Perceived Quality

A Major Business Trend & Success Factor for Manufacturing and Design

Learn how to improve consumer perception with CATIA & DCS Solutions

This post is based on the presentation given at *CATIA Creative Design and ICEM Conference* by **Dassault Systemes** and **DCS** Partner **Hitex**. It focuses on using high-end visualization in the **3D**EXPERIENCE Platform (CATIALive Rendering) as part of the engineering process to help determine build objectives and improve the Perceived Quality of products.

Perceived Quality has become more valuable to manufacturing as OEM's begin to understand that the perception of their vehicles' quality is almost as important as the quality of their vehicles. Companies are even rated on their Perceived Quality and compared to their competition as a means of determining brand quality. Perceived Quality has understandably then been given greater and greater attention by manufacturers. (1, 2)

What is Perceived Quality?

« Look »

« Feel »

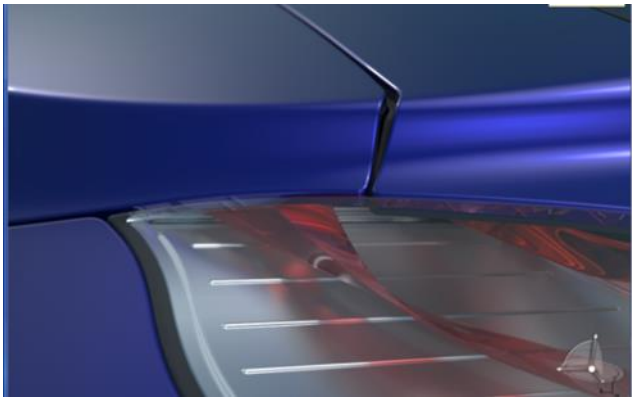
« Touch »

Perceived Quality is the quality attributed to a product based on its perceptual experience. This incorporates the experience a customer has with a product and how it makes them feel about the product. Bringing together the shape, the appearance, the texture and physical feel of the product as well as the emotional experience of using the product, Perceived Quality directly affects the customer's opinion of the value of the product. This perceived value then drives the business.

Gap and Flush Automotive Business Case

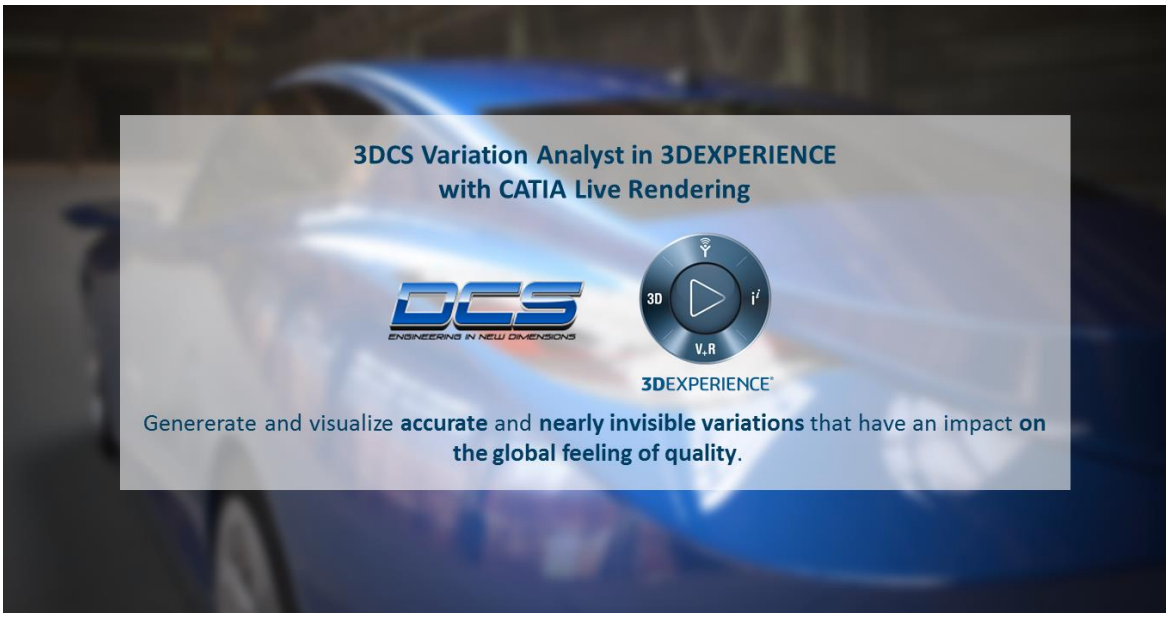
Perceived Quality can be applied to many aspects of an automotive vehicle. From the way the surface and color look, to how the trim and steering wheel feel, or the noise level when driving, there are many different aspects of Perceived Quality. In this study, we focus on Gap & Flush appearance based on manufacturing variation.

The variation observed on gap and flush is one of the main visual issues influencing the global feel of quality on an automobile. These gaps and flushes could be on the hood to fender, associated with door fit or trunk closure, or involved in the headlights or tail lights.



The Design Department wants to know,

Can we anticipate the variation on Gap & Flush early in the product life cycle with an accurate visualization experience?

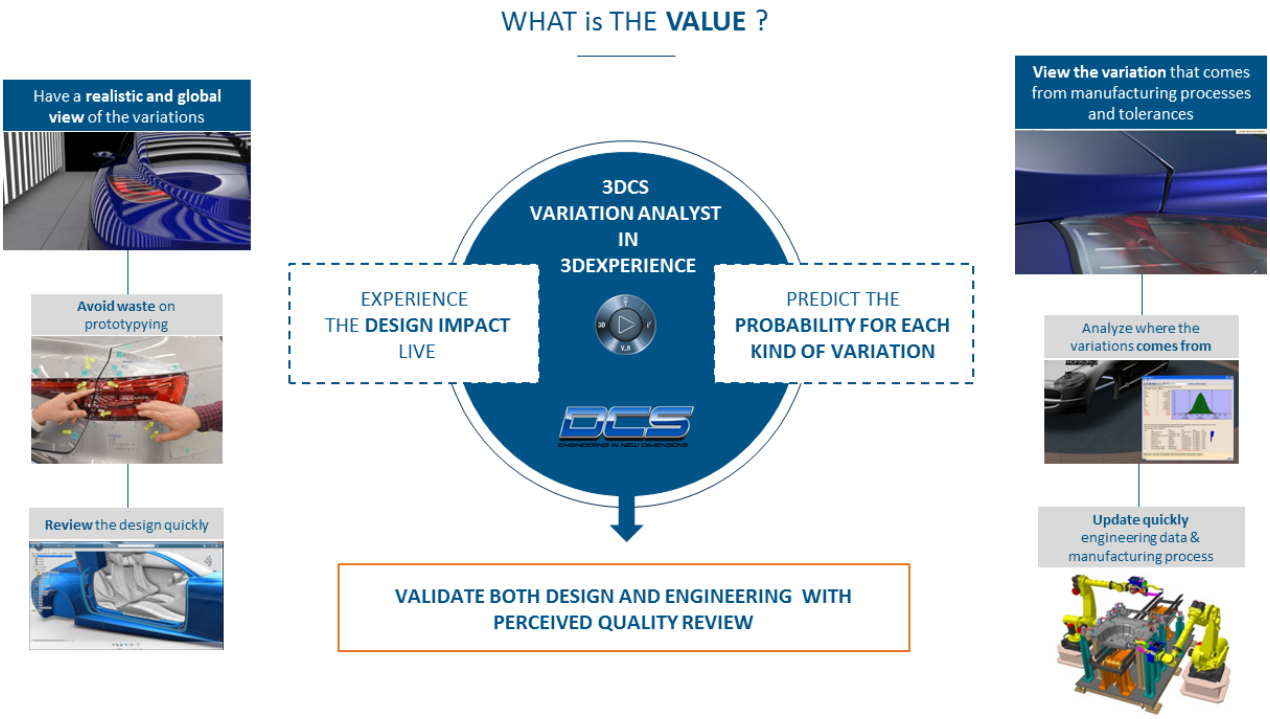


Using 3DCS Variation Analyst in the **3D**EXPERIENCE allows engineers and designers to generate and visualize accurate and nearly invisible variations that have an impact on the global feeling of quality.

What Value is in Perceived Quality?

1. Experience the Design Impact Live

2. Predict the Probability for each variation scenario



Experience the Design Impact Live

The combination of these two tools into a Perceived Quality solution delivers a realistic and global view of variation. This allows the user to see how variation will affect different areas, gaps and flushes of different components, and see them in varying scenarios, to finally determine what is acceptable. This can reduce the need for prototyping, avoiding both the expense and the long wait times for prototype fabrication. In addition, it empowers design teams to review the designs quickly, and make changes that can be seen on the product almost instantly.

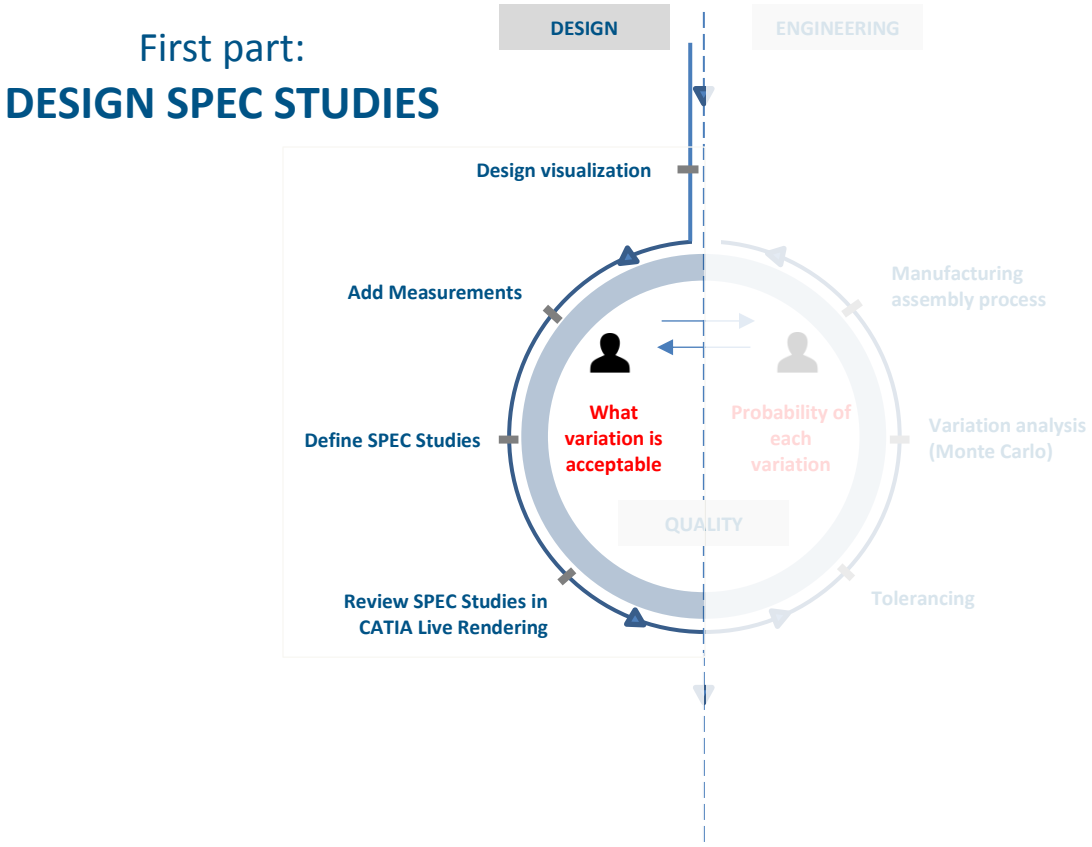
Predict the Probability for each variation scenario

The variation seen on the product comes from manufacturing processes and tolerances. This means that the variation seen in the design phase is the variation that, if the design is not modified, will be present on the final product. As part of this process, analysis produces the root cause of the variation, allowing engineers to identify the source of the problems and iteratively introduce design changes and updates to manufacturing processes to control variation at critical to quality feature locations.

Validate both design and engineering with perceived quality review

The Perceived Quality studies come from two sources; the design team's chosen objectives and the engineering team's analyses of the design. These two studies interrelate as means of communicating quality objectives between the teams and developing a process from determining acceptable levels of variation for both design and engineering.

As a first step, the process defines what is acceptable from a design standpoint. This is passed down the line to the engineering teams who analyze the product and determine what specifications need to be met. These analyses predict the outcomes of building the product, and determine if the conditions specified by design can be met. If, pending analysis, the design objectives are unachievable, the process can be looped back to review the specifications or the process to determine when adjustments can be made.



How Do You Realize the Benefits of Perceived Quality?

Perceived Quality Studies are means of communicating quality objectives and attainable quality levels between Design and Engineering teams. This process incorporates iterative studies to determine acceptable aesthetic levels and then confirms manufacturing's ability to meet those objectives. Here is a walkthrough of the process steps.

Design

Design SPEC STUDIES (https://youtu.be/L5gMHGLyfyk)

The first stages of the process begin in the design studio. The design team drives the tolerancing process by creating the Spec Studies, the visualization studies of gap and flush conditions set at specific values to determine acceptable levels of variation.

The process of creating Spec Studies is broken down into four components:

1. Design Visualization
2. Add measurements

3. Define SPEC STUDIES
4. Review SPEC STUDIES in CATIA Live Rendering

Design Visualization (https://youtu.be/sb1u1sgOpmA)

To begin, visualization is added to the CAD model to graphically represent the final product. This uses the **3D**EXPERIENCE CATIA live rendering application for high end visualization. To see an example of how this is done, click this link.

Add Measurements (https://youtu.be/YRc5GMC3f-U)

Measurements are the outputs of a 3DCS model. They are created by choosing two points on a model. The distance between those two points will be calculated given differing inputs during simulation. In this case, as the tolerances and processes have yet to be determined, they set the distance between two parts for a gap condition, or the amount for a flush condition. These same Measurements will be used for the Variation Analysis completed in engineering to determine if the tolerance conditions chosen by design can be adhered to in manufacturing. To see an example, click this link.

Define Spec Studies (https://youtu.be/Wltz1w0Lvy8)

This component of the design phase sets the scenarios for the studies. Specified gap and flush conditions are set, and then rendered onto the product to see their effect on the final products appearance. The Spec Studies include all information pertaining to each scenario, which are often names based on given conditions, such as a 'smile' condition, which has large gaps at the edges of two parts, and a small gap in the middle, or V and A gaps that have large gap conditions at one side of the joining of two parts and small gaps at the other side.

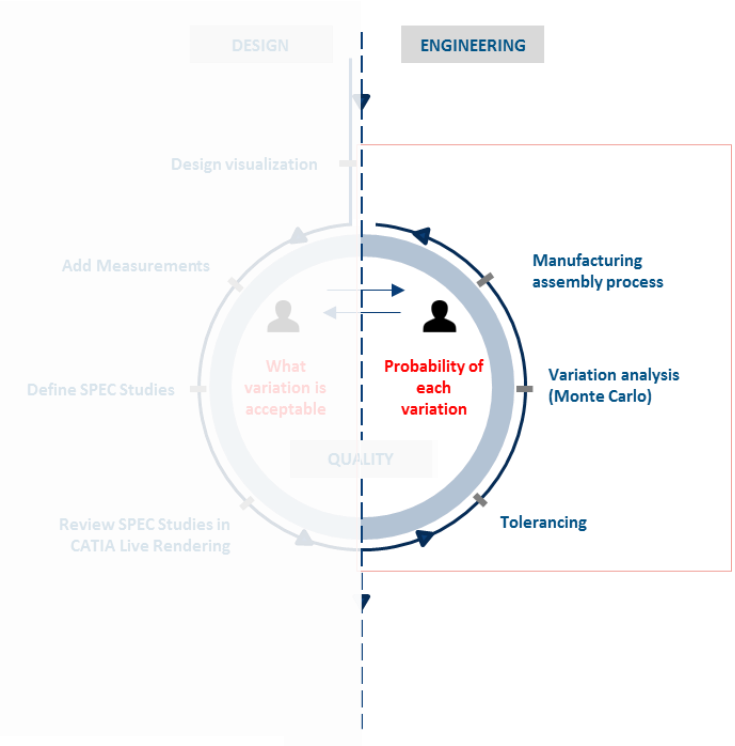
Review Spec Studies in CATIA Live Rendering (https://youtu.be/vFOsVVETje8)

The final portion of this design process before moving to Engineering is the review of the Spec Studies using CATIA Live Rendering to view the product in high detail with physically-correct rendering, in a realistic environment with advanced lighting capabilities. At this point, the studies are either accepted and passed on for Engineering to complete their analysis, or rejected and quickly modified for review.

Engineering

Engineering Variation Studies

Second part:
ENGINEERING VARIATION STUDIES



Manufacturing Assembly Process and Tolerancing (https://youtu.be/x08XUhu1jZs)

As part of the 3DCS model, Tolerances are defined on the parts. These can be from CATIA FT&A or applied by the modeler. In addition to part tolerances, Moves are added to the model to simulate assembly processes. These are either pulled from DELMIA or applied using 3DCS move routines.

Variation Analysis (Monte Carlo RSS) (https://youtu.be/Et7tBTb1xHM)

Once the Design Objectives are accepted, the results are sent to engineering to complete Variation Analysis. This includes the manufacturing part tolerances, locators, manufacturing and assembly processes and determines the chance of variation on different conditions. Using Monte Carlo analysis, 3DCS Variation Analyst simulates the production of hundreds of virtual products and analyzes them to determine the level of non-conformance and source of those issues.

Sharing and Approving Results – Communicating Outputs (https://youtu.be/dLLDdQOCkRc)

3DCS offers an automated report function that summarizes all of the model inputs and outputs, including tables, charts, reference images and organizes it into an Excel or HTML presentation for easy sharing with Design and Engineering teams. This provides a simple solution to sharing analysis results with Design Teams on whether their chosen Design Objectives can be effectively met.

A Note on SPEC STUDIES vs VARIATION STUDIES

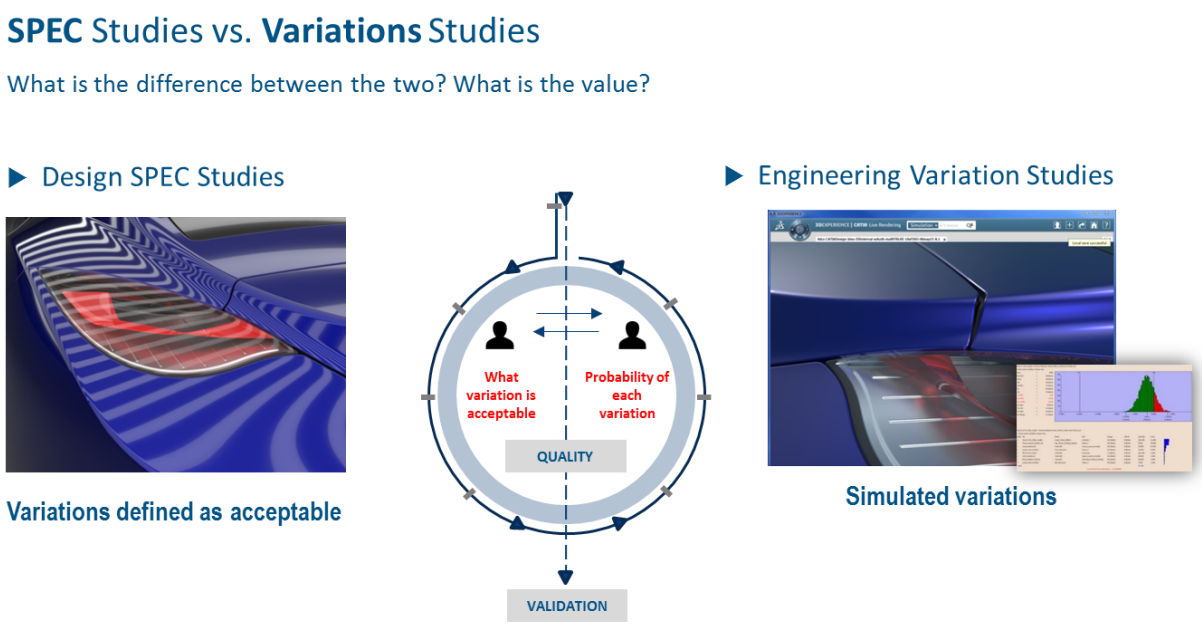
What is the difference between the studies conducted by design and those being done by engineering?

Design Spec Studies

Use defined tolerances and variation studies. This means that all gap and flush conditions are chosen by the design team and used to determine design specifications. This is the maximum allowable variation on the product that still retains the products quality appearance.

Engineering Variation Studies

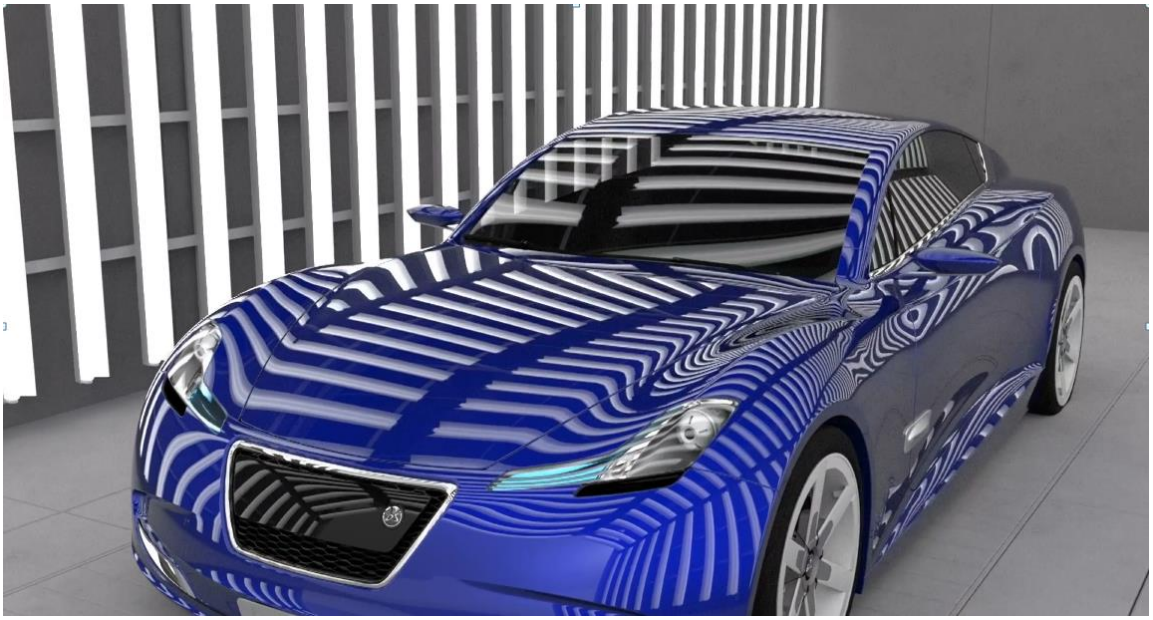
These studies are conducted using simulation tools, in this case 3DCS, that incorporate part and process tolerances to determine the predicted amount of variation on the final product. This is the probability of specific variation scenarios stemming from manufacturing inputs.



Bringing It All Together – Perform Perceived Quality Studies (https://youtu.be/EbB_H-WGPYE)

From the variation analysis results, predicted scenarios can be applied to the model and live rendered to product realistic images featuring as-built variation simulated from manufacturing data. These studies show how the product could look if produced given the current design, and can be compared to the Spec Studies crafted by the Design Team to see if the predicted variation is within acceptable levels

aesthetically. This gives the two teams a combined tool and communication method to compromise on Specifications, Tolerancing and Assembly Process.



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About DCS

DCS has been supporting quality management in industries including automotive, aerospace, medical device, electronics and industrial machinery for over 20 years. DCS solutions are used daily by companies like Airbus, BMW, GM, LG, Nissan, Phillips, Sony, Textron Aviation and VW. By applying DCS's 3D Model Based environment for Predictive Variation Analysis and Responsive SPC, manufacturers have reduced quality costs related to yield, scrap, rework and warranty issues. Read more at www.3dcs.com.

As the first Gold Software Partner for Dassault Systemes, DCS has worked for over ten years delivering quality management solutions to manufacturers in combination with Dassault Systemes PLM.

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