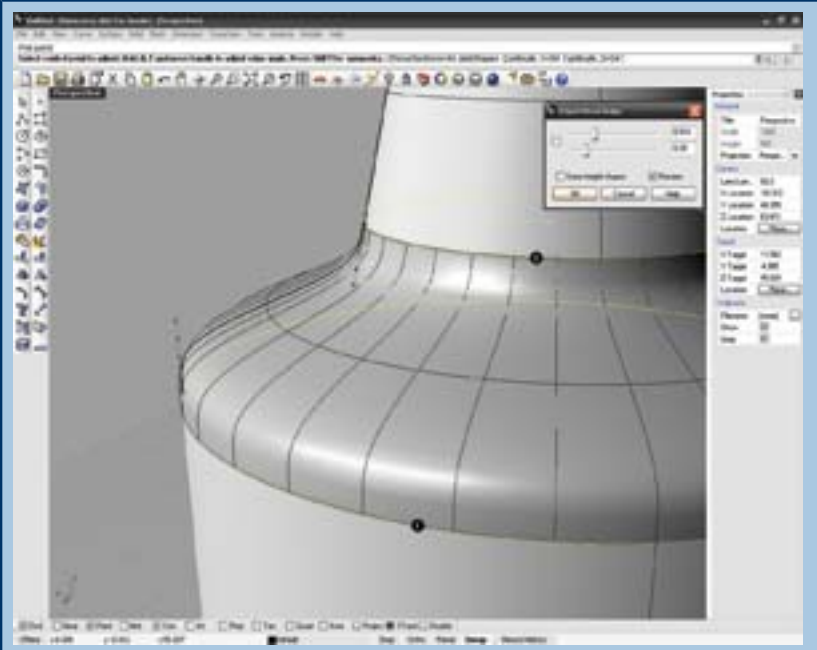
Alongside the core application, there are a number of both McNeel developed add-ons covering photo realistic rendering (Flamingo), non-photorealistic rendering (Penguin) and

Callaway C16. One of the most critical tools that Rhino brings to this type of project is rendering, as Couillard explains, "I can immediately evaluate the connection between surfaces and the highlights. You don't see these types of tools usually in a thousand-dollar piece of software. You see those in IM tools like Alias and ICEM, which are at least ten times more expensive."

Rhino workflow



Starting with this basic model of three lofted sections to create a cocktail shaker. The form is basic and not particularly inspiring - transitions are linear and not particularly organic.

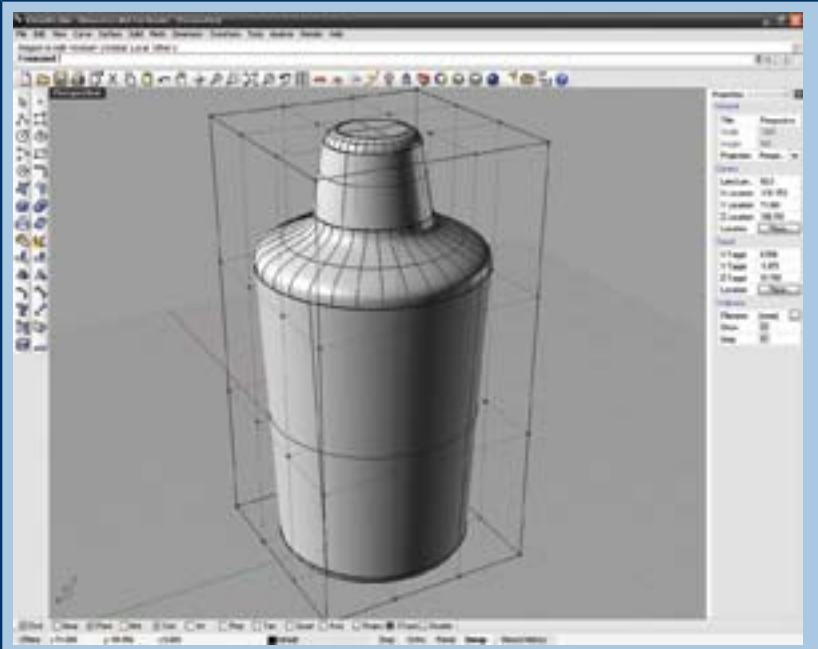


Here, the transition between the body at the cap has been removed and a blend surface has been created between the two lofted surfaces - Rhino allows you to create up to G4 curvature continuity and this has been

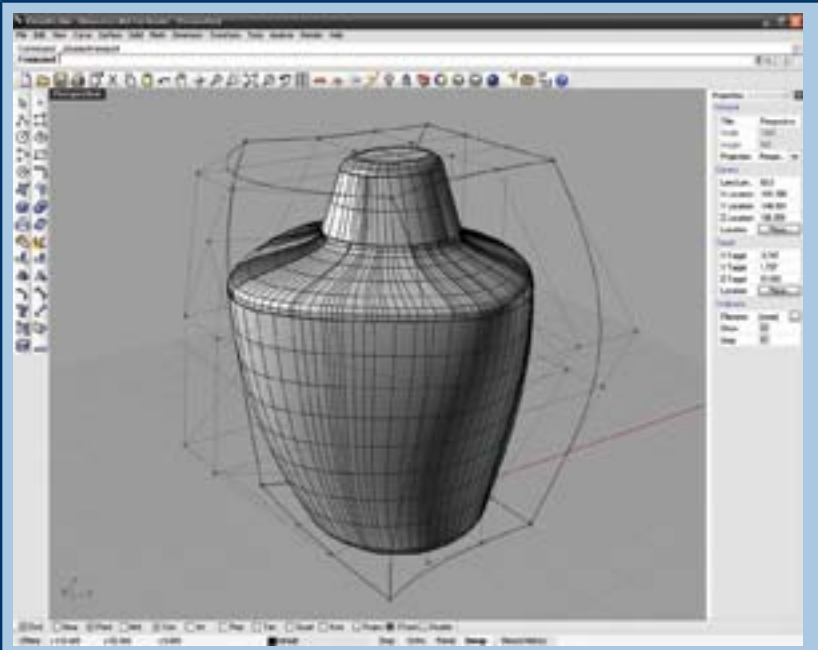
Bongo for animation. But additionally, there's also an incredibly active third-party developer community, and everything is there if you need it, from various rendering tools, reverse engineering, CAM and NC programming into task or industry specific tools for shoe, jewellery design to name but a few.

The latest release sees a huge amount of work done to bring ultra advanced surface modelling technology to the user community – what's impressive is that the tools added to this release, from the updates all across the board (which we haven't covered here), through the Universal Deformation and G-Infinitely technology, have all been developed with two purposes in mind. Allowing the user to create the geometry they want or indeed, need – with G4 curvature continuity being added to a wide range of operations, that's eminently more possible. But alongside that, the various operations and commands have been built with ease of use in mind – so you have a holy duo – incredibly powerful surface modelling tools, combined with ease of use, both during creation and with the introduction of history, during modification.

put in place to ensure that a smooth transition is created between the two. This is fully adjustable using the on-screen controls and if a non-uniform shape is required additional cross sections can be added.

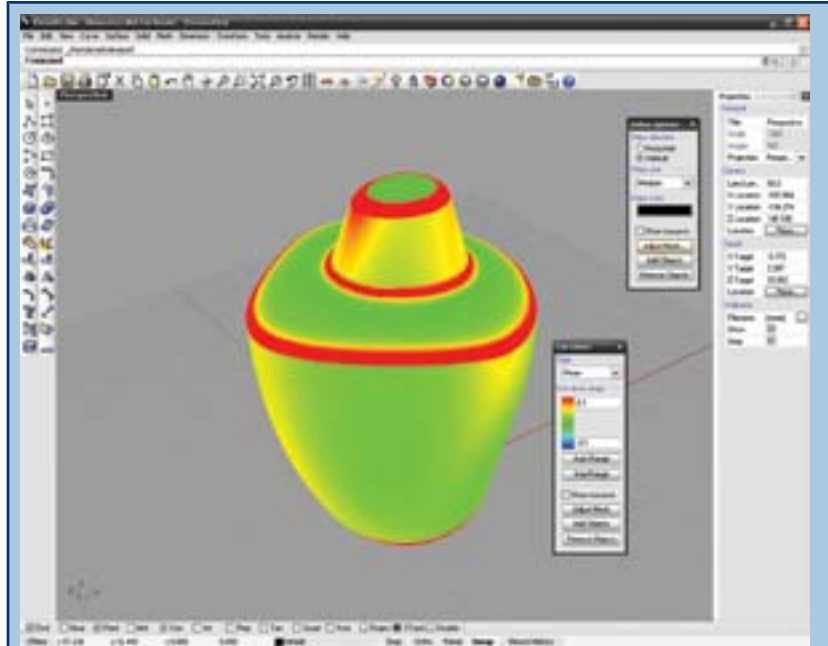
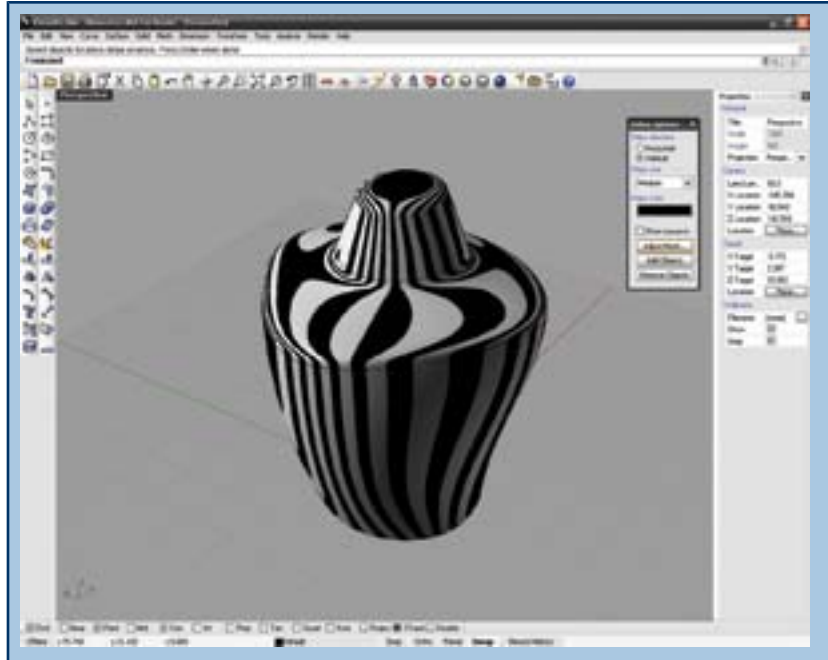


Now that we have a basic shape, we're going to create something more interesting using the Cage Edit tools. To use the Cage Edit tools, you first create the Cage. This is a bounding box around the part (with filleted cap and base) - you have full control over the number of edit points you create in this cage and using these, you can drag the shape into the form you require.



Here, the part is being deformed by pulling out the control points you want to - if the part is to be symmetrical, you can just work on a single half and have the system calculate the other half. Further edits are made pushing and pulling the Control Cage to

create a more interesting form.



The new Zebra striping and Curvature analysis tools are used to inspect the flow of the surfaces for aesthetic quality.

Product

Supplier

Rhinoceros 4

McNeel & Associates
www.rhino3d.com