The STEAM Journal

Volume 4
Issue 1 *Metaphorical Cities*

Article 10

December 2019

3-D printing as a STEAM tool for bridging artistic and technical design perspectives

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Recommended Citation

Patterson, Albert E. and Muna, Nasiha (2019) "3-D printing as a STEAM tool for bridging artistic and technical design perspectives," *The STEAM Journal*: Vol. 4: Iss. 1, Article 10. DOI: 10.5642/steam.20190401.10
Available at: https://scholarship.claremont.edu/steam/vol4/iss1/10

STEAM is a bi-annual journal published by the Claremont Colleges Library | ISSN 2327-2074 | http://scholarship.claremont.edu/steam

3-D printing as a STEAM tool for bridging artistic and technical design perspectives

Abstract

In this reflection, we discuss some thoughts on the usefulness of 3-D printing as a tool for bridging the different perspectives on product design offered by both artistic and technical approaches. This bridging could be very useful, as it would allow the bridging of the two approaches using a sort of “common” language; both methodologies could be used better in parallel to produce the best possible product design, one which considers both qualitative and quantitative product/design value better than either the artistic or technical approach could alone.

Keywords

Manufacturing and design, design perspectives, mathematical design, STEAM

Cover Page Footnote

None

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Many of the current technology problems for which a solution has been evasive are in the realm of design, both in technical design and artistic design. Technical design perspectives tend to focus on the functionality, usability, or reliability of a product ("quantitative design"), in contrast to the artistic approach, which prioritizes more subjective but equally important aspects such as beauty, meaningfulness, user satisfaction, and product quality ("qualitative design"). The quantitative approach to design is fundamentally *design-by-numbers*, where all of the design success metrics are driven by *things that can be measured*. In contrast, the qualitative approach to design is focused more on the *quality or value* of the product produced, where design decisions are made based on more subjective design success metrics. These perspectives are both essential for successful product development in a high-technology, user-centric environment; a way to give them equal weight and simultaneous consideration in the design decisions is a holy-grail of design that has not been fully explored.

3-D printing ("additive manufacturing") as a technology is relatively young, but it is a unique technology that could be very useful for both the quantitative and qualitative approaches to design and allow them to be used in parallel. There are quite a few different types of additive manufacturing processes, but they all fundamentally work by adding some kind of raw material as a layer and fuse it to the previous layer to build a solid geometry. This allows the generation of extremely complex and nearly-freeform geometries directly from 3-D computer model data. This process chain allows the input of design data, in whatever form the design team wishes, to a 3-D model which can then be meshed[1] and converted directly into a final product or intermediate design using the 3-D printer.

Whether the design decisions are made by a group of artists (as in purely artistic design) or a mathematical program (as in mathematical optimization) or some medium between the two, the common product produced would be some kind of digital model that can be 3-D printed on-demand and would be in the same format and appearance for both realms of designers. This model and the generated products could serve as the "link" between the qualitative and quantitative needs of the product design, allowing both perspectives' weight in the decision-making process.

Much research and development are needed in this area, but we think this is a valid approach and toolset to begin trying to address this problem and to produce the best possible designs. This could massively reduce bias in the design process, where both the qualitative and quantitative could act as "checks" on each other and prevent either one from being swept aside or silenced; both artists and engineers are known for their egos, and we think that having a link

[1] *Meshing* in this context refers to the process of dividing up a geometry into small parts ("elements") which are easier to analyze and describe in a digital environment. This allows the better conversion of surfaces and shapes into mathematical functions for more accurate representation.

between their perspectives would better balance them, where all opinions are valued but the ultimate focus ("winner") is the user of the final product.