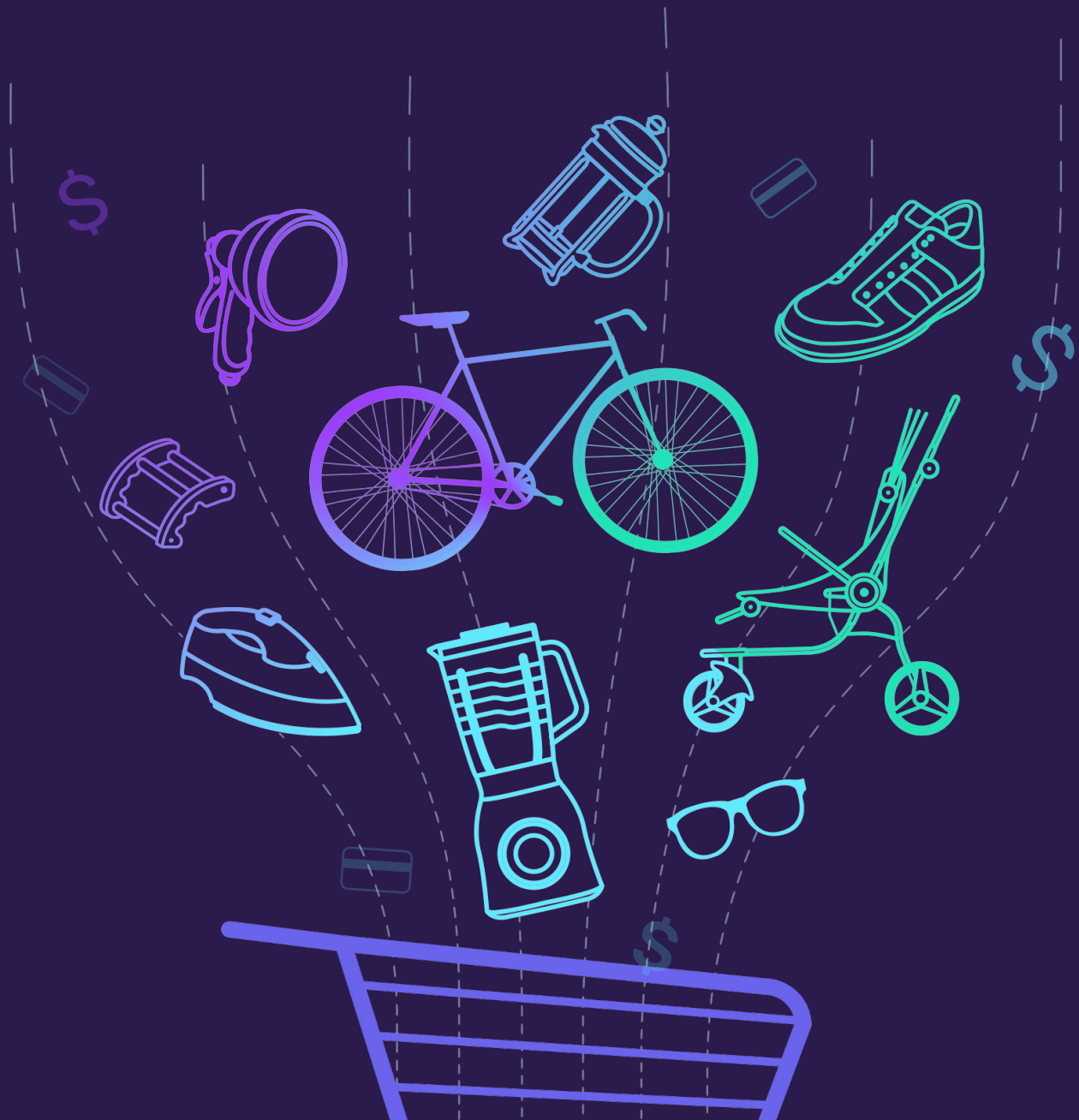


Onshape

10 Design Questions That Can Make or Break a New Consumer Product



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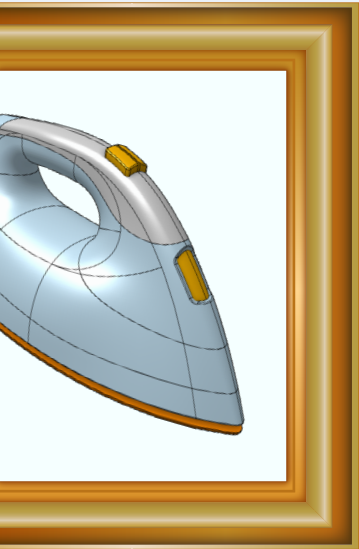
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Introduction: Customers Don't Desire Products



Your 3D product design model might look stunning enough to be in an art museum, but that doesn't mean it's going to make a great product.

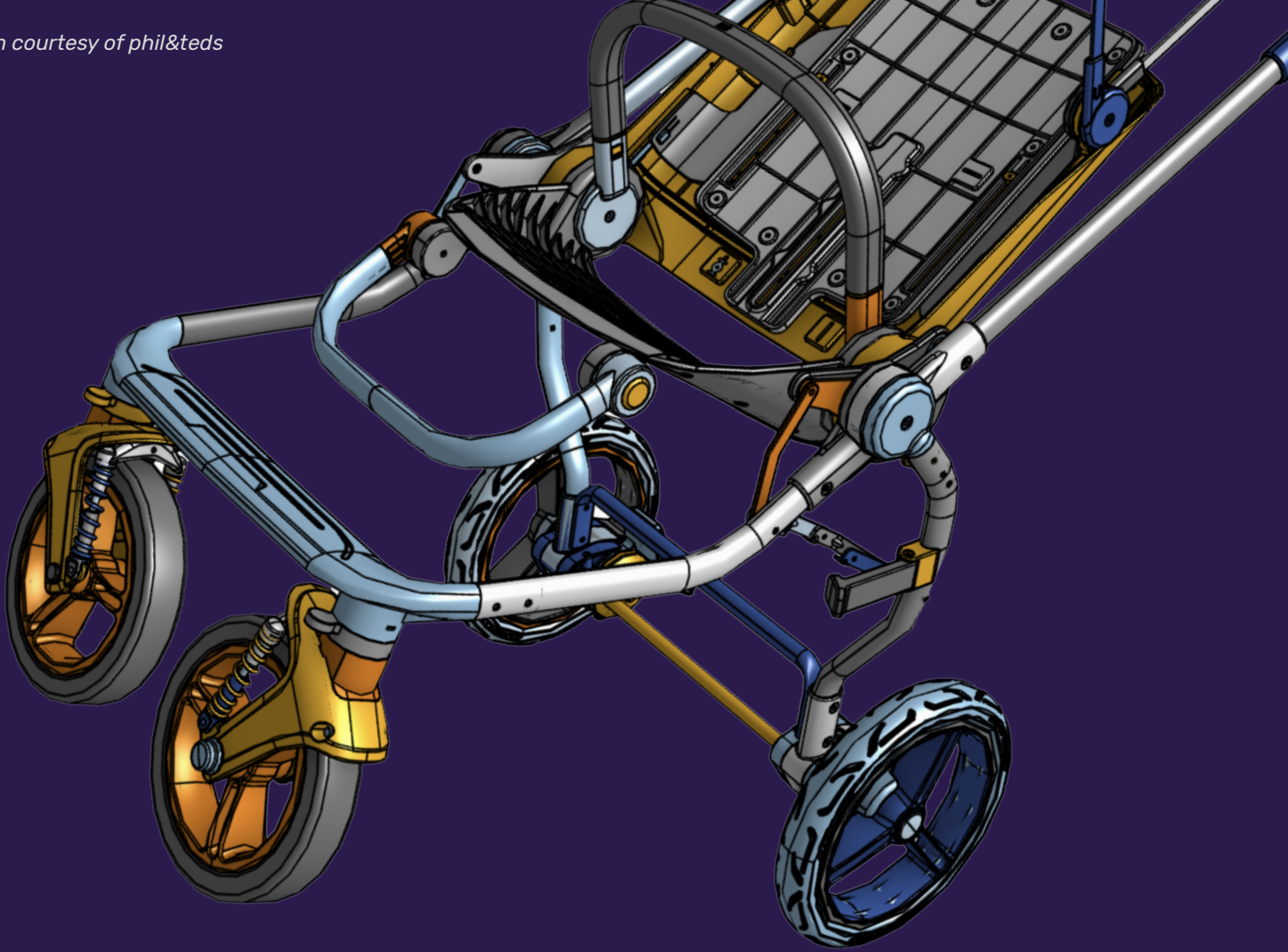
It's easy to fall in love with your own CAD design on the computer screen, but it's how everything fits together off the screen that really matters. Before you start sketching your product idea, before you commit a single line or shape to the screen, walk away from your computer for a bit. You can save yourself a lot of time, money and aggravation by thinking more about why your product should exist in the first place – is it a “nice to have” or a “need to have” product?

If it's the latter, and the world is eagerly awaiting to use your product, what obstacles can you reasonably expect to face when manufacturing it? When marketing and selling it?

These questions might seem overly simplistic on first glance, but they are far from obvious. In the second half of this eBook, we'll examine a “Hall of Shame” of epic product design failures executed by extremely talented and well-funded teams. The overriding lesson of those failures is that **customers do not desire products, they desire outcomes**. Products need to solve real-life problems or provide huge benefits that genuinely merit separating money from wallets.

To help you on your design journey, we have developed a 10-question checklist for you to pressure-test your ideas. These questions come from engineers and designers who graciously shared their decades of product development experience for this guide. Their companies specialize in a wide range of products, including: acoustic equipment, home furnishings, baby products, athletic gear, power tools, farming equipment, FM radios, and bicycles.

Despite the diverse focus of these successful companies, it's remarkable how much their product design and development processes share in common. Let's dive in...



Part One:

10 Product Design Questions You Should Be Asking

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1 How Well Do You Understand Your Customer Needs?

The success of a consumer product heavily depends on how well you as a product designer know your target customers. Given the plethora of tools and technologies that are available, it is very tempting to start your product design using CAD. However, this approach will backfire and result in wasted time, money and resources if you don't deeply understand your customers' needs first.

History is riddled with examples of products that failed miserably because the designers built products that no one wanted.

How do you avoid becoming one of these embarrassing examples? For starters, you must spend a significant amount of time with your target customers. Find out what is causing them the most pain in terms of money, time or other resources. Observe how they use the current solution to solve these painful problems. Carefully listening to them articulate the drawbacks of their current solution should form the core of your research. Once you discover what is causing the most pain, determine what your product needs to deliver to eliminate it.

It's important to always keep in mind that **customers don't desire products, they desire an outcome.**

You also should spend time talking to other stakeholders who may have insights into the needs of your target customers. This may include internal stakeholders such as sales, marketing, and product management – and also external stakeholders such as industrial design and manufacturing partners.

1. How Well Do You Understand Your Customer Needs?

In addition to understanding the unfulfilled needs of your target customers, it is equally important to assess if these needs are painful enough for customers to justify paying for a new solution. If the answer is yes, establish how much money they are willing to spend. How much money, time or resources is the customer already investing in their current solution?

This target price point will have a huge influence on later decisions, such as choosing materials, manufacturing processes, etc. This knowledge cannot reside only in the minds of your product managers or sales team. You, as a product designer, should also be well-versed in this information.

When you're in the early research stage, here are some sample questions to ask yourself (this is not an exhaustive list):

- Who are the target customers? What are their demographics?
- What problems do they have today that are in your area of expertise?
- How painful are these problems, and how urgent is it for them to make their pain go away?
- What solutions are your customers currently using to solve these problems? What are the strengths and weaknesses of these solutions? How satisfied are your customers in using these solutions?
- What are the characteristics of the environment in which this product will be used? Will it be in an office? In a rugged environment such as factory floors or construction sites?
- What are the unique non-functional requirements that these environments will pose for the product? For example, water sealing, temperatures, humidity, pressure, etc.





2

What Are Your Compliance Requirements?

At the very outset, make sure that you understand all the standards your product will have to comply with. Consumer products cannot launch without being compliant to standards, which are usually in a state of flux and vary depending on the markets where you sell your products. For example, the European Union may have different regulations than the United States.

Compliance to associated regulations also have an impact on where you could possibly manufacture your products. For example, manufacturing in China has had a cost advantage in the past because of lax environmental regulations, but this is changing as the Chinese government ratchets up the compliance requirements of these regulations. Consequently, the cost advantage that Chinese factories once enjoyed is slowly shrinking, resulting in higher demand for alternative manufacturing destinations such as Vietnam.

It is important that you understand these shifts so you can get your product manufactured to the right specifications and at the right cost.

2. What Are Your Compliance Requirements?

For starters, here are a few questions to ask:

- Where will your products be sold?
- What specific regulatory standards will your products need to meet?
- How often do these standards change and what will the requirements be at the time you launch your product?
- How much will these standards impact the cost of your product?
- Where will your product be manufactured?
- What regulatory standards do these manufacturers need to meet in these locations? How will this impact the manufacturing cost of your product?
- Are there other locations where regulations are less demanding that could help you manufacture your product to the same quality?
- What is the compliance track record of your manufacturing partner in meeting these regulatory requirements?



3

Are You Up to Date on the Latest Technological Advances?

The pace of technological advancements has dramatically increased over time. New disruptive technologies can potentially make your products obsolete very quickly. For example, the lighting industry is being forced to shift quickly from incandescent bulbs to LED technologies. Similarly, smartphones are heavily influencing customer expectations for all handheld devices and many appliances, with people expecting color displays, high resolution, large screens, and an interactive touch-screen experience for products that previously never “communicated” with them.

Another example is wearable technology, which has seen explosive growth in recent years. Wristband devices track our sleep, diets, exercise, heart rate, anxiety and more. There are “smart rings” and biometric clothing that perform the same function, relaying health metrics to your phone – and light-sensitive bathing suits that monitor how long the wearer has been exposed to the sun.

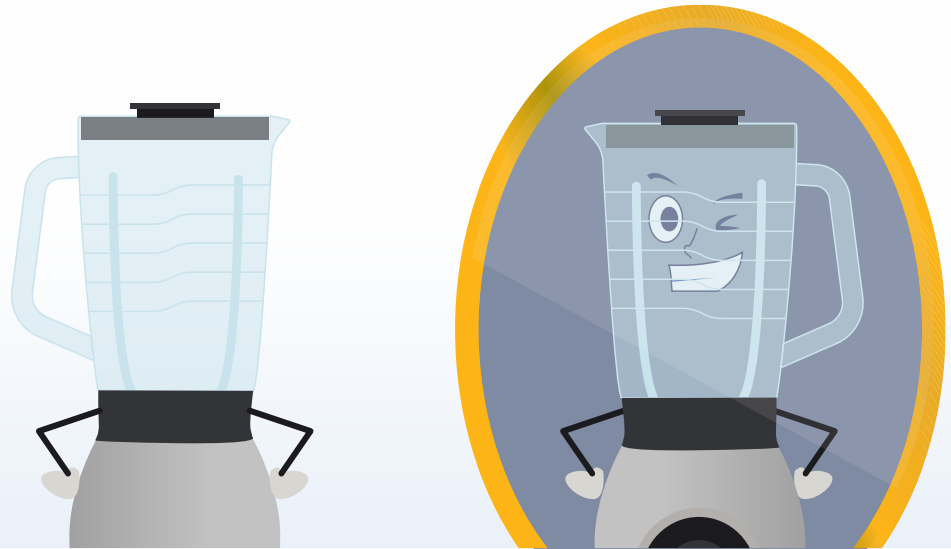
What does this all add up to? Consumers have been accustomed to “connected” products feeding them a steady stream of metrics. This thirst for connected, non-stop information is only getting stronger.

3. Are You Up to Date on the Latest Technological Advances?

If you are not on top of these shifts in both technology and customer expectations, you could be easily left behind by competitors who are more in tune with the changing landscape.

Here are some questions to ask:

- What are the latest trends in your industry that you can take advantage of? For example, the use of materials such as carbon fiber, nanotechnology, etc.
- What are the latest trends in manufacturing technologies that are relevant to your product and which could help you speed up prototyping/manufacturing and/or reduce your costs?
- How is your manufacturing partner staying on top of these trends and improving their capabilities? If they are out of the loop, can you find other manufacturers who are more tech-focused and can manufacture your product at the same or higher quality?
- Can the manufacturing partner showcase their past successes using new manufacturing technologies? What key learnings have they had from adopting these new technologies?



4

How Much Attention Are You Paying to Aesthetics?

Addressing a product's functional needs is necessary, but that is no longer sufficient enough to guarantee market success. Consumers pay a disproportionate amount of attention to the look and feel of products and demand stylish designs. The design of even the most mundane consumer products is heavily influenced by design trends in fashion, clothing and consumer electronics.

In the past, product designers could get away with less aesthetically designed products for the lower-end market segments. However, this is no longer the case. Style matters to everyone. Consequently, consumer products that offer superior design and customer experience are able to command higher price points and hence higher margins. For evidence of this, look no further than the iPhone. Why does it command a price of \$699 and above? Because the value that is derived from all the applications on the iPhone far outweigh its initial cost.

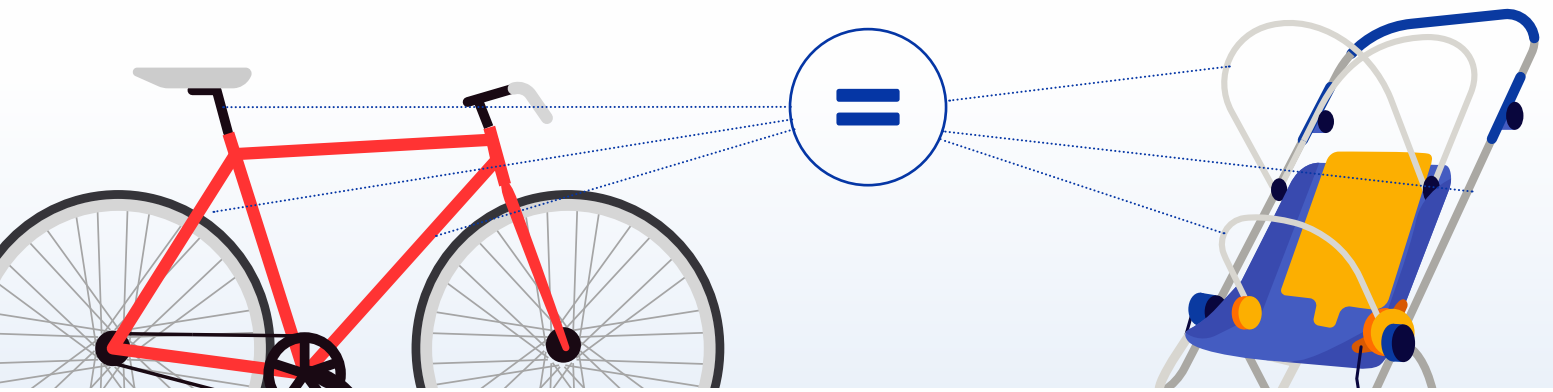
Many products now have a high-end category for items you would not expect to cost \$1000 and up – child car seats, baby strollers, gaming consoles and wheelchairs are notable examples.

4. How Much Attention Are You Paying to Aesthetics?

A category that does not have well-designed products could represent a great opportunity for a manufacturer to introduce an aesthetically designed and functional product, and very quickly establish a higher price point to become a market leader.

Here are some questions to ask your target customers during initial market research:

- What other products do you use in your daily life?
- What 1-2 products would you describe as the most elegantly designed and functional products and why?
- What 1-2 products would you describe as products that have very poor design aesthetics and why?
- How important is the look and feel of a product when buying one? Can you describe the last purchase of a product where you chose a particular brand because it had a better look and feel?
- Do you spend more money to purchase a product because it has a better look and feel?



5

What Makes Your Product Truly Different?

When a new trend catches attention, all product manufacturers start incorporating these trends into their products. Think about how pumpkin spice-flavored everything just popped up in the supermarket aisles overnight.

In the consumer product world, virtual reality, artificial intelligence (AI), voice recognition and integration with Amazon Alexa or Google Home are now the hottest trends. But seemingly everyone is doing this. To stand out in the market, you need to figure out the unique value proposition offered by your product that will provide you with a sustainable competitive advantage.

Often, differentiating ideas can come from looking at other industries for inspiration. For example, a leading manufacturer of juvenile products recently explored using carbon fiber to make their stroller frames. Noting that the material was already being used extensively in the bicycle industry, they interviewed bike designers to get a deeper understanding of their supply chain for carbon fiber components.

Learning best practices from other companies can help you avoid reinventing the wheel.

To do this effectively, network with product designers outside your industry. This should minimize any resistance to share information due to competitive concerns.



6

How Early Are You Focusing on Manufacturability?

When designing products, consider the manufacturability of your design right from the outset. Design decisions you make early on and where you choose to manufacture your product have a major impact on your product costs.

Ignoring these factors will increase the risk of creating a product that is either too expensive to manufacture or one that will cost much more than what your target customers are willing to pay. A classic example of this kind of design failure is the “Coolest Cooler” that raised \$13 million on Kickstarter only to find that the product could not be manufactured and shipped for its already advertised price.

You can learn more about the “Coolest Cooler” disaster in Part Two of this eBook.

6. How Early Are You Focusing On Manufacturability?

Here are some tips on how your company can avoid a product disaster:

- Involve manufacturing partners (internal or external) right from the outset starting with the very first design review. Often times, manufacturers can react and provide valuable feedback based on a 2D sketch or a 3D model with just the critical dimensions. Do not wait until the detailed design is complete.
- Speak with people, internal or external to the company, who have done it before. Speak to folks who are in a different industry (and hence not competitors) who are using similar materials and manufacturing methods that you want to use.
- Invest in training your product designers on Design For Manufacturability (DFM) and Design for Assembly (DFA) design methodologies.
- Ensure that designers have a holistic view of the concept to launch processes, including sourcing of components, material costs, factory negotiations, expected customer returns, etc. Do not depend on your purchasing team to figure all this out. The more knowledgeable your product designers are on these factors, the more they will think about them during the design process.
- Make sure your manufacturing partners are aware of the design intent of your product. They need to know the problem your product is trying to solve, the target customer, the features critical for your product's success, and the user experience you are trying to deliver.
- Do not equate 3D printing to large-scale manufacturing. DFA and DFM issues are often not obvious from 3D-printed models. Human hands still need to put things together when your final products are being manufactured. Build physical prototypes to uncover potential issues.

7

How Strong is Your Supply Chain?

If you have a great supply chain, it could be one of your biggest differentiators. Unless you get this right, you are not going to get to your price points, sustainability or reliability goals.

Product design matters, of course, but your supply chain is also absolutely critical. You need to deeply understand the capabilities of the factories you're working with. If you have a local manufacturing partner build your initial designs, you can then more quickly learn what works and what does not. This will not only iron out design issues upfront, but also help you immensely during negotiations of manufacturing costs with domestic or overseas factories.

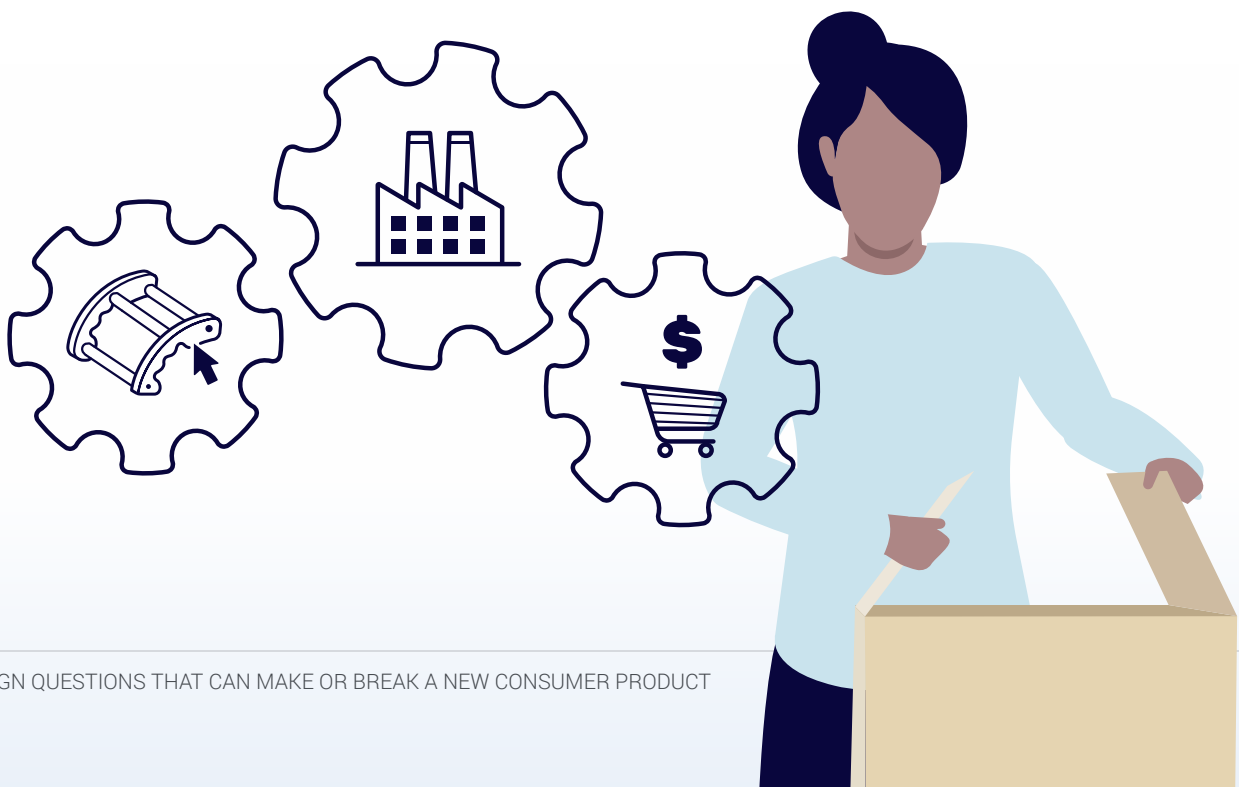
Here are sample questions to ask when choosing a new manufacturing partner:

- **Manufacturing Capabilities** - Do they have experience manufacturing components similar to the ones in your product?
- **Quality Control** - What are their quality control processes? Ask them to describe how they monitor quality and show you proof of their track record.
- **Lead Times** - What are the typical lead times for components like yours?
- **Busy Time** - When is the factory the most busy? How do they handle the busy times? Do they hire additional staff or do they require additional lead time to handle their busy workload?
- **Hiring Process** - What is their hiring process to attract high quality talent? Your product is only going to be as good as their talent, especially if it calls for advanced manufacturing methods.

7. How Strong is Your Supply Chain?

- **Communication Preferences** - What are their preferred communication channels: phone, email, face-to-face meetings, or video conferences? If the latter, check if they have the internet bandwidth to do this effectively.
- **Change Control Process** - What processes do they use to ensure that products are [manufactured to the right version of the design](#)? How do they keep track of different versions?
- **Business Contact** - Who would be the point person of contact for you? Will this person be completely dedicated to your project or sharing their time with other companies? If the latter, how much time will be allocated to your project?
- **Business Viability** - What were their sales for the last 3-5 years? Are they profitable? You want to make sure that they are growing, investing in their capabilities, and will be a viable long-term partner for you.

For each of the above cases, ask the manufacturer to describe instances where their process has worked flawlessly, where things have gone wrong, and what corrective actions or process improvements they made to prevent such errors in the future.



8

What Are You Doing to Reduce Time to Market?

With the rapid pace of technological innovations, it's no surprise that speed to market usually wins. Your whole design process needs to be fluid and all the tools you use should allow you to move fast.

Creating the initial design is the easy part. The design tools you choose should allow you to quickly create multiple design iterations so that you can find the right balance to achieve the desired form, fit and function. You should be able to pivot fast when you hit design issues. Therefore, make sure the tools that you select don't constrain you, but instead are very flexible to design changes.

Here are some specific things to consider when choosing tools. Ask yourself how easy is it to:

- Make design changes and have the change reflected in all other documents that reference the component being changed?
- Collaborate and get feedback from your cross-functional team (other designers, manufacturing, quality control, purchasing, etc.) starting from the conceptual stage without having to email files back and forth?
- Version control your designs so all team members are working off the same version of the design in order to avoid costly errors?

Also consider the reputation and innovation history of the vendors whose tools you choose to use. For example:

- Who else uses the tools you want to use?
- How often does the vendor release new enhancements or fixes to their products?
- How long has the vendor been in business and how much financial backing do they have? (You want to choose a vendor who will be around for the long run).





9

What Are You Doing to Improve Collaboration?

Basketball Hall of Famer Michael Jordan once said “Talent wins games, but teams win championships.” This is very true when it comes to building successful products. You can’t do it alone, so communicating efficiently and effectively with your internal and external partners is vital to get everything right.

Overseas manufacturing drastically increases the importance and complexity of your communication because of different time zones and cross-cultural nuances.

9. What Are You Doing To Improve Collaboration?

Here are a few ways to ensure that everyone is always on the same page:

- Ensure that you listen to all stakeholders at the start of the project and get all approvals needed upfront. Establish who needs to be involved in design reviews and in making final product decisions.
- Develop personal relationships with everyone who has an impact on your product's success, especially manufacturing. The more complex the manufacturing, the more important these relationships will get. Face-to-face meetings are the best way to build effective relationships versus relying on web conferences or email. Devote the time, money and effort to travel to facilitate in-person meetings. Better relationships ultimately result in better products.
- Making sure everyone is on the same page needs to be a continuous undertaking and not something you do just at the start of your project. It is better to over-communicate than to assume everyone understands the details.
- Make sure your design tools allow you to easily communicate changes and ensure that everyone is working on the same version of the design.
- If English is not the first language of your overseas partners, make sure you have an onsite liaison who is fluent in both languages. But even in this case, use simple words when communicating in English. It's better to rely on more visuals and fewer words. Dealing with a language barrier requires extra effort and you should plan for the extra time this will take when creating project timelines.

10

How Soon Should You Build Your First Prototypes?

Product design software tools have come a long way in helping engineers discover potential red flags during the design process. However, building physical prototypes are still essential to ensure you will not run into assembly issues during production or user experience issues after the product launch.

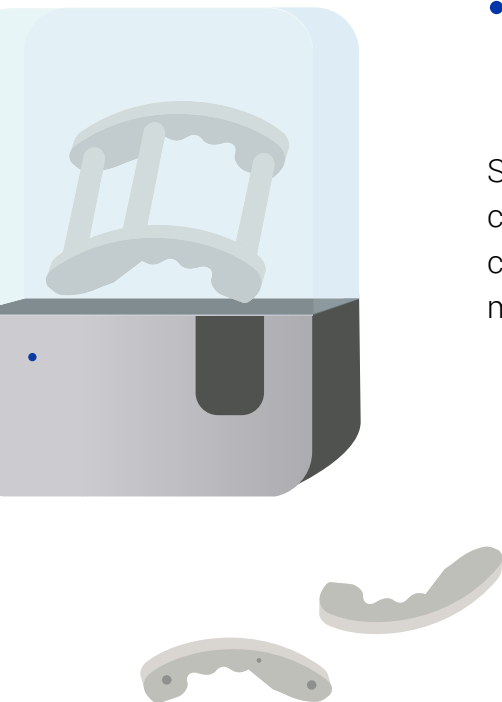
Hardware is hard even if you have done it for many years – and teams often underestimate this complexity.

A few real-life examples:

- A leading speaker manufacturer discovered that their acoustic signals failed to meet standards due to resonant frequency issues. The company didn't realize this until they built their first physical prototype.
- An established bike manufacturer still builds early prototypes to ensure its cables can be routed through tight spaces without any issues.
- A company that makes warehouse barcode scanners learned that its own employees did not want to use the scanner because it was too heavy to hold in one hand.

Seriously considering the user experience for your products makes it critical to build early physical prototypes and test them with your target customers. This ensures that your product's form, fit and function meets their personal requirements.

Remember: You can't force or bribe your customers to like your products. Listen to their early feedback and make necessary design changes to solve any uncovered issues.



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Part Two:

Lessons From 5 Epic Consumer Product Design Failures





Let's be blunt: It's human nature to be mesmerized by other people's failures.

Sports broadcasters and movie DVDs show us highlight reels of athlete and actor bloopers for entertainment. War documentaries hyperfocus on historic military blunders. And even in our own industry, there's a strong sense of "[schadenfreude](#)" the phenomenon of secretly enjoying the mistakes of others. This is hopefully only the case when a massive design failure causes just financial loss and embarrassment – versus tragic situations that lead to injuries or death.

In any case, those who seek to learn from their mistakes become better engineers and designers. And it's far more preferable to learn these lessons from other people's mistakes, saving yourself the aggravation (and winding up being on one of these lists).

With that in mind, let's take a closer look at five notorious consumer product design failures and what went wrong.

1 Coolest Cooler (2014)

The Product

The [Coolest Cooler](#) is an all-in-one outdoor entertainment solution for tailgating, camping, boating, picnics, beach parties, barbecues, and anytime you're enjoying the great outdoors. It includes a blender, bluetooth speaker, USB charger, LED light, oversized wheels, bottle opener and bungee tie down. The company initially raised \$13 million from 60,000 customers pledging \$165 and more for a cooler, making it the highest funded Kickstarter campaign of 2014. But 20,000 early backers had still not received their coolers two years after the promised delivery date, sparking an investigation from the [Oregon Department of Justice](#). You can read a letter from CEO/founder Ryan Grepper to his angry customers [here](#).

Why was this an epic fail?

- Cost of development, manufacturing and shipping each cooler was \$235, far exceeding what customers pledged on Kickstarter.
- To try to make up for the shortfall, the company began selling the cooler on Amazon for \$400 with immediate availability. This caused further resentment amongst loyal Kickstarter customers, inspiring a flood of vengeful 1-star reviews on Amazon.



Lesson Learned

Great renderings and videos may help pre-sell an idea, but developing the full product and manufacturing it at necessary margins is a different ballgame and multiple times harder. Your supply chain can make or break your product. This cannot be an afterthought.

2 Google Glass (2013-2015)

The Product

Google Glass was a wearable, voice-controlled Android device that resembled a pair of eyeglasses and displayed information directly in the user's field of vision.

Why was this an epic fail?

- Consumers did not know what problems a wearable computer would solve for them and why they needed a \$1,500 pair of glasses.
- The design was not aesthetically appealing. As [The Guardian](#) put it, users of the product looked like “dorks,” the “contemporary version of those 1950s engineers who always had several pens and a propelling pencil in their top jacket pockets.”
- There was a public backlash over privacy concerns. Because the glasses allowed wearers to clandestinely record video – unlike the obvious presence of cell phone cameras – the product made bystanders uncomfortable. Nightclub bouncers, for example, banned patrons from wearing them.
- The same [safety fears](#) about cell phones and radio frequency radiation were magnified with Google Glass, because it was meant to be worn on your face all the time.
- The product had significant UI and firmware issues, with [no product fixes for nearly 3 years](#).



Lesson Learned

Technologies looking for a problem to solve have a very high probability to fail. Product designers need to solve problems that customers care about and are willing to pay to resolve. Do not fall into the “If we build it, they will come” mindset.

3 3D Television (2010)

The Product

[3D TV](#) was television that conveyed 3D depth perception to the viewer for special 3D-formatted programming. Experiencing the effect usually required wearing specialized plastic glasses (like the 3D movie glasses), but some TV sets offered a simulated 3D mode that could be viewed with the naked eye. Major television manufacturers such as LG, Sony and Samsung were initially on board along with some TV networks.

Why was this an epic fail?

- There was an awkward user experience with viewers wearing cheap plastic, bulky and uncomfortable 3D glasses. Eye strain and dizziness were reported by 20-25% of users. Although this may have been a tolerable tradeoff for a single movie-watching experience, it did not translate well to ongoing daily use.
- Developers were caught in a Catch 22. Zero 3D content available at the product launch meant low TV sales. Low TV sales meant no motivation for content creators to create new content.

Lesson Learned

User experience at every touch point can make or break a product. Adding friction to the customer experience by requiring users to do more work will reduce adoption. Users do not desire products – they desire to accomplish an outcome. Customers want to do less work using your product, not more. The only exception is if doing incremental work makes them realize more

benefits than before. Furthermore, designers can't focus on just the product. The ecosystem in which their product lives also matters tremendously. Consumers now expect instant gratification and do not have the patience to wait. If your product cannot be used and enjoyed immediately, it will not win.



4 Juicero Press (2017)

The Product

The Juicero was a \$400 internet-connected juicer that used single-serving packets of chopped organic fruits and vegetables sold exclusively by the company by subscription. The company, which targeted restaurants and health food enthusiasts, raised \$120 million in investments and shut down 6 months after launch.

Why was this an epic fail?

- The over-engineered device, which included [400 custom parts](#) and delivered 4 tons of force, could be replicated by simply squeezing the fruit and vegetable packets by hand. Given this, the juice press was redundant and unnecessary, quickly shifting from a Silicon Valley darling to a social media [laughingstock](#).
- It was an overly complex solution to a simple problem. Does a juice machine truly need to be connected to the internet?
- Juicero was a pricey appliance, requiring an initial \$400 investment, plus \$5-8 for a single juice packet. That did not compare favorably to the cost-per-serving at a trendy juice bar.



Lesson Learned

Juicero remains a cautionary tale for all product designers. Successful innovation is not about creating solutions in search of a problem.

Seek simple solutions for even complex problems.

5 Microsoft Zune (2006-2012)

The Product

[The Zune](#) was a portable digital music player from Microsoft launched as a competitor to the Apple iPod.

Why was this an epic fail?

- Too late to the party: Microsoft launched the Zune five years after the Apple iPod established itself as the dominant market leader.
- The Zune had no unique or innovative differentiation compared to the iPod. It did not solve any problems that iPod was not already solving. As Robbie Bach, the former head of Microsoft's home entertainment unit, [later admitted](#), the Zune "wasn't a bad product, but it was still a chasing product, and there wasn't a reason for somebody to say, 'Oh, I have to go out and get that thing.'"
- The Zune was also a casualty of insufficient marketing, though this could not have made much of a difference given the lack of product differentiation. "We did some really artsy ads that appealed to a very small segment of the music space," [recalled Bach](#), "and we didn't captivate the broad segment of music listeners."



Lesson Learned

Products must have a clear and unique product differentiation. "Me too" products will not succeed if there is a well established market leader. Changing consumer behavior or making them switch products is hard. They need a compelling reason and benefits to make the switch. Throwing marketing dollars behind a flawed product usually is the equivalent of flushing money down the toilet.

Conclusion

So there you have it: A rubber-necked stroll of some of the biggest consumer product design disasters of the recent past. It's easy to point fingers and find scapegoats after the fact. The truth is that we're all at risk of being blinded by our own brilliance.

Even the cleverest product ideas executed by the most talented engineers are destined to fail if manufacturing, marketing, sales and product distribution challenges aren't considered from the very beginning.

SPEED UP YOUR PRODUCT DESIGN PROCESS WITH ONSHAPE

Onshape is a next-generation cloud design platform that speeds up product development. It's an all-in-one system that combines CAD, release management, workflow, real-time collaboration tools, and an API with more than 50 engineering applications.

Onshape helps extended design teams work together faster and helps executives make better business decisions with real-time analytics and unprecedented visibility into their company's design and manufacturing processes.

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