RapidMade
2828 SW Kelly, Ave, Suite B
Portland, OR 97212
503-943-2781 | info@rapidmade.com

Reverse Engineering Made Simple

Introduction

When designing a product or part, many people take inspiration from what's around them and end up looking to have an object 3D scanned in order to modify or reproduce it. In 3D scanning, the term "Reverse Engineering" has a very specific meaning: converting the messy point cloud or polygonal data into a file better suited for engineering CAD software (e.g. STEP, IGES, or native SolidWorks files).
However, 3D scanning isn't always the most cost-effective option. 3D scanners can range in price from a few hundred dollars for a low-end consumer model, up to tens of thousands for high-precision metrology devices:

- Consumer: Occipital Structure Sensor, $379.00, 500 micron accuracy
- Professional: FARO Edge ScanArm HD: approximately $70,000.00, 25 micron accuracy

The consumer product will indeed scan objects, but with such low accuracy that it's basically useless for any industrial or design use. However, the 20 times more accurate FARO Arm costs almost 185 times as much as the consumer model. Using a high-end scanner effectively also requires training in both the scanner itself and specialized scanning and reverse engineering software.
3D scanners are almost magically useful when you need to replicate an obsolete or discontinued part, especially one with complex geometry. However, for certain parts (and customer budgets) it can be far more effective to have a qualified designer or engineer replicate the object digitally using precise measurement tools and design know-how.

Background

Figure 1: The original iPhone case provided by the client

Consider the case of a client looking to create a retro-style case for a Samsung Galaxy Note 5. Unfortunately, the existing case was designed to fit an Apple iPhone 4 and the client wished to make numerous improvements to the design:

- Add a hinge
- Add a locking/opening mechanism to allow easy access to the inside
- Maximize the internal cavity's useful storage space

RapidMade
2828 SW Kelly, Ave, Suite B
Portland, OR 97212
503-943-2781 | info@rapidmade.com

Solution

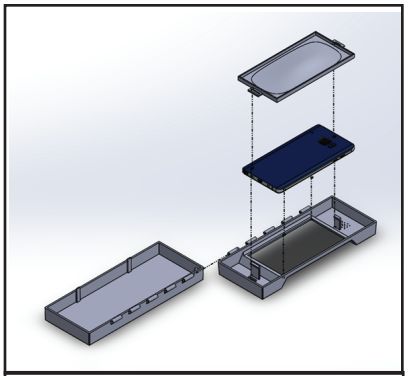

Figure 2: the upgraded design, with redesigned phone-mounting and added hinge to allow easy access.

Scanning the original object would have locked in its dimensions in the CAD file and made it much more difficult to modify with any desired changes. The cost for doing the required scan, when combined with the CAD design time to make the modifications, was also unnecessarily expensive. Instead, using digital micrometers and other measurement tools, the important details of the design were captured without having to resort to the more expensive 3D scanning and reverse engineering option.

From there, it became a design project like any other, iterating on the concept until the client's needs were met.

Results

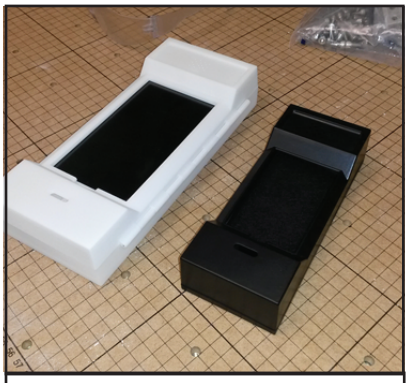

Figure 3: The final design next to the original provided product.

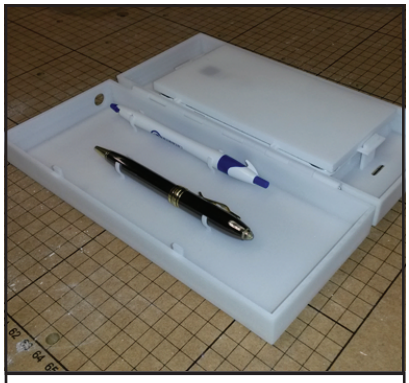

Figure 4: The interior cavity of the final design with pen clips.

Once the design process was completed and the client was satisfied with the product design, prototyping was the next logical step.
In order to accommodate the larger Samsung smartphone, the design was significantly enlarged. Several flexible, snap clips intended to hold ballpoint pens had also been added to the interior cavity. In order to provide a prototype of the highest quality and durability with the final geometry, it was produced using a 3D printing process called Selective Laser Sintering (SLS).

SLS produces parts with fairly consistent material properties and geometries in all directions, ensuring that both the flexible and hinge features of the design would work as intended. Other processes such as Fused Deposition Modeling (FDM. also known as Fused Filament Formation or FFF, is the type of 3D printing used in consumer-grade 3D printers) would have left the client with a product that only lasted a very short period of time, or was much less aesthetically pleasing.

In the end, opting to bypass 3D scanning is what made this project possible. While a wonderful tool, 3D scanning isn't always the correct fit. Using the right methodology and tools for any given job is incredibly important. Sometimes, starting from scratch frees the designer's imagination and allows for fewer constraints during the design process, leading to a successful project for all involved.