# EMERGING TRENDS IN PRINTING TECHNOLOGY

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**Abstract**—*Two-dimensional (2D) photography has traditionally facilitated preoperative analysis and surgical planning for plastic surgeons. While this has historically been standard of care, recent technological advances have propelled plastic surgery innovation forward, transitioning from traditional 2D photography to a more comprehensive and realistic modality, using three-dimensional (3D) imaging and printing. With the advent of 3D imaging in facial aesthetic surgery, the plastic surgery community has primarily focused on its utility in preoperative surgical simulation and marketing. This study highlights the clinical value of 3D printed models in helping to align patient and surgeon goals. in the preoperative and consultative setting, and focuses on the value of custom surgical templates for use as operative blueprints to facilitate intraoperative decision making in rhinoplasty. Recent technology advances for security printing have been in biometrics, unique inks, advanced substrates, and 2D bar coding. The printed electronics market may grow to approximately $20 billion within the next ten years.*

**Keywords**—*2D Bar Coding, 3D Imaging, CAD Model, Printed Electronics, Security Printing.*

## INTRODUCTION

"Emerging Printing Technologies & Applications" presents a stimulating overview of new technologies and applications and the applicability of these budding technologies for printers and printing industry suppliers. The research examines printed electronics and displays, 3D printing, and biomedical printing, as well as 2D bar codes and security printing; nanotechnology is also investigated. Each of these emerging printing technologies is generating buzz in the industry. New trends in printed electronics The ID Tech Ex Conference Printed Electronics Asia in Tokyo last week revealed several new trends in printed electronics. 3D printing is a "wow" technology that is quickly going mainstream, with applications for rapid prototyping and rapid manufacturing, and even medical uses such as 3D printed organs and prosthetics. Digital printing is growing leaps and bounds as it allows print suppliers to improve the levels of service they offer to customers, as well as creating new opportunities to make money.

## SECURITY PRINTING

Security printing, although a longstanding industry specialty segment, is changing dramatically due to the increasing sophistication of criminals and heightened number of threats. Security printing, bar codes, 3D printing, and nanotechnology provide opportunities for printers to shield a brand owner from would-be imitators by implementing print techniques that are not easily duplicated. Recent technology advances for security printing have been in biometrics, unique inks, advanced substrates, and 2D bar coding.

"Biometrics," referring to the identification of humans by individual characteristics or traits, is in use today. For example, in state-issued drivers' licenses, a cardholder's image and personal information is encrypted into a 2D bar code that appears on the license. When scanned, the code provides an image of the actual license holder for comparison to the person presenting the license.

## PRINTED ELECTRONICS

In printed electronics, while commercial printing of complete circuits remains elusive, there has been some success in

the laboratory and also pilot-scale operations. The first fully printed electronic products will likely be display backplanes, which will be combined with today's printed (but not electronic) front planes to form a fully printed complete device. Firms that manufacture fluids (ink) formulations or new substrates will experience the most opportunity. According to the study, the printed electronics market may grow to approximately $20 billion within the next ten years.

New trends in printed electronics The ID Tech Ex Conference Printed Electronics Asia in Tokyo last week revealed several new trends in printed electronics. It is not yet certain whether printed organic photovoltaics and transistors represent the lowest cost routes to these devices. Because they are large in area, high yield is more difficult to obtain and more material is used. Organic materials are currently very expensive. It is even increasingly common for companies to develop both metal oxide transistors for transparency and organic transistors for rollability, both being a route to lowest cost.

## 3D PRINTING

Despite the groundswell of hype surrounding 3D printing, the report notes that production speed and cost currently limit commercial manufacturing. At an average build-up of one inch per hour and relatively high costs of $4 per cubic inch, 3D printing will remain in the hobbyist realm

3D imaging means different things to different people. While 3D imaging has been around in some form for decades, technological advances have brought it to new applications, thanks in part to improvements in image sensors, standardization of interface technologies and increased demand for new solutions for more complex imaging needs.

3D imaging is popping up in applications over a very wide spectrum, and use of the technology is growing rapidly. Here are a few instances where 3D imaging is emerging as a solution for the future and some applications where it is already having an exciting impact.

3D printing is a "wow" technology that is quickly going mainstream, with applications for rapid prototyping and rapid manufacturing, and even medical uses such as 3D printed organs and prosthetics. Although users have not yet scratched the surface of possible 3D printing applications, 3D imaging may well play a part in expanding the use of 3D printing, by facilitating the measurement and inspection of 3D printed objects.

3D printers are able to use melted plastic to mold objects. Some 3D printers have the ability to melt and mold metal using a laser, enabling the printer to create metallic parts. 3D inspection enters in if the user is interested in examining the 3D printed object and comparing it to the CAD model to assess whether the 3D printed object is accurate, or, if there are inaccuracies, to gauge the size of those defects and assess how they might impact functionality. Assessing an object with 3D imaging techniques saves time and promises a very high degree of accuracy.

The 3D printing industry keeps expanding, and is working with different types of melted plastics, hardened UV polymers, laser-etched or laser-generated metallic 3D models. As entrepreneurs look to 3D printing to produce usable products or components, they will likely need 3D imaging for measurement and quality control.

### 3D X-ray Imaging

3D X-ray imaging is already a very hot technology in the medical field, revolutionizing mammography and other kinds of medical imaging. However, electronics inspection is also seeing growth of 3D X-ray techniques, due to the rapid increase in electronics complexity, and the decrease in the size of objects.

As the electronics industry produces stronger, more powerful, more compact products, the technology inside those products is increasingly difficult to inspect with traditional machine vision technologies. Some manufacturers are using 3D X-ray imaging to inspect solder in small electronics that may be covered by other fixed components. There is no way to view the condition of the solder without taking the object apart, which would be counter-productive. 3D X-ray enables inspection of covered solder points. Confirming the integrity of the solder points is essential to reducing the odds of catastrophic failure of the electronics. 3D X-ray imaging is becoming an indispensable inspection tool for those electronics manufacturers that need to ensure the integrity of their products. Traditionally this inspection was performed offline, but now is being used online as well.

### Robotics

One of the fast moving, potentially transformative applications for 3D imaging has to do with robotics and automation. While a lot of what we've discussed so far has to do with using 3D imaging for inspection applications, 3D technology

is also being used for position recognition—finding an object in a 3D space. This is going to be a game-changer in the advance of automation.

Until now, using robots for manufacturing required that components that need to be picked up and moved by a robot must be in a fixed spot. Moveable parts would need to be clamped down in a certain way or the manufacturing process would need to be adjusted so that the robot always picked up a part in the same way. Today, manufacturers are harnessing the power of 3D imaging to enable robots with the skill of "bin-picking"— locating small objects that are not fragile, and taking them out of a pile, one at a time. 3D imaging allows the robot to "see" like a human would. This "vision" enables robots to do tasks that were previously too difficult. Applications like bin-picking are becoming easier to do because of advances in 3D imaging, the camera technology, sensors, and the standardization of the software. All of this is bringing us closer to the possibility of delivering robots that can do nearly any manufacturing task that a human can, and probably a few that humans cannot.

### The Future of 3D Imaging

3D imaging is already here and being used in many applications. It is changing the way some inspection applications are performed and opening up new possibilities for position recognition and automation. 3D imaging isn't going to replace everything—there is still a role for 2D imaging. However, 3D imaging will certainly add a dimension and make certain tasks much easier to execute.

That concept can now be translated into 3-D printing of implantable devices customized to a specific patient using their imaging. Experts at several medical conferences are saying printing functional biological replacement tissues is already in development. Three-dimensional printing has become a topic of discussion in conference sessions and on the expo floors at many medical meetings over the past several years. The topic was covered in a session at the Radiological Society of North America's (RSNA) annual meeting in December, which is detailed in the following sections.

### Impact of Digital Printing on the Industry

The switch to digital communications across media, advertising etc. has had a greater effect upon the printing industry worldwide. The impact is more profound in countries where these markets have reached the top in terms of developments.

Leveraging the concept of mobility with the rapid increase in smartphone usage is another key development expected. E-readers like the Kindle are also getting popular and are surely going to challenge print.

### Digital Printing to Remain Strong in the Coming Years

Digital printing is growing leaps and bounds as it allows print suppliers to improve the levels of service they offer to customers, as well as creating new opportunities to make money. Increased personalization helps make print more targeted for the end users as the digital world continues to become more and more connected.

Speaking of future, the most dynamic areas that will use digital printing will be in the fields of packaging, cartons, rigid, flexibles, metal and corrugated and will include digital production methods. Future growth predictions for printed packaging are all good with no signs of replacements with electronic counterparts.

### Demand for Cost-Effective Printing Will Continue To Grow

There is a growing demand among consumers for affordable yet high quality printing and this trend has been observed majorly among home segments and students. The demand for cost effective printers has started to increase in home segments, where they avoid running to nearby cyber cafes to get print outs. Therefore, many players in the industry are launching products for home buyers.

### Expect to See Printers with Erasable Printing Technology

Toshiba recently demonstrated a prototype of their printing and copying system that automatically erases the contents printed on a piece of paper. Based on a technology that was originally intended for Pilot pens it works by depositing ink onto the page which is then rendered transparent through the use of a high-temperature heat plate located within the equipment. With this latest development, people would not need to discard incorrectly printed material. Instead, they can feed it back to the printer which would take care of the errors.

### 3D Printing to Fuel Various Sectors in Forthcoming Years
With the launch of 3D printing we know that printing is not merely about ink on paper anymore. 3D printers can produce three-dimensional objects using additive manufacturing process for developing prototypes, human cells and even organs, including the heart and liver.

## 5 Trends In 3D Printing

The ability for the masses to make almost any object not only fuels imagination but challenges modern consumerism and its supply chain. Here are five trends in three-dimensional printing that will redefine the way we print.

**3D Printing Starts Saving Lives:** 3D-printed medical implants will improve the quality of living of many individuals. Because 3D printing allows products to be custom-matched to a particular body shape, it is being used today for making better titanium bone implants, prosthetic limbs and orthodontic devices. Experiments in printing soft tissue are underway, and may soon allow printed veins and arteries to be used in operations. Today's research into medical applications of 3D printing covers nano-medicine, pharmaceuticals and even printing of organs. Taken to the extreme, 3D printing could one day enable custom medicines and reduce if not eliminate the organ donor shortage.

**Faster Product Innovation:** From ultramodern architectures to automotive models rapid prototyping using 3D printers can reduce the time to turn a concept into a production-ready design. Although the concept of rapid prototyping is not new, however this gives designers more access to printers, allowing them to modify it, re-print, and so on. The result will be better products, designed faster.

**Enhanced User Customization:** Companies will use 3D printing technologies to give themselves a competitive edge by offering customization, allowing you to buy a product, customized to your exact specifications, which is 3D-printed and delivered to your doorstep. At first this may start from creating custom smartphone cases or ergonomic improvements to standard tools, but it will rapidly expand to new markets.

## CONCLUSION

The main is to bring knowledge about new trends in 3D Printing is an opportunity for surgeons to incorporate personalized models of patients into their practice for use as intraoperative guides. Additional randomized control studies are needed to further elucidate the benefits of this technology; however, we believe this technique represents a paradigm shift and will become standard of care in the years to come. It also explains the future trends in printed electronics and also security printing.

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