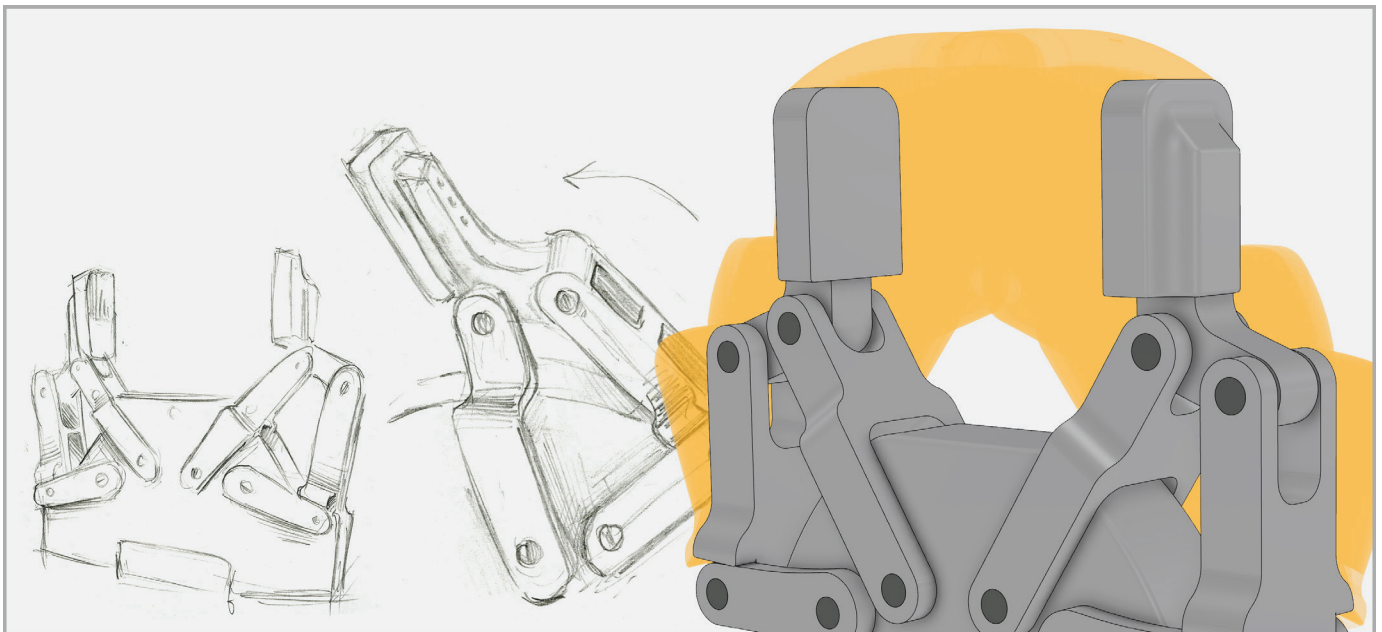


MAXIMIZING CONCEPTUAL DESIGN EFFECTIVENESS WITH SOLIDWORKS MECHANICAL CONCEPTUAL

White Paper



New concept creation represents the lifeblood of product development, powering an organization's innovation engine and driving the development of successful products. Continued manufacturing success in a rapidly evolving global market demands an effective approach to conceptual design. To maximize the effectiveness of conceptual design efforts, designers require a modeling platform that supports different needs, challenges, and objectives. The SOLIDWORKS® Conceptual Designer solution makes conceptual design workflows instinctive, less constraining, and more productive, enabling manufacturers to effectively spark the development of innovative product concepts.

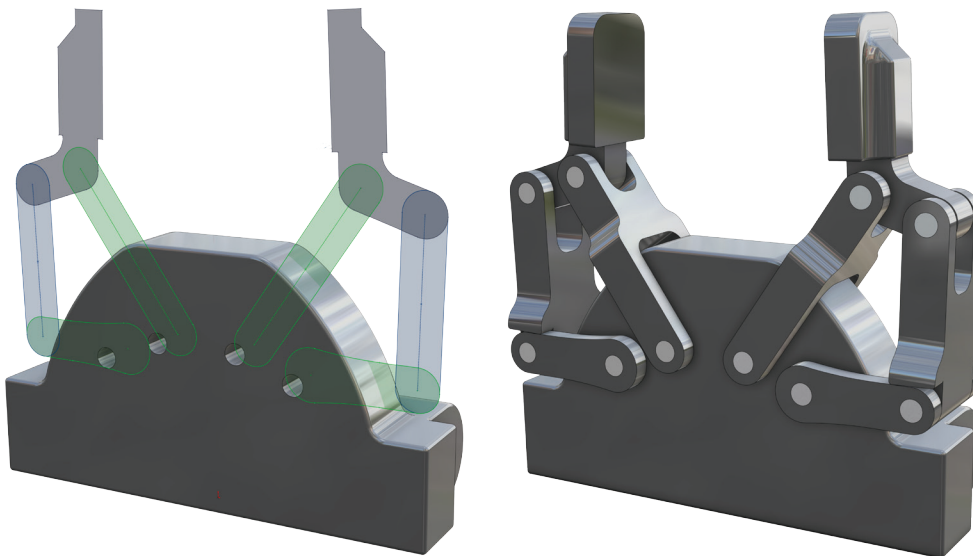
CONCEPTUAL DESIGN VS. DETAIL DESIGN—DIFFERENT REQUIREMENTS DEMAND DIFFERENT SOLUTIONS

Successful product development organizations always have an eye to the future. They understand that although their product offerings may do well in the current market environment, there's no guarantee that today's top-performing products will remain so in the coming years. The competitive landscape is strewn with examples of once-prosperous products that have fallen by the wayside—replaced by market-disrupting innovations from within a market and beyond.

That's why innovation has become so critical to the manufacturing enterprise. If product innovations come from within a product development organization, rather than from without, the company not only can anticipate market disruptions but also drive them, realizing the rewards of innovation instead of falling victim to it. The key to future manufacturing success is to be ahead of market and product trends by cultivating a hotbed of innovation in product development—better known as conceptual design.

Maximizing innovation in new product development requires a commitment to, focus on, and investment in conceptual design. Technological advances and more efficient 3D design systems have streamlined product development, reducing design cycles, controlling costs, and improving quality. However, while 3D CAD technologies have revolutionized product design and manufacturing workflows, their primary focus is on production—on taking a design through all of the detailed steps required to manufacture a product. Conceptual design—creating the innovative concepts that will pay dividends down the road—is a decidedly different undertaking, with its own needs, challenges, and objectives.

While the ultimate goal of conventional product development is to make a product, the endpoint of conceptual design is to discover innovation, transforming new ideas into workable concepts for future development and production. In addition to having separate objectives, product design and conceptual design require different workflows and approaches to be effective. For example, conceptual design focuses on concepts instead of details, and requires free-flowing collaboration and communication with extended stakeholders (customers, partners, etc.) early during conceptualization, rather than precise communication and documentation with downstream departments after a design is already established. Conceptual designers explore the “what if” rather than the “what is”, and investigate how to design an innovative concept rather than how to make a product. These distinctly different workflows, challenges, and goals require a design solution that's tailored specifically to conceptual design. That solution is SOLIDWORKS Conceptual Designer.



THE UNIQUE WORKFLOW REQUIREMENTS OF CONCEPTUAL DESIGN

Understanding how a modeling platform that was designed specifically for conceptual design can help product development organizations spark innovation requires a thorough assessment of the unique workflow requirements related to conceptual design. In many companies, new concept development plays a secondary role to designing the next product model, with most of the focus, urgency, and resources targeted on the product design at hand. Too often, conceptual design is given short shrift, falling through the cracks due to the strong emphasis on day-to-day development. For conceptual design to be effective, it must be a separate function, with its own dedicated time, resources, and workflows.

Effective conceptual design does not take place in a vacuum and demands a new communication paradigm. Conceptual designers need to communicate with an extended team of internal and external stakeholders differently than the downstream communication that typically occurs in detailed product development. Team-wide communications regarding new concepts must be fast, fluid, visual, and accessible. Designers have to be able to share conceptual models and images across the stakeholder team to solicit input, receive feedback, and tap into the creativity derived from a range of perspectives. And, they need to be able to facilitate this free flow of information from within a single modeling environment, so they can incorporate inputs directly to the evolving concept model in real time.

To spark the inspiration, creativity, and inventiveness that produces innovation, the development of new concepts must take place in an extremely flexible modeling environment. The constraints imposed by traditional CAD data, which provide the necessary data structure for production, actually inhibit conceptual design, making it more time-consuming and challenging.

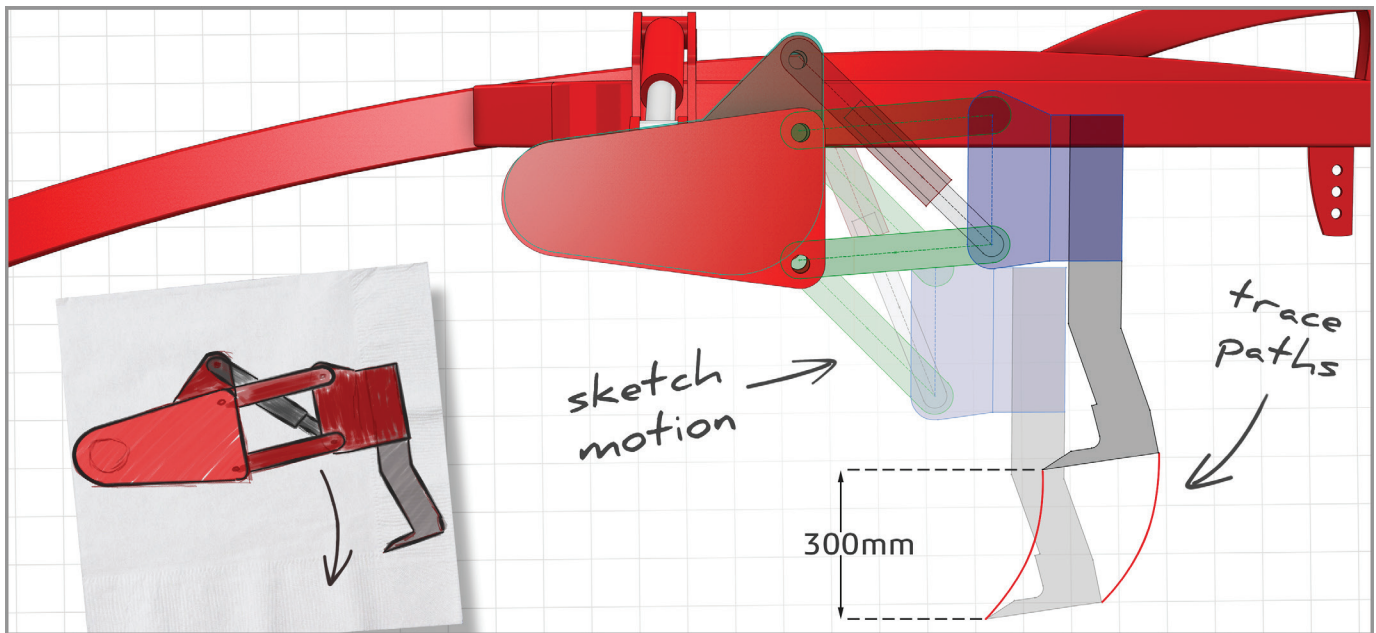
Although conceptual modeling should be intuitive, instinctive, and unconstrained, it also must be grounded in reality. Even rudimentary concepts need to be validated for fit and function through design analysis and prototyping. Once a concept is validated, there has to be an efficient means for transitioning concepts into full-blown designs for production. Thus, capturing and retaining conceptual design data in an automatic, transparent fashion is critical. What designers truly need is a modeling environment that is aligned with the unique nature of the conceptual design workflow.

THE CONCEPTUAL DESIGN WORKFLOW—CREATING CONCEPTS TO SUPPORT FUTURE PRODUCT DEVELOPMENT

The conceptual design workflow is a fluid, dynamic, and nonlinear process, with a great deal of give-and-take and trial-and-error, requiring an intuitive single modeling environment like SOLIDWORKS Conceptual Designer. Although conceptual design activity may be difficult to describe in linear terms, there is a basic series of steps, or best practices, that conceptual designers undertake in the quest for product innovation—steps that are fully supported by SOLIDWORKS Conceptual Designer.

Concept Definition

The first step in the conceptual design workflow is to roughly define the product concept. Before a designer can start sketching and modeling, he or she must fully comprehend both the actual customer needs and the intended product solution methods. In many cases, a customer may not realize the need for a product that ultimately will become indispensable once it becomes available. Understanding customer needs—or more specifically the problem to be solved—requires input from players in the field, such as customers, partners, distributors, etc. Gathering and synthesizing these inputs into a defined concept represents the initial step in developing an innovative solution.



Market Definition

In addition to defining the product concept, designers must consider the current state of the market, including existing products, current trends, and active/potential competitors. Before a conceptual designer can develop innovative concepts, he or she must take market dynamics into account. What are the current available solutions? Where are they weak or how do they underperform? What problem isn't being solved? In short, where are the opportunities for innovation? As with concept definition, obtaining market insights and intelligence from the field is a basic step toward developing innovative conceptual designs that are either differentiated from or disruptive to a market's current offerings. Capturing, sharing, and validating a definition of the market opportunity is vital to creating a design specification that's on target.

Design Specifications

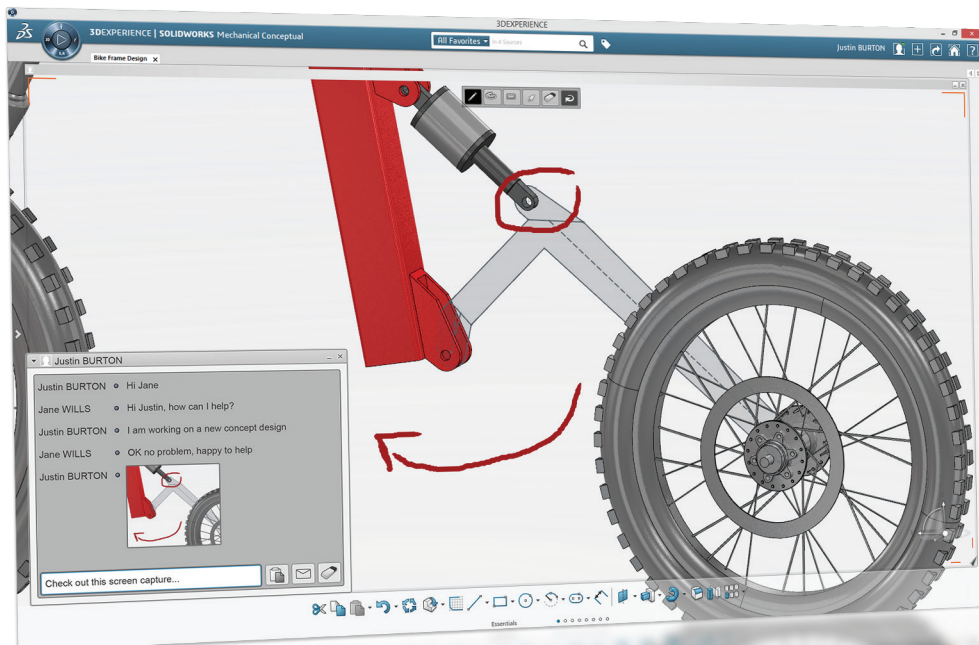
Once a conceptual designer understands the customer problem to be solved and the market opportunity to be exploited, he or she must determine the likely characteristics of the operating environment in order to establish basic design specifications. In other words, how will the physical conditions under which the product will be used influence various design parameters. Will its operating environment affect or limit the materials used? Is there an overall design constraint based on size, weight, or shape? Will the product be subjected to loads and/or forces, such as stress, temperature, or humidity? Getting information on where, when, and how a product will be used also requires communication and collaboration with the field.

Initial Concept Modeling

Following complete comprehension of the user, engineering, and business requirements for a product, the conceptual designer is ready to start working with initial concept models. Here again, geometry creation tools need to be unconstrained, instinctive, and free flowing to support a range of new ideas, unconventional approaches, and innovative solutions. Whether working in 2D or 3D—or utilizing sketches, primitives, features, bodies, or components—modeling functionality must be flexible and intuitive, so the conceptual designer's focus remains on the concept rather than the tools required to model it.

Collaborate, Modify, and Iterate

After creating initial concept models, designers need to be able to share them in CAD-agnostic formats with key stakeholders inside and outside the company. When this collaboration takes place from within the same application through which concepts are created, conceptual designers can more quickly and easily incorporate valuable stakeholder feedback to evolve, enhance, and advance innovative concepts. This iterative approach to collaborating on and modifying concept models is more informal, interactive, and effective than traditional design reviews, especially during the what-if phase of concept development, when on-the-fly collaboration and sit-down sessions can be especially productive.



Concept Evaluation

In addition to soliciting stakeholder feedback on new design concepts, conceptual designers also must assess new approaches from a performance standpoint. Access to motion simulation and structural analysis capabilities from within the conceptual design modeling environment can greatly facilitate evaluations of design concepts, which can range from basic design validation to more complex design optimization. After completing design simulation, analysis, and virtual prototyping, concept designers may also want to build and test a physical prototype before deeming a concept worthy of detailed product development.

Release for Detailed Product Development

Following a positive performance evaluation of a design concept from an engineering point of view, the conceptual designer needs to be able to capture and convey all of the work he or she's done up to that point, so the concept can be further evaluated for release for formal product development. Decisions about whether to proceed with development of a new concept extend beyond engineering questions and require a thorough investigation of likely production costs, prices, and margins. In the end, innovation has to pay. Before advancing innovative concepts for development as products, manufacturers understand that they must be able to make and sell it at a profit.

Retaining Conceptual Design Data

The last step in the conceptual design workflow is capturing, retaining, and saving all of the design data, communication, and activity that occurred during the development of a design concept. This is important not only for using the information to advance additional development of promising ideas, but also to support future conceptual design and innovation. While many ideas may not fit the immediate need—and some may never pan out—saving a record of failures is just as valuable as documenting successes. In addition to providing guidance to future conceptual designers that an idea is unsuitable for similar applications, documenting it might inspire other approaches for which the idea may have potential.

SOLIDWORKS CONCEPTUAL DESIGNER—A NEW CLOUD-BASED PLATFORM STREAMLINES CONCEPTUAL DESIGN WORKFLOWS

Dassault Systèmes took the specific challenges, goals, and workflows related to conceptual design into account in developing SOLIDWORKS Conceptual Designer. This flexible, cloud-based, single modeling environment leverages the power of the Dassault Systèmes **3DEXPERIENCE®** platform to facilitate innovation in new concept development. By matching the software's architecture, appearance, and functionality to best practices, the software streamlines conceptual design workflows, making your conceptual design efforts more efficient, strategic, and effective. Here's how:

Single Modeling Environment Accelerates Conceptual Design

SOLIDWORKS Conceptual Designer brings all of the tools, capabilities, and functionality that designers need to support conceptual design workflows into a single modeling environment. These include intuitive modeling, social innovation, real-time communication, design simulation, and transparent data management solutions. The software's cloud-based, thick-client architecture enables designers to leverage these tools from anywhere with web access. The flexibility to work locally, communicate globally, and save automatically—with intermittent contact with and storage to the cloud server—accelerates the conceptual design process. Because designers can access and perform all tasks related to conceptual design workflows anytime, from anywhere, and from within a single application, the entire process becomes faster, more dynamic, and more effective.

Bring User, Engineering, and Business Requirements to a Single Platform

Making determinations about the user, engineering, and market requirements that drive new concept development is much easier from within the SOLIDWORKS Conceptual Designer single modeling environment. The initial stages of conceptual design demand a significant volume of communication with a diverse range of stakeholders, including external contributors—such as customers, distributors, and partners—and internal colleagues—like management, manufacturing, sales, marketing, etc. SOLIDWORKS Conceptual Designer allows designers to interact with key stakeholders and gather valuable input on customer, performance, and market requirements from directly within the conceptual design modeling environment. This simplifies the process of gathering and synthesizing field inputs into actual design specifications.

Modeling Freedom and Flexibility

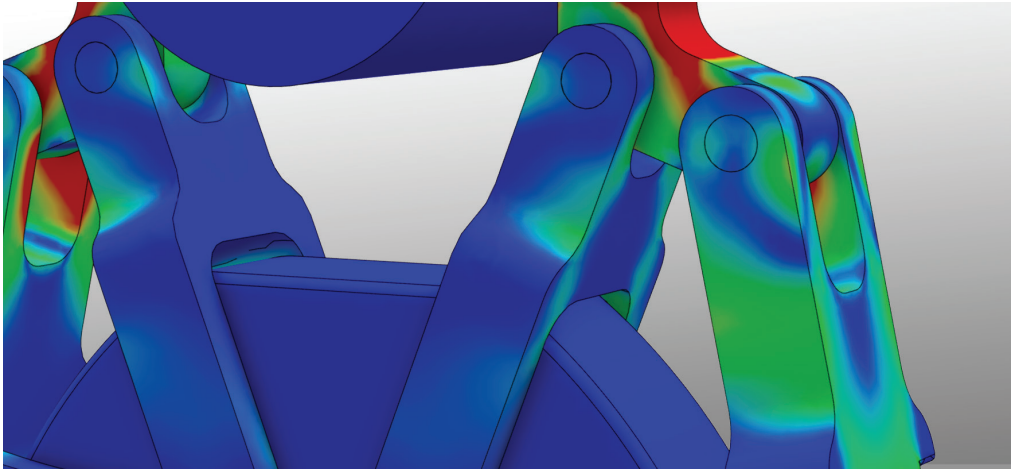
After establishing the specifications for a new concept, designers can more freely and flexibly create models with SOLIDWORKS Conceptual Designer. The application's modeling approach matches the unique needs of conceptual designers, allowing them to quickly create concept geometries, liberally manipulate model features, and simultaneously work on multiple concepts. Designers can work in 2D or 3D, using and/or combining sketches, primitives, features, bodies, and components, and have far greater freedom to modify concept geometry using the software's design tree. Designers can start in 2D, and then move to 3D. They can turn parametrics off and on with Direct-Edit tools, supporting part changes in an assembly with or without ripple effects. They can even imbue part intelligence, embedding motion information within individual components, for use across concepts.

Drive Collaboration with Social Network Communications

By establishing a new communications paradigm, SOLIDWORKS Conceptual Designer brings the power of social innovation to conceptual design. Collaboration with internal and external stakeholders is a key element of effective conceptual design workflows—initially to solicit inputs during concept definition, later to include field feedback and insights during design iterations. The software's cloud-based, web-centric architecture incorporates a social network framework, which facilitates secure team-wide communications. Using a standard web browser (e.g., Chrome™, Firefox®, and Internet Explorer®), stakeholders can view, critique, and offer comments on new concepts from any digital device, whether it be a laptop, tablet, or smartphone. This capability eliminates the CAD technical barrier to collaboration and helps drive innovation by allowing designers to incorporate the insights and feedback of key players into new concept development.

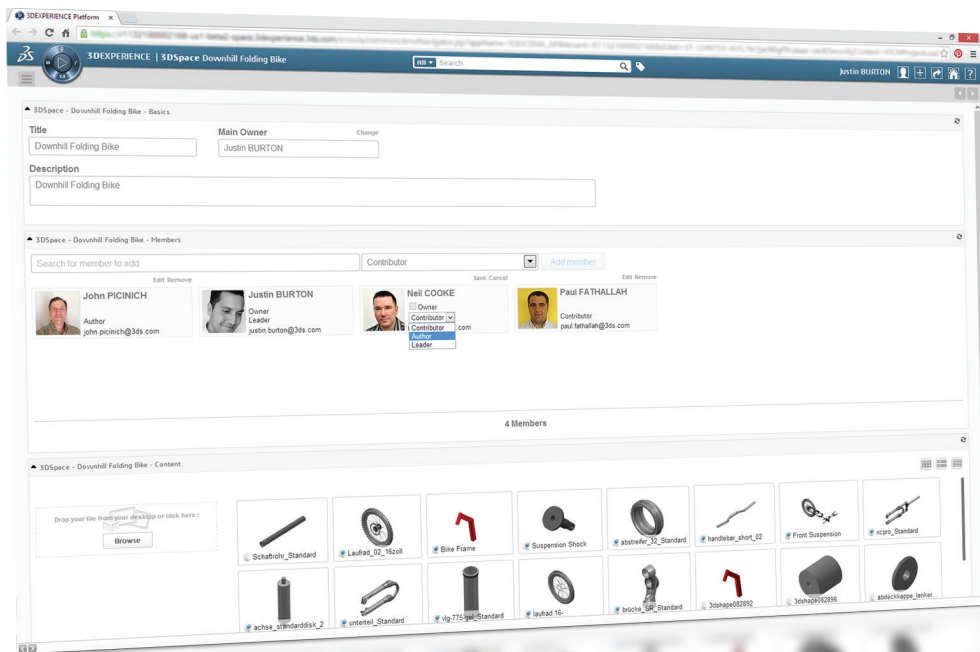
Virtual and Physical Prototyping

With SOLIDWORKS Conceptual Designer, designers can conduct quick design simulation and performance assessments, as well as export the data to produce physical prototypes, inside a single modeling environment. Motion simulation, structural analysis, and rapid prototyping capabilities enable designers to evaluate more design concepts in less time. They can quickly incorporate stakeholder input, and then run simulations to determine if changes cause any performance issues. Or, they can run analyses on a range of concept options to identify which approach has the strongest performance characteristics. In addition to conducting virtual prototyping using motion simulation and structural analysis tools, designers can output model data to produce physical prototypes for further assessment of ergonomic and aesthetic features.



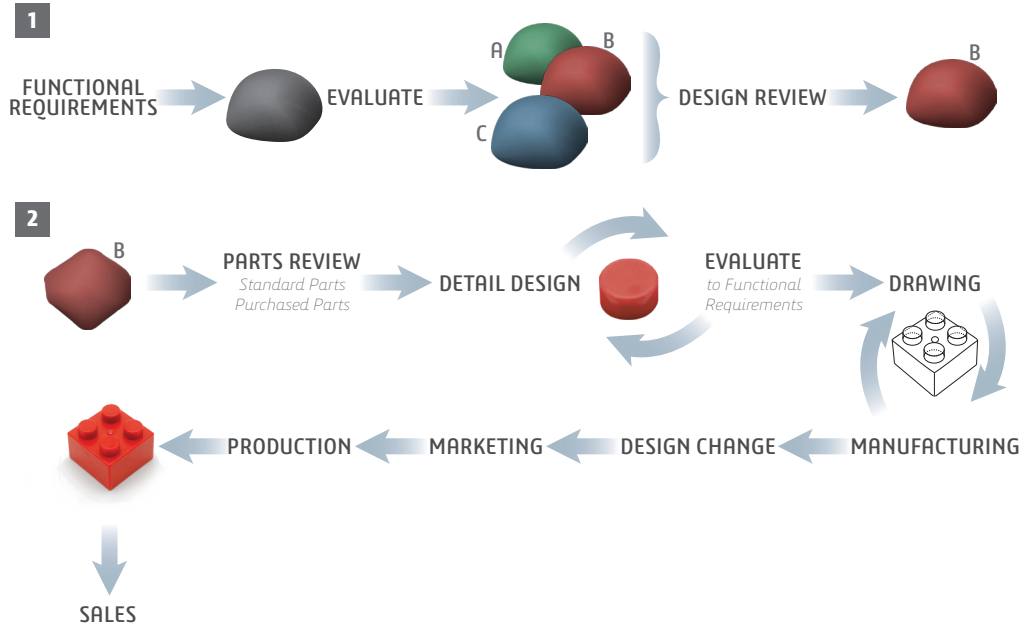
Saving, Safeguarding Data Transparently

When using SOLIDWORKS Conceptual Designer software, data management is another, of the many, distractions that designers no longer have to worry about. The software automatically and transparently captures, retains, and manages all data related to conceptual design in a database that resides in the cloud. With SOLIDWORKS Conceptual Designer, all conceptual design activity is stored in a tagged concept archive that is accessible at any time. Every concept that a designer creates—the successes, the failures, and the innovations waiting to be uncovered—are safeguarded for future use, allowing product development organizations to retain and continue to leverage this valuable resource.



Innovate Instinctively

SOLIDWORKS Conceptual Designer is designed to make the development of innovative product concepts instinctive and the completion of conceptual design workflows more productive. The software strips out all of the production-related constraints of traditional CAD tools to provide conceptual designers with greater freedom, agility, and flexibility. Because the software lets designers focus on concepts rather than production, innovation rather than tools, and collaboration rather than documentation, it establishes a modeling environment that allows creative talents to emerge, blossom, and shine. The instinctive character of the software makes conceptual design more efficient and effective, resulting in the increased levels of innovation necessary for continued manufacturing success.

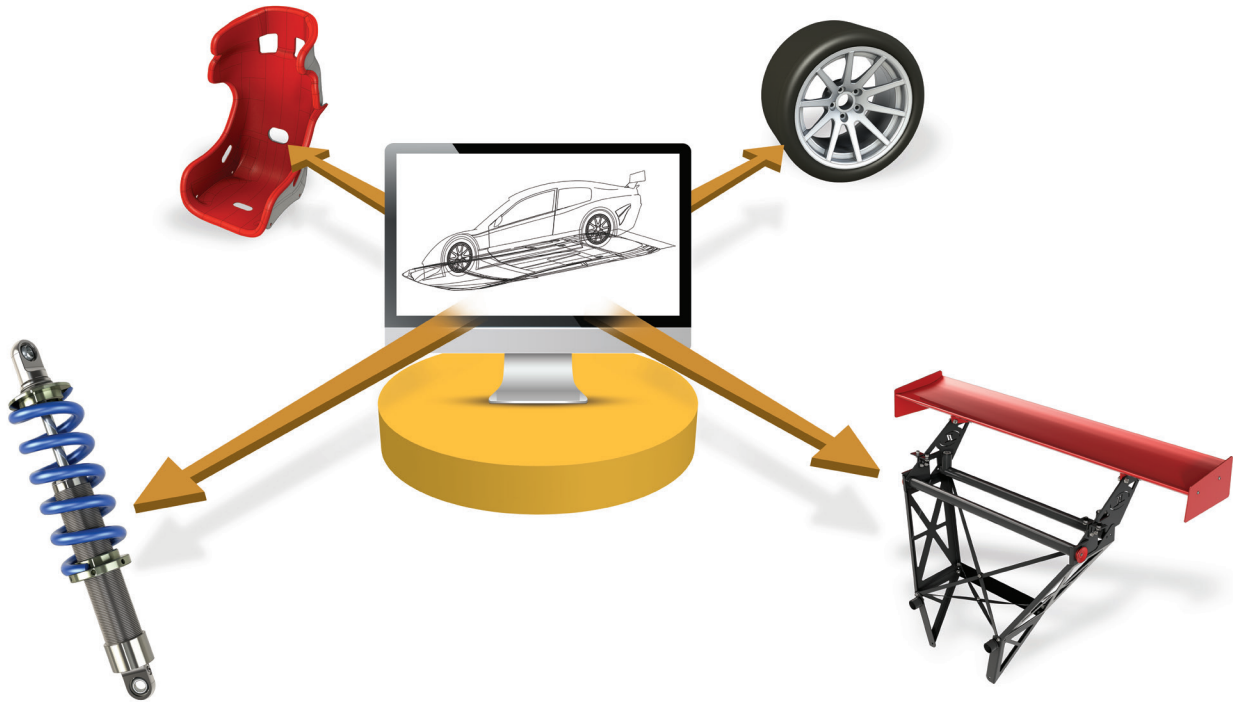


Choosing the Best Modeling Approach for Specific Products

The modeling flexibility inherent to SOLIDWORKS Conceptual Designer extends beyond the individual steps involved with conceptual design workflows to encompass the best modeling approach for the type of products that your company creates. Designers can choose to utilize top-down, bottom-up, or master model design techniques, depending on the nature of the design concept. Designers can leverage the advantages of each approach and even start modeling in one methodology before switching to another technique—all while maintaining the integrity of already created features and parts. This additional flexibility enables designers to utilize the best modeling method for developing innovative approaches to specific types of products.

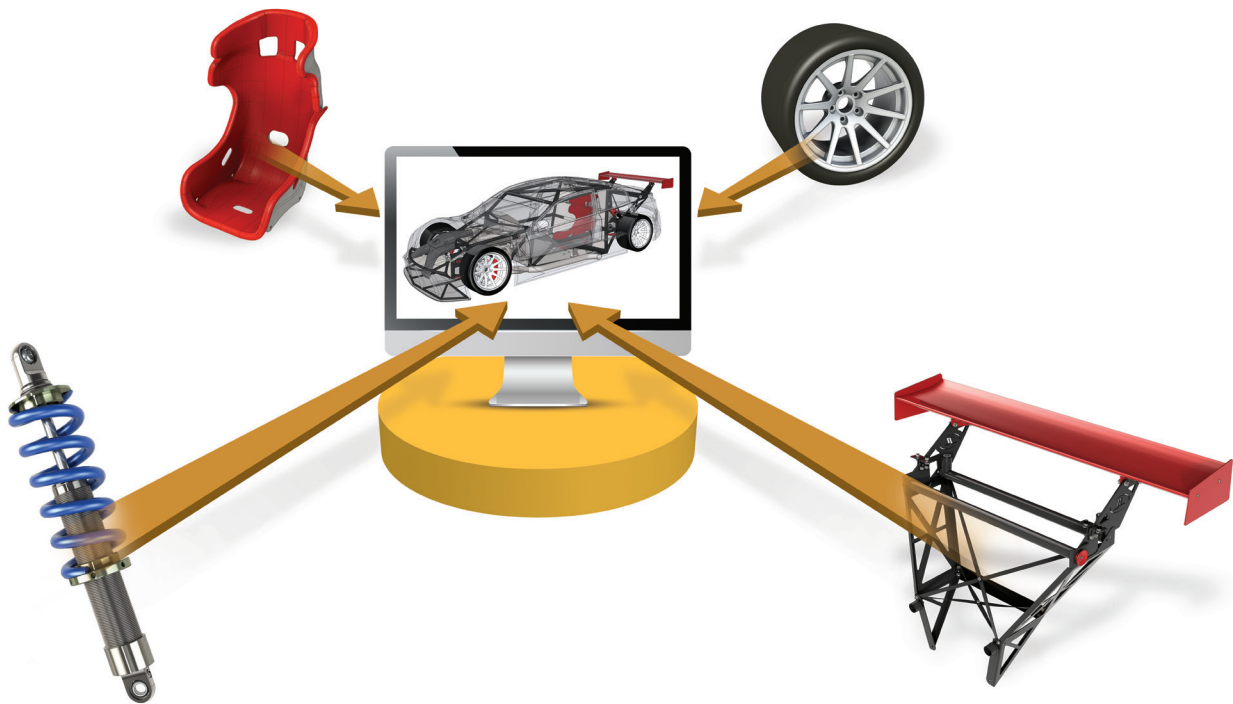
When to Use Top-Down Modeling

The top-down modeling approach is especially useful when a design concept requires associativity among individual parts or between components and an assembly. SOLIDWORKS Conceptual Designer uses an associated “layout sketch” of the assembly at the top of the design tree to manage part creation within the assembly. Using the assembly layout sketch, or relationships to other geometry, as a guide, the designer can then easily create each component model using the top-down modeling technique. Designers can start working on an assembly concept using the top-down modeling method, then switch to the bottom-up approach to create additional components that are not governed by assembly constraints, such as when adding hardware or standardized components.



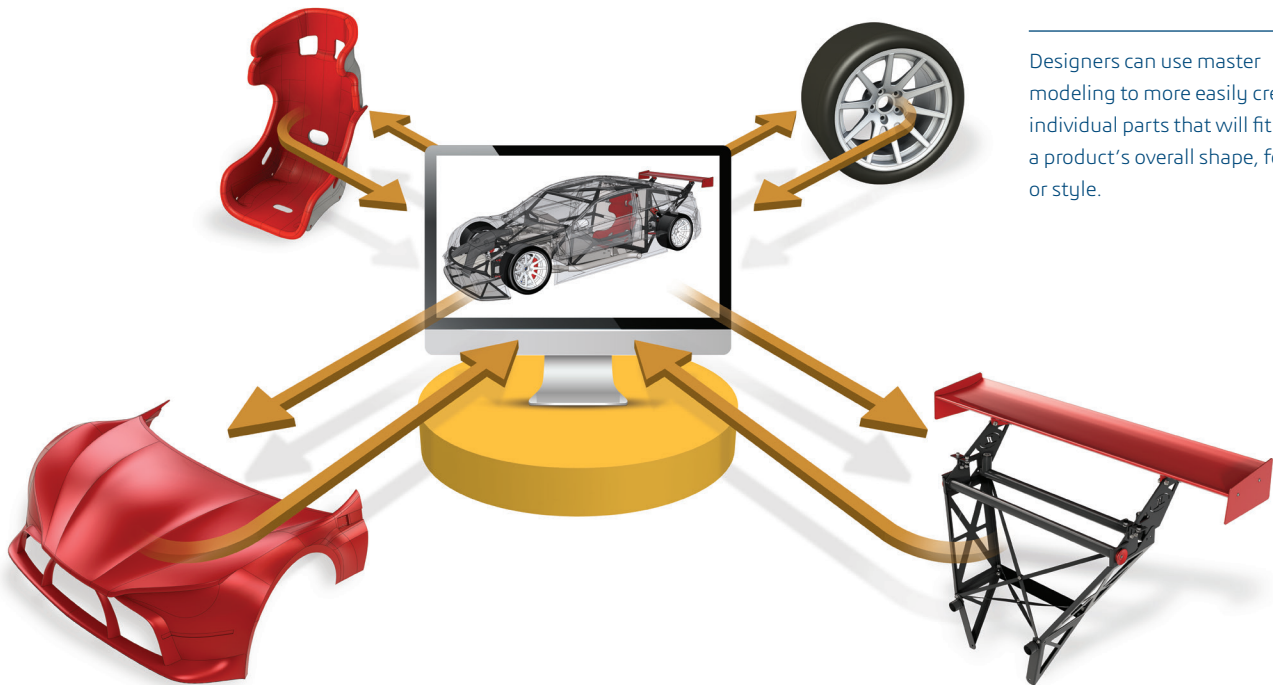
When to Use Bottom-Up Modeling

The traditional bottom-up modeling approach has been completely re-invented in SOLIDWORKS Conceptual Designer. The bottom-up approach allows designers to create individual components and build an assembly free of intercomponent or assembly constraints and dependencies. This makes for very robust designs that are tolerant to individual component changes to facilitate the evolution of design intent. Because each single-body component has no association to other components, designers can try different part concepts, mixing and matching component variations to build an assembly. Using this approach with SOLIDWORKS Conceptual Designer is particularly advantageous because designers don't have to create a new empty assembly, or jump between component and assembly workspaces, as they must with traditional CAD tools. They can even add, replace, or modify components to an existing assembly. The bottom-up technique is especially beneficial for developing innovative components, with ideas sparked by the ability to handle assemblies with a greater degree of dexterity.



When to Use Master-Model Modeling

The master-model modeling technique in SOLIDWORKS Conceptual Designer facilitates concept development in situations where a designer must work toward an overarching master shape, form, or envelope in the creation of individual parts. With this method, designers can use master model features in the design tree to drive the creation of all sketches, features, and bodies, which are later converted into individual parts. This approach is most useful when developing assemblies with static components that don't move, such as those that are used with housings, casings, and space envelopes. The master-model modeling methodology makes extensive use of the software's 3D parametric capabilities.



Designers can use master modeling to more easily create individual parts that will fit into a product's overall shape, form, or style.

SOLIDWORKS CONCEPTUAL DESIGNER MAKES CONCEPTUAL DESIGN WORKFLOWS MORE EFFICIENT

Innovation is vital to the future health of today's manufacturing enterprises, and effective conceptual design is how innovation begins. To ensure the consistent creation of product concepts that continue to succeed, product development organizations need to maximize the efficiency and effectiveness of conceptual design efforts. Yet, supporting conceptual design with traditional CAD tools, which are designed for production rather than concept creation, presents challenges because of the different needs, goals, and workflows related to conceptual design.

By developing the SOLIDWORKS Conceptual Designer modeling and collaboration solution, Dassault Systèmes SOLIDWORKS Corporation has innovated the first single modeling environment that is designed to satisfy the specialized needs, requirements, and goals of conceptual design. Leveraging the Dassault Systèmes **3DEXPERIENCE** platform, SOLIDWORKS Conceptual Designer provides the tools that designers need to define, specify, model, communicate, evaluate, simulate, prototype, and capture innovative design concepts for additional development—all within a cloud-based, web-centric application. SOLIDWORKS Conceptual Designer makes conceptual design workflows instinctive, less constraining, and more productive, which enables manufacturing enterprises to stimulate and drive innovation, resulting in the continued development of successful products.

To learn more about how SOLIDWORKS Conceptual Designer can improve your approach to conceptual design, visit www.SOLIDWORKS.com or call **1 800 693 9000** or **1 781 810 5011**.

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