WHY PROTOTYPING IS SO IMPORTANT TO PRODUCT DEVELOPMENT

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But why? Why can't a perfectly designed product go straight from CAD to production? In reality, making a product that is worth further investing in, one that customers will want to buy, requires several prototypes, sometimes tens of prototypes to prove the concept and perfect your idea. Success comes through practice, just like with the musicians and the athletes.

Rarely in life is anything perfect on the first attempt. Writers write drafts that are proofed and edited (including this article). Musicians practice over and over, and athletes practice years to perfect their skills before becoming pros. So, it only makes sense that a product developer would develop a prototype before manufacturing their products.
The word prototype derives from the Greek word meaning, “primitive form”. It’s an early sample or model of a product built to test a concept or process. Understanding that a prototype, by definition, is an early form of your final product, know that there is often a compromise between your prototype and the final product design. Differences in materials, manufacturing processes and design may create a slightly different look and feel of your prototype.

So then, why prototype? A full design build is expensive, and it can be time-consuming. First, you build, then you look for any flaws and problems, figure out the solution, then rebuild with the updates. The process may repeat multiple times. Instead, rapid prototyping can be used for your initial prototype. This allows you to inexpensively build and test the parts of the design that are most likely to be flawed, solving issues on the front end, before you make the full product.

This necessary step is needed to progress with your product development and take you further toward the commercialization and marketing of your product.
IS PROTOTYPING VALUABLE?

The Learning Curve

Prototyping allows you to learn about the product, the design, and the functionality. Tom Chi, former Experience Lead for Special Projects at Google X, stated:

“We’re all pretty smart people involved in product design and development, but the truth is that no matter what we start working on, there’s maybe a 5% chance that the thing we’ve started working on is the right thing, based on the first idea that comes out of our head. Now, if you end up having some startup idea or a product idea and you chase after it and it has a 5% chance of success, you end up with a success rate of most startups. Less than 5% end up having a useful product or a great exit. But, here’s a little bit of math. By the time you try 20 things, even if each individual thing only has a 5% chance of success, by the time you try 20 things, your chance of success goes up to 64%. By the time you try 50 things, it goes up to 92%. It’s almost like you can’t fail!”

His process is sound. By doing repetitive prototyping, you eliminate the guesswork and base your decisions on actual data and facts. Don’t ever guess. Just learn. Just prototype.

Market Testing

Initially, companies put products into a store untested and hoped the product did well. As product development grew, so did the understanding of the market, the users, and the idea that the consumer knows best what he wants.

Product designers cannot predict how a consumer will react to a new product, and IDEO’s designers realized that early on. They began to engage the consumers with early prototypes, receiving valuable feedback that helped shape their final products. They would release several prototypes, and gather feedback, switching up the product until it was exactly what the consumer was looking for. When the final product went to manufacturing, and finally to market, it was almost guaranteed to be a success—an unintended use for prototyping, and yet one of its best uses.

Designers quickly began to realize that what looks good on paper isn’t always what the end-user is going to want to see. By getting an inexpensive prototype in front of the consumers, designers have been able to get quick feedback, adjust the product, and create a winning product!

Prototype, share with consumers, learn, improve, repeat! And get ready for success.
PROTOTYPING STYLES AND DEVELOPMENT

Let’s dive a little bit deeper into the types of prototypes (for both hardware and software) available and goal of each:

1. A Proof-of-Principle Prototype verifies that the key functional aspects of the product work, but rarely has all the functionality intended for the final product.

2. A Working Prototype represents all or nearly all of the functionality of the final product.

3. A Visual Prototype serves as the body of the design, showing the size and appearance of the product, with no functionality.

4. A Form Study Prototype is an early visual prototype, showing the geometric features of a product, but not including color or other aspects of the final product.

5. A User Experience Prototype shows a consumer enough of the final appearance and function so they can test the product and provide feedback.

6. A Functional Prototype captures function and appearance of the product, sometimes with different manufacturing techniques or even at a different size from the final product.

7. A Paper Prototype is simply a drawn or printed visual representing the UI of software products. These are commonly used to test and confirm design decisions during the development process.

WHILE THERE ARE MANY VARIETIES OF PROTOTYPES, THERE ARE TWO MAIN WAYS TO DEVELOP THOSE PROTOTYPES.

Rapid Prototyping

This method is used for quantitative purposes. Often dozens of sketches, CAD drawings, and models are created to understand the product, and many times several prototypes are made to understand how the product will function and feel. Rapid prototyping is a quick process that allows you to get a product in your hand, understanding the nuances.

Pilot Prototyping

When creating a pilot prototype, you aim to get as close to the real product as possible. These prototypes are used to prove that the product is economically sound. This is often the prototype that is built right before a product is ready to launch.
**A GUIDE TO PROTOTYPING**

**RAPID PROTOTYPING**
- **Question answered**: What are the different ways we could solve this problem?
- **Fidelity (i.e. the degree to which a prototype reflects a polished and finished product)**: Low
- **When to employ it in the product-development process**: Early, to explore many ways to achieve a goal and periodically during the mid-phase to deliver a specific feature or value driver

**LIVE PROTOTYPING**
- **Question answered**: Does our massage and solution resonate in the market?
- **Fidelity (i.e. the degree to which a prototype reflects a polished and finished product)**: Just enough for the product to appear real in the marketplace.
- **When to employ it in the product-development process**: Midway, to rigorously explore market appeal once a specific opportunity area has been identified.

**TECHNICAL PROTOTYPING**
- **Question answered**: Can the problem be in this specific way?
- **Fidelity (i.e. the degree to which a prototype reflects a polished and finished product)**: High enough to prove feasibility.
- **When to employ it in the product-development process**: When technical feasibility is in question or when the function has been identified but the specific means is yet to be determined.

**PILOT**
- **Question answered**: Are the economics attractive enough to justify scaling?
- **Fidelity (i.e. the degree to which a prototype reflects a polished and finished product)**: Very high.
- **When to employ it in the product-development process**: Late, as a final check to tweak details before launching at scale.

**SOURCE** DAVID AYCAN AND PAOLO LORENZONI

Pilots require a working solution and are often more polished than the scalable versions to overcome initial market awareness challenges.
**PROTOTYPING BENEFITS**

- Saves money by cutting corners. It allows for evaluation of the market and multiple iterations of the prototype.
- Prototyping allows us to watch people use the product, as they would in “real life.” It provides us with the opportunities to look at situational factors that may affect the product in the market.
- Prototyping provides consumer feedback on the product, allowing for the improvement of the product before it gets to market.
- Forecasting sales is often difficult, but as you see the product, and how it competes against other products in the market, you can start to understand the sales cycle of the new product and set forecast predictions.

**EXAMPLES OF FIRST PROTOTYPES**

**iPHONE**

The iPhone was ahead of its time when it was created. The early designs show ideas similar to smartphones today. As Business Insider tells us, “…the prototype was designed by Hartmut Esslinger, who helped design the Apple II desktop PC. It’s pretty slick for a device from the early 80s, featuring a touchscreen and stylus input. On the screen, you can see a virtual check and an accounting app, so it looks like Apple wanted to design a hybrid phone/computer as early as 1983.”

**DEPENDING ON THE GOAL, BUDGET, AND TYPE OF PRODUCT, THE PROPER SELECTION OF PROTOTYPING METHODS CAN MAKE OR BREAK THE PRODUCT.**
**NINTENDO WII U**

In 2008, Nintendo realized that their Wii system had several limitations, and public perception was that the system was more for a casual audience, not for gamers. Nintendo sought to bring those gamers back with their Wii U system. The console needed to stand apart, and significant changes needed to be made. This prototype was one of the designs.

**OCULUS RIFT VR PROGRESSION**

Below we show you the progression this product went through when designing the perfect VR set. The first attempt was not perfect, nor was the second. Through the series of attempts, this team reworked, analyzed, and studied the product, making changes and working to create a product that finally was ready for mass production.

As you can see, everything starts with a rough prototype to test product intended use. Sometimes making a perfected prototype can even negatively affect further product development. The product team can appreciate the product without further looking for improvements and asking for feedback from the target audiences. In that case, the product might be very close to the inventor’s original intention, but not close to consumers who will pay for it, which might lead to a commercialization failure.

On the other side, we need to carefully follow the prototype path, avoiding the pitfalls of polished prototypes. When people, in general, see something that closely resembles a final product, they focus on the prototype itself – what it can do and how it performs. People forget about why the product was created, what problem it is solving for, and any additional obstacles that stop the team from solving that problem.
DIFFERENCES IN PROTOTYPES AND MANUFACTURING SAMPLES

There is always a confusion between prototypes and initial samples. Manufacturing or production samples are just as useful as the prototypes when used at the right stage of the game. But in order to know when to use them, we need to make a clear distinction between the two sample types.

**Production samples** are used to validate production (manufacturing design)

**Prototypes** are used to validate product designs

**HERE ARE SOME OF THE KEY DIFFERENCES BETWEEN THE TWO SAMPLES:**

**Material:**
Prototypes are often made from a less expensive material than the production sample, saving the investor some money upfront.

**Process:**
The process of making one object, or a small batch of them, is usually not the same as making a mass-production run. Prototypes often use less expensive machining and fabrication methods, again looking to save money. This will lead to differences in the appearance of the product. The production sample will be made from the same method used for mass-production and will look and feel like the final product.

**Verification:**
Prototypes are often made with the assumption that rework will be needed. The prototypes don’t go through a quality assurance process, as a production run would, but are instead inspected by the project team and the inventor.
CONCLUSION

The beauty of prototyping is that each prototype interaction opens new opportunities to improve. It’s like an exam at the universities—with each interim test, you get better prepared for a final.

The type of prototype is determined based on the goals of your product development and budget. You need to put constraints on time as well to ensure the most efficient resource allocation.

We would summarize the prototypes usually are done for:

- Product features and functionality testing
- Potential customers feedback
- Testing technical feasibility

In all reality, you will likely need more than one variety of prototype to develop a truly valuable product. Product development can get bogged down in meetings, where the product is analyzed, and guesses are made as to “the best way,” but by getting to the rapid prototype stage, you can skip some of that guesswork and replace it with real information from the product.

Prototype, iterate, and repeat to avoid costly mistakes. And if you need any help, reach out to our prototyping engineers to get your answers.