Virtual car design: From ‘stone age’ to 21st century in eight years

Virtual car design might be said to have moved from the stone age to the present day in a space of eight years. In 1994, it took several hours to display a design sketch on a computer – now, it takes 30 seconds!

The modern car designer has the fantastic advantage of being able to design a car from concept to finished product in a few weeks using the Alias supercomputer program. And yet, he or she is well aware that pencil and paper, as well as the polystyrene model, will always be essential design tools.

Stefan Jansson is only 30 years old. Even as a child at home in Sundsvall, he knew that he wanted to be a car designer. So it was that he enrolled at the Art Center College of Design in Switzerland – the oldest car design school in the world.

"It was an intensive course and we had the option of a three-term, rather than a two-term year," he recalls. "As a result, I finished the course in three years instead of four, at the tender age of 23."

Having already had some summer work experience at Volvo, he was offered a job with the company before he qualified in 1995.

From P26 to SCC

"At the beginning of 1996, I was working on ‘Project P26’ – the new V70 – with responsibility for the exterior design of the Cross Country variant. Two years later, I moved to our VMCC design centre in California, where the highlight for me was my responsibility for the exterior design of the SCC concept car.

"Since September 2001, I have been back in Gothenburg as Studio Chief Designer for the exterior design of Volvo's large platform.

"So, in the few years that I have been a Volvo designer, I have had the good fortune to work on both a fantastic concept car and a production model."

From hours to seconds

Stefan Jansson describes what virtual design means, noting that its development has been explosive. In 1994, the Swiss school had what were then state-of-the-art virtual design computers:

"However, by modern-day standards, they were really antique," he laughs. "You logged into the computer and opened your big design file. Then you went off to work for a few hours on your physical model. Later, if you wanted to modify a feature of the design – a shading detail perhaps – you could take a coffee break while the program executed it.

"Now, a mere eight years on, you can display the model in 30 seconds and make the same shading modification in five seconds..."

Physical models necessary

So the computer expert probably thinks that a physical model is no longer necessary?

"Wrong," responds Stefan emphatically. "As in all development fields, virtual development naturally reduces the
need for physical models and mockups, but I cannot foresee a situation in which we will be able to dispense with them completely. Nor can we escape the fact that we use pencil and paper to develop our initial concepts. Freehand sketches must be made before work on the computer is even started."

He talks about the importance of a feeling for lines, as well as surfaces and reflections. However well the computer can simulate these things, the human senses must have an input before the design is finalised.

"The virtual image must be verified physically and a model of the car must be produced, preferably in full scale," he notes.

**Rapid development**

"The SCC concept car is an extreme example of how we can work. This was a rapidly executed project which was to culminate in the production of a single example of the car. Once the computer design was finalised, we built two models – one a full-scale reproduction of the special 'see-through' A-post and the other a 1:10 scale model of the complete car. These were produced by an SLA (stereolithography) machine, in which liquid plastic is hardened by ultraviolet light in a tank.

"Two weeks before the dies were to be made, we milled a full-scale model of one half of the car from polystyrene, providing a smooth, fine-surfaced model which was easy to study. This produced a list of about twenty minor modifications which were made by computer within a week. We then did the same thing with the other half and carried out another five small changes. After that, the car was ready to be built.

"The differences between the actual car and the computer version were insignificant."

**Design by Alias**

He explains that modern programs enable geometrical information to be used during the entire period that the car is being 'built' in the computer. As an example, the designer may opt to include either the complete engine or only its 'corners' to reduce the size of the document. The number of variations is almost limitless.

Known as Alias, the design program was developed both for design applications and the film and computer games industry. The films Titanic and Jurassic Park are notable examples of its use.

"In films and computer games, the main requirements are rapid action and mobility," says Stefan Jansson. "Our quality requirements are greater since they relate to surfaces which must be produced. And although everything in the virtual design is nice and refined, we still need to use pencil and paper first – in the end, that's also a form of virtual design..."

**3D – naturally!**

He describes the process, starting with the first sketches of the concept on paper, perhaps in the form of a side view, which is then scanned into the computer.

"Lines are drawn and we start to work in 3D," he continues. "We integrate the lines and once a number of curves are developed, we can derive a surface from them. This we can modify by pulling, drawing, stretching, and so on. Adjustments are needed all the time and changes are made in 3D.

"Surface after surface is built up in this way, and the transitions from one to another must work. The surfaces are simple and angular in the early stages, but gradually become gentler and more complete. The time taken to develop the basis for a physical model may be as short as 1-2 weeks."

**Models by Internet**

Despite the sophistication of the models as described by Stefan, they are not too big for easy transmission to the design engineers or to suppliers. An exterior model may be as small as 20 MB and a complete interior no more than 100 MB. Having studied the proposal, the designers respond with feedback.

"They use the same design models as us, but only as information. They are not permitted to modify the design model themselves, but we do need their feedback to produce a design that can be built.

"In years gone by, clay models were produced from the design sketches. These were measured physically and modification was a highly complicated affair. Today, the models are scanned by laser, which returns information directly to the computer – precise information which makes modification easy."

**Reflection essential**

Although Stefan naturally regards virtual design as a fantastic tool, he sees risks in it:

"The process is fast and efficient – but it can be too fast. There can be a temptation to make decisions too early – forfeiting the opportunity of going back to make important changes. A design must be allowed to mature, to give time for reflection.
“The SCC, for example, did not have time to mature properly – we shot from the hip. Nevertheless, it did receive complete approval and I’m still happy with it.

“Virtual design enables you to keep better track of where you are in the process. It also leads more quickly to the stage at which models can be built and necessitates fewer modifications later on. You can aim at the target from Day 1 and obtain the right information for decisions earlier on. This saves money since clay models are expensive, although there may be some lines which are easier to visualise in clay than on the computer. A clay model is still required for verification,” believes Stefan Jansson.

“The end result must be a production car of the highest quality, which will be appreciated by large numbers of buyers.”

Importance of the human touch

The same Alias models, which are also used by the design engineers, can be tested in virtual wind tunnels, yielding very accurate drag coefficients and enable dirtying, cooling characteristics and other factors to be evaluated early in the development process.

“Driving in desert heat or arctic cold can also be simulated, with excellent results,” adds Stefan.

“A design process in which the computer can do everything is feasible. As a human being, however, you need something tangible to evaluate,” believes Stefan. “This applies especially to the interior of the car – for which a test series must be produced. Everything inside the car must be evaluated with all five senses, not just visually. A surface is something you have to feel!”

He adds that it is occasionally pleasant to take time to explore one’s ideas, even if they are unrealistic. It costs nothing to try out various things on the computer. In the early stages, when there are no physical models, the designer can work on perhaps a dozen computer designs before reducing them to just one.

Worldwide aspect

Stefan Jansson also appreciates the fact that Volvo Cars has design centres in California and Barcelona, as well as in Gothenburg:

“We have video conferences with each other, and we can display the same models in each location and work on them simultaneously. We can project full-scale models onto the walls of our virtual reality rooms.

“Alias can be run on a laptop. Basically, we can travel anywhere in the world to gather ideas and impressions – which is necessary to sell the car in a given market. Or to obtain that vital inspiration which is needed to add the finishing touches to its design.”

Photos

1. Stefan Jansson, Studio Chief Designer with responsibility for the exterior design of Volvo’s large platform.

2+3. The pencil will always be a visualisation tool for the designer’s initial concepts.

4. The designers use the same Alias program as their colleagues in the film industry.

5. Volvo cars are designed in several locations, such as Barcelona, so that the designers can derive inspiration from different impressions.

6+7. The Volvo SCC (Safety Concept Car). Stefan Jansson was responsible for the model’s exterior design.

8. Although physical models are not required to the same extent as before – the entire job can be done by visual design – every new car must be verified using a physical model before it can become a reality.

9. Designing the exterior of the Volvo XC70 was Stefan Jansson’s first assignment as a designer.

Media Contacts

Per-Åke Fröberg
Director Volvo Cars Heritage
Volvo Car Group

Phone: +46 31 3257654
per-ake.froberg@volvocars.com
Volvo Cars
PVH50, 50200
SE-405 31 Göteborg
Sweden
Phone: +46 31 59 65 25
Fax: +46 31 54 40 64
https://www.media.volvocars.com/

Descriptions and facts in this press material relate to Volvo Cars’ international car range. Described features might be optional. Vehicle specifications may vary from one country to another and may be altered without prior notification.