Visualization in automotive product development workflow

Image courtesy of Lean Design GmbH

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Automotive original equipment manufacturers (OEMs) and their suppliers are under unrelenting pressure to design innovative and alluring vehicles—and bring them to market faster than the competition. To find and manufacture a single automotive product that exudes quality, is pleasing to the eye, and appeals to buyers, hundreds of conceptual design details must be vetted. Automotive designers must then shepherd the winning concept through design review, evaluate it for manufacturability, and plan for production—all to ensure a beautiful, quality vehicle.

Manufacturers, meanwhile, are in an endless race to introduce the newest design trends to market as quickly as possible, while avoiding costly design changes. This creates both time and quality pressures in the automotive product development cycle. What if automotive design software had the tools needed to visualize a vehicle from conceptual design through to engineering and production? High-end photorealistic visualizations and virtual prototyping enable better design decisions up front and help speed the best concepts through the product development process utilizing the Autodesk Digital Prototyping solution.

Common challenges: communication gaps and expensive prototypes

In the automotive design and development process, communication gaps often arise between product development and management, and between design and engineering teams. Even in the earliest stages, designers must communicate and present design intentions to management for approval. But management needs visual aids to understand what the actual vehicle will look like, and to help inform their decision making.

The automotive industry also relies heavily on physical prototyping. In early stages, clay or foam models can be created relatively quickly, but still are an expensive way to visualize the form. If needed later in the process, a complete verification, pre-series model is an extremely expensive and time-consuming project. Because a prototype is by definition unique, building a single full-scale vehicle doesn't qualify for economies of scale.

Special equipment must be manufactured just to produce parts for the prototype. The end result is only one configuration of the vehicle, with no fast or easy way to explore variants of different details. Often, the prototype is only used in one step of the product development process.

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Quality control is another challenge. Any changes made to the vehicle's design late in the process can have significant cost and scheduling ramifications. The more issues that can be resolved up front, the more efficient and cost-effective the model will be to produce.

Image courtesy of ŠKODA

The value of visualization in the product development lifecycle

Visualization can help automotive manufacturers and their suppliers address the key challenges outlined above. High-quality, photorealistic images communicate design intent, so management can make more informed decisions. Switching to a virtual prototype can save significant time and cost related to producing physical prototypes, while providing more digital variations for review in less time.

Also, visualization software allows design teams to input vast amounts of technical data to create an extremely accurate virtual representation of the assembled product—complete with all systems and components such as engine, interior, seats, and instruments. The visualization is so accurate that design teams not only can evaluate design concepts, but also perform quality control. For example, they can check operational functionality in virtual space and make adjustments as needed prior to production.

Here's a closer look at how visualization software helps to enable fast and efficient workflows in different phases of the automotive product development cycle:

Conceptual design

Important decisions about product design are made at a very early stage in product development. The best design departments promote creativity and produce a flood of design ideas that must be reviewed and vetted. But with an extensive number of design concepts, physical and digital, clamoring for attention, how does a singular design get traction?

Visualization can help depict nonexistent products in a photorealistic manner, making it possible to present, validate, and promote conceptual designs. Using generated imagery to create visual feedback of data, visualization strengthens the review process and improves the quality of designs before prototypes are built and production planning begins. Rather than relying on a single prototype, design teams can quickly produce multiple configurations of a vehicle in a 3D environment. These high-end visualizations with photorealistic qualities help the design team evaluate the form and aesthetics functionalities and feasibility of specific designs, saving time and cost, while considering more options than ever.

Detailed design

High-end visualization tools allow automotive manufacturers and OEMs to perform more design reviews and evaluate more alternatives faster. Moving into the detailed design stage, visualization can be used to evaluate the aesthetics of shapes, materials, colors, and lighting to make more informed decisions. Virtual prototyping allows designers to evaluate the behavior and appearance of materials—including plastic, paint, metal, leather, fabric, and more—and see what the real product will look like.

With fast feedback, users can switch colors or environments to see how the product and materials will be perceived in different surroundings. Design teams can work with both interiors and exteriors, and consider different material and trim combinations, lighting designs, and more. For example, visualizing the interior "mood lighting" or animating seat adjustments or door motion can help finalize design decisions faster.

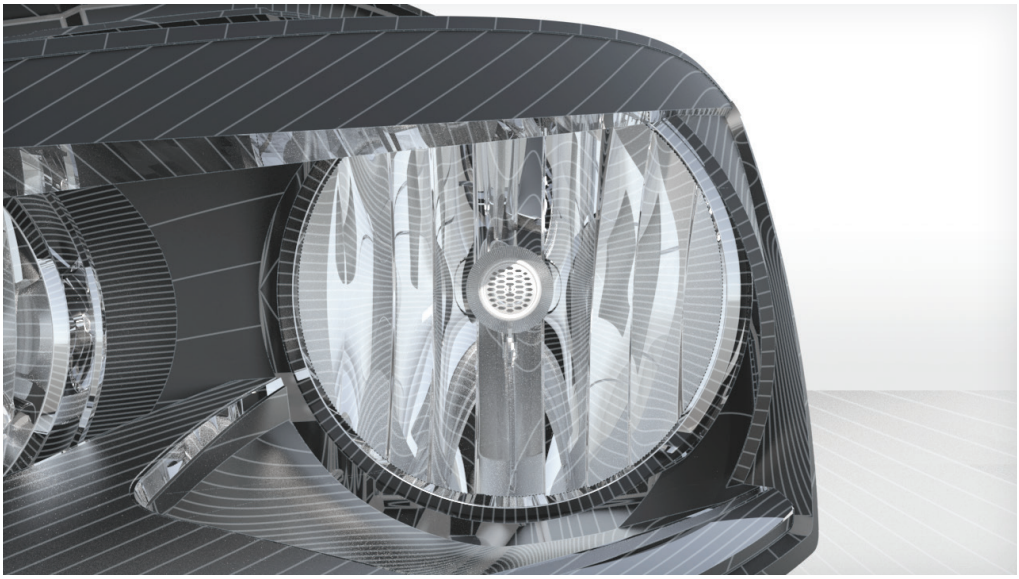

Image courtesy of ŠKODA

Technical surfacing

Technical surfacing helps transition the design concept from an idea to a vehicle ready to be manufactured. Technical surfacing specialists review and optimize the behavior of shadows, reflections, and highlights to evaluate surface and overall perceived quality. Visualization is essential to assessing perceived quality of craftsmanship—for instance, is the overall appearance high quality? Do the parts fit tightly together? As an example, automotive companies spend a great amount of time and effort to keep gaps in-between car panels consistent. In theory, the design is perfect, but walking around the vehicle, the gaps might look and be perceived as different. With high-end visualization tools that use actual NURBS surface data, technical surfacing teams get the highest degree of accuracy. Not only can they evaluate the panel gaps, but also look into gaps to see the placement of fasteners or welding points that might impact a buyer's perception of quality.

Engineering

Once a detailed design model is complete, the technical design review begins. At this stage, visualization allows for virtual prototyping, so certain aspects of the design can be reviewed prior to moving to production. For example, do all the components match and line up? Does the material show the expected characteristics? Does it look good to the eye? The virtual prototype is so real, engineering can use it for quality control, reviewing results in enough detail to identify issues and take proactive steps to avoid more costly revisions downstream. Visualization also helps keep design intent intact while evaluating manufacturability.

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As an example, virtual design validation uses the complete model in all its configurations—for instance, coupe, sedan, convertible, and wagon—to identify glitches. Is each model fully functional? Is there a disturbing windshield reflection in a certain configuration? How does different lighting interact with surface gaps? With physical prototyping, only a few, very expensive prototypes can be created. But with visualization, design teams can prototype an almost unlimited number of samples with more variety for better design decisions.

Beyond visualization and into virtual reality, design teams can evaluate external or environmental factors—for example lighting, shading, and exposure to real-world elements—to see the potential impact of environmental factors on the surface or appearance of the vehicle. The white dashboard may look cool, but does it produce a disturbing glare at night under the street lights?

Image courtesy of ŠKODA

Marketing

Visualization also plays an important role in helping to reduce resources needed for promoting new vehicles. Photorealistic computer-generated images can be used for print and video marketing, even before a vehicle is produced. Marketing teams can choose from any number of astonishing settings for those images—a beach, a forest, a cityscape, and more. They no longer need to coordinate expensive and hassle-ridden physical photo shoots that require prototype vehicles to be secreted around the world to exotic locations. Instead, they can visualize and promote more configurations of the vehicle in a variety of settings, quickly and cost-effectively—and without compromising design security.

Sales

More and more customers are going online to research and purchase automobiles. An online customizable configurator that utilizes visualization can be an extremely effective tool for closing the online deal. Whether your customer is at the dealer or sitting in a home office, visualization has the power to give customers an actual photorealistic image of exactly the vehicle they want to buy.

Utilizing the same engineered data as marketing departments, sales offices can use a powerful visualization solution to let customers see their preferred configurations, complete with custom colors and interiors. They can get creative and try different combinations to help ensure customers order exactly what they want—from a candy apple red convertible to a black-on-black sedan. The image creation is so fast that images can be rendered on the fly, which means customers can try any number of unique combinations—providing more confidence in the final decision.

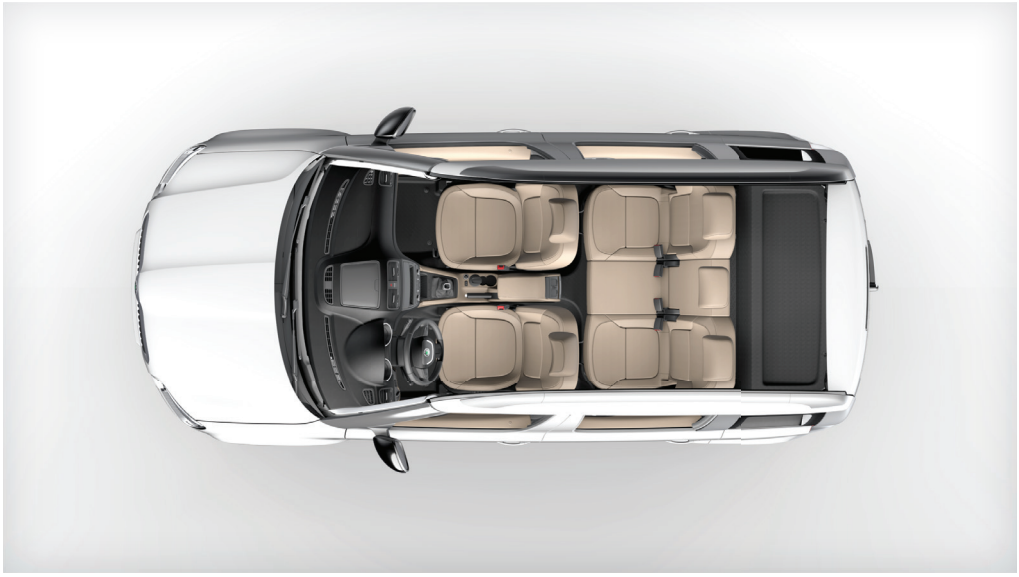

Image courtesy of ŠKODA

Bring abstract data to life
The art of "virtual reality" is to make the nonexistent visible and bring abstract data to life. Using visualization in the automotive design and development process allows designers, executives, engineers, and marketers to minimize reliance on physical prototypes, and see and evaluate their future vehicles long before production begins—and with greater speed, flexibility, and accuracy than ever before.

Innovation, stability, and strength

When you invest in visualization tools, you want the security of knowing your technology partner will be able to meet your needs both today and in the future. Founded in 1982, Autodesk offers a proven record of strength, growth, and innovation. A world leader in design innovation technologies, Autodesk is committed to building and supporting the new design tools automotive designers and engineers need. No competitor matches the breadth and depth of Autodesk's product portfolio—or global community and ecosystem. When you invest in Autodesk visualization tools, you'll partner with a financially stable company. Autodesk has annual revenues of more than US$2 billion, cash and equivalents of more than US$800 million, and an operating margin that exceeds 25 percent.

Autodesk VRED solutions

An innovative and powerful software solution for high-end 3D visualization, Autodesk® VRED™ solutions evolved from the field of photography and now include interactive design exploration and presentation as well as virtual prototyping. VRED enables the automotive industry to create high-quality visualizations for use from conceptual design to design review to engineering. You can make better decisions based on realistic parameters and share one virtual prototype model throughout the automotive design workflow process. With its advanced visualization and analysis tools, Autodesk helps you take advantage of today's global trends and prepare for tomorrow's demands.

For more information

To find out more about what makes Autodesk a leader in automotive design visualization, visit **www.autodesk.com/autoevolution**.

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