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The Future of Additive Manufacturing

Since the dawn of the industrial age, humans have manufactured equipment, tools, and parts on large scales. Manufacturing has seen many changes over the past centuries due to the integration of electronics and computing, allowing a relatively new technology to emerge: Additive manufacturing. This manufacturing process utilizes CAD (Computer Aided Design) which takes the design and layers material accordingly. Additive manufacturing, or 3D Printing, has recently seen integration into many manufacturing processes. 3D printing has many applications and will likely play a major role in future manufacturing.

In 1981, Japanese inventor Hideo Kodama created the first device recognized as a functional 3D printing machine. The device relied on ultraviolet light to harden polymers and create solid objects (Hahn). Kodama's printer utilized a very different process in comparison to modern printers, however the invention influenced other future designs. Modern 3D printers also employ various technologies and sciences depending on their application: selective laser sintering, fused deposition modeling, and stereolithography. The majority of modern printers rely on fused deposition modeling (Hahn). Each of the previously mentioned printing technologies require a form of CAD modeling. Printers receive the CAD design from a computer and process the information, layering material accordingly. Printers which use the aforementioned process create the category of "Desktop Printers" (Metal Additive Manufacturing). These printers

typically cost up to $100,000, a relatively inexpensive price for an average consumer considering other options.

Additive manufacturing offers simple and prompt solutions. Recently, 3D printing has seen use in the medical industry due to its efficiency. Medical professionals can now quickly design tools and solutions for patients with a variety of unique disabilities (Laverman). Many patients require the aid of a device which holds common objects, such as pens. 3D printers can quickly create these tools. Previously, medical professionals could not design specialized solutions as quickly and precisely as with a 3D Printer. A future technology known as Bioprinting utilizes the precision of 3D printing to mend bones. The printer assembles “Living Bone Structure” to mend a patient’s bone, acting as a replacement (Laverman). The artificial bone structure would grow and fuse with injured or nonexistent bone. In the far future, 3D printers may manufacture replacement organs as well (Laverman).

Prototyping with a 3D printer allows inexpensive designs with room for error as well as improvement. The process of printing starts with the user's analysis of a problem. After adequately analyzing the problem, the user can create a 3D model of an object using CAD software. The user can choose from a variety of CAD applications depending on their skill and previous modeling experiences. However, most CAD applications have a similar design process; tools and mathematics help the user to create a digital model which a printer precisely imitates (Bonnard). Complex CAD designs require an equally complex printing machine for greatest results. The printer receives the model in the form of digital files and processes the information, applying material layer by layer according to the 3D model. Once printed, the user can create improvements to the 3D model, and then to the physical object until the component serves its function correctly (Laverman).

Innovations over the past few decades have drastically improved the process of Additive Manufacturing. These innovations mainly improve upon the somewhat complex requirements of 3D printing. Currently, most CAD software requires a knowledgeable user. Learning to fully utilize CAD applications requires time and experience. Scanning objects would completely eliminate this complication by removing the need for manual design and adding another layer of functionality (What Is Additive Manufacturing). Both commercial and consumer users can benefit from this simple solution. Although, users will require a physical object for the printer to scan in order to replicate.

3D printing offers many advantages over traditional methods of commercial manufacturing. As the name suggests, additive manufacturers layer or add material as opposed to removing material. This saves material and increases efficiency (What Is Additive Manufacturing). Additive printers can print almost any object, shape, or component that complies with the parameters of the CAD software and physical printer, whereas a conventional manufacturing machine can usually create a single object or component. This in turn means that manufacturing of a single product requires multiple machines (Laverman). 3D printers can also print with a large variety of materials depending on the objects intended use. 3D printers use material and space much more efficiently than conventional manufacturing machines.

Due to the innovation and efficiency of additive manufacturing, the process will likely replace current manufacturing methods. The technology brings ease and functionality to the design and manufacturing process, simplifying a previously intricate task. Many professionals can benefit from the simplicity and efficiency of the 3D printing process, and many individuals have purchased “Desktop Printers” for personal use. Additive manufacturing allows creativity and engineering to flourish in a way previously thought impossible.

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