

Thinking Out of the Screen

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Figure 1. Stereolithography (SLA) printing allows the user to choose from a variety of material types and opacities.

1. Introduction

The introduction of low-cost, personal 3D printers has been heralded as manufacturing revolution, but the implications of access to this technology is still being defined. Thinking Out of the Screen will survey the origins of the industry, explore faults with current generation technology and explore disruptive methods of design and production developing, with an emphasis on practical use for the digital artist.

2. History

The history of manufacturing underwent a radical shift in the late 18th century with the appearance of the Wedgewood ceramic factory in England. For the first time, consumer goods were mass produced, due to the efforts of Josiah Wedgewood to “make machines of the Men as cannot Err..” (Finer and Savage, pp.82-83). Key to this process was the separation of designer from the manufacturing process.

The increasing options for automation confirmed this separation and forced designers to work within the limits of available mass production technologies. Over time, the role of the designer was separated from the model making process as well by introduction of CNC milling equipment, which had to be programmed by a technician – further reducing the interaction of the designer with the final product.

The introduction of early 3D printing systems in the 1980s, heralded a shift in this production method. Designers were still constrained by mass production technologies for final products, but could now rapidly iterate and check physical copies of designs within a manner of hours. Access to these systems was limited to those working at firms large enough to afford these systems.

By the mid-2000s, the emergence of the rep-rap movement, and the first 3D printer manufacturers began selling kits to the general public, decentralizing access to additive fabrication. Poor print quality and reliability became limiting factors, but with time, the market has matured, providing users with access to relatively inexpensive, high performance systems.

3. Barriers

The growth of the 3D printing industry offers the potential for a manufacturing pipeline capable of hyper-customization and personalization of products for the consumer, as well as low to no-cost changes to production lines for the designer. However, the reality is that slow build times, lack of CAD knowledge, expensive feed materials costs and limited access to systems has bottlenecked the use of 3D printing as a mass production method to date.

3. Solutions

For a designer with a background in the digital arts, leveraging 3D technology requires significant consideration of product end use, and a cursory knowledge of the printing materials and technologies available. Designing for printability reduces part costs while enhance print reliability.

While fused deposition modeling (FDM) technology has become the de facto additive manufacturing technology in the personal 3D printer space, Stereolithography (SLA) printing has emerged in the last 18 months as the gold standard for surface finish and fine detail. For artists, the end result is less post print finishing and results more closely matching the digital file, with extremely smooth surface finishes and intricate detail possible. This greater quality comes at expense – SLA resins and printers incur have higher material costs per cm³ and have slower part times per part.

With the expense of printing, several techniques can be applied to file design to reduce print costs and decrease print times. As with all 3D printers, forms to be manufactured are sliced along the z-axis in software. The *area per layer* is the amount of area to be printed in a single slice. By reducing the total area in any single layer, reduce forces are applied to the production piece, while also lowering material costs. Techniques such as shelling and use of biomimetics can be applied to reduce expense and increase quality of finished parts.

Scale-up and production have been aided by new services available in the marketplace. Online service bureaus and decentralized printing networks and file repositories offer allows short run production to occur with no tooling costs and relatively few design limitations, although cost per unit is significantly higher than traditional manufacturing techniques such as injection-molding, die-cutting and stamping. Notably, the flexibility of these emergent services means that minimal knowledge of the manufacturing technique is required to go from digital design to product.

4. Conclusions

For a digital artist, the introduction of low-cost, high resolution 3D prints provides the opportunity to bridge the digital / physical divide, allowing potential for product development and personal expression, thought material limitations, production throughput, and design for process remain as strong considerations.

References

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